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URBAN TRANSPORT INFRASTRUCTURE

NATIONAL ECONOMIC ANALYSIS FOR INFRASTRUCTURE AUSTRALIA

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Executive summary

ACIL Allen has been engaged by Infrastructure Australia (IA) to provide an audit and projections of urban transport infrastructure in Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney. The analysis carried out for this audit covers the road network, buses, heavy rail, light rail and ferries. Freight rail is excluded.

This report on urban transport infrastructure complements a broader report on infrastructure in Australia, the Australian Infrastructure Audit (AIA): National Economic Analysis, which is a review of existing airport, port, rail, electricity, gas, petroleum, water and telecommunications infrastructure, their economic contribution and future needs.

Study scope and objective

This report aims to provide an overview of the current and projected direct economic contribution (DEC) of urban transport infrastructure in the conurbations of Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney. (A conurbation is an extended urban area, which might consist of several towns merging with the suburbs of a central city.) Conurbations cover a larger area than the Greater City Statistical Areas (GCCSA) used by the Australian Bureau of Statistics (ABS). Figure ES1 shows the geographic area covered by each conurbation. The report also identifies the capacity, utilisation and congestion of existing urban transport infrastructure and future infrastructure gaps under a “low investment” scenario (where only projects already committed to by governments are included in the modelling and analysis).

The estimate of the DEC of urban transport infrastructure provided in this chapter is calculated using a methodology that makes the results comparable to those obtained for other infrastructure services as part of the broader AIA. The more detailed modelling of the urban transport networks in the 6 major conurbations was based upon Veitch Lister’s transport modelling. To provide an Australia-wide estimate for all 8 capital city urban transport networks, ACIL Allen Consulting undertook some top-down economic analysis to estimate the direct economic contribution of the Darwin and Hobart urban transport networks. However due to the top-down nature of the modelling, there is not as much detail. For this reason, most of the analysis concentrates on the 6 major conurbations. However where possible, Hobart and Darwin have been included to provide an estimate of the Australia-wide economic value of urban transport networks in the 8 capital cities across Australia.

The application of a consistent methodology for calculating DEC allows comparisons across different modes of urban transport infrastructure, cities and areas within cities. Hot-spots or areas where urban transport infrastructure has a high DEC and high congestion costs can be identified using this methodology.

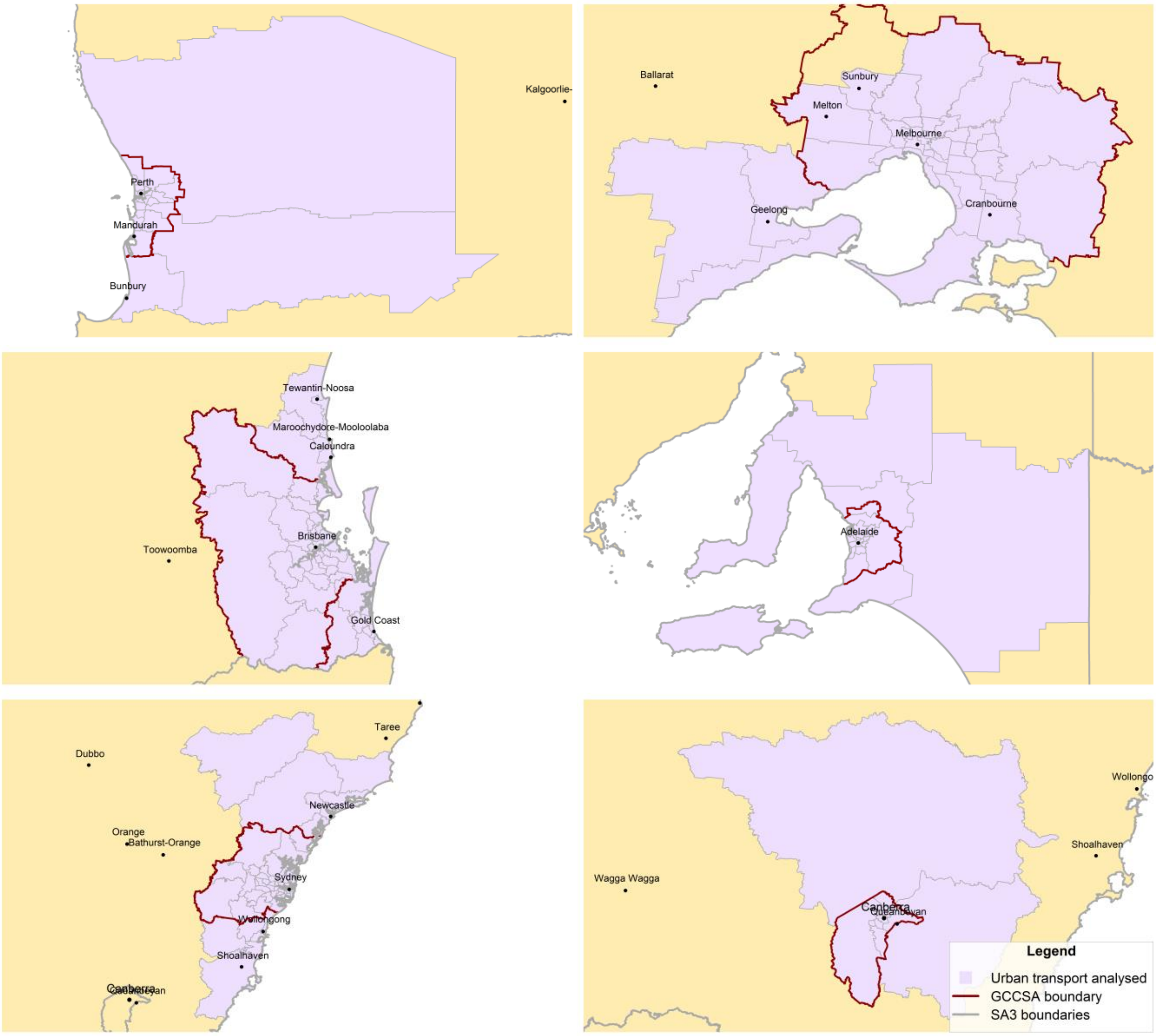
The objective of this work is to allow Infrastructure Australia to conduct an evidence-based assessment of the current and future urban transport infrastructure needs in Australia’s major cities.

The estimate of DEC of urban transport infrastructure provided in this report is calculated using a methodology that makes the results comparable to those obtained for other infrastructure services as part of the broader AIA.

The application of a consistent methodology for calculating DEC allows comparisons across different modes of urban transport infrastructure, cities and areas within cities. Hot-spots or areas where urban transport infrastructure has a high DEC and high congestion costs can be identified using this methodology.

The objective of this work is to allow IA to conduct an evidence-based assessment of the current and future urban transport infrastructure needs in Australia's major cities.

Figure ES 1 **Geographic area covered by each conurbation**



Source: ACIL Allen Consulting, 2014

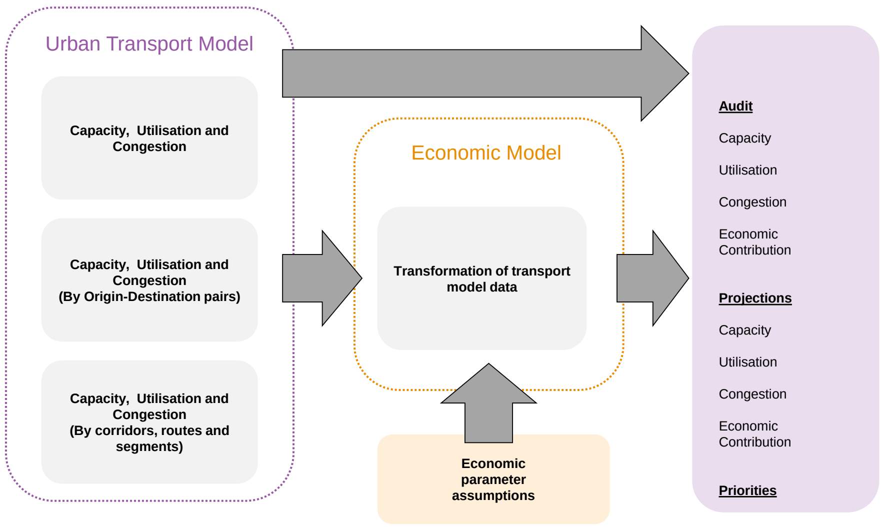
Methodology

The approach taken for this study is a bottom-up approach combining transport modelling at a high spatial resolution by Veitch Lister Consulting (VLC) with economic modelling. Key steps in this process are:

1. Review existing urban transport infrastructure and project future capacity
2. Development of existing and future travel demand data
   a) Establish a baseline set of demographic data
   b) Development of demand estimates for special travel demand generators
   c) Projections of future travel demand
3. Transport modelling using VLC's Zenith model of the 6 conurbations
   a) Simulation of transport systems for 2010-11 and 2030-31
4. Develop a set of economic parameters to convert transport modelling results to economic impact modelling results
   a) Shadow toll as an estimate of user willingness to pay, and fares paid on public transport
   b) Input cost as operating costs excluding labour
5. Economic modelling
   a) Economic parameters combined with measures of transport activity to derive economic contribution by mode
   b) Reconciliation of bottom-up measurements of DEC with top down estimates of DEC, where economic contribution is estimated using a combination of national accounts and household expenditure surveys. Top-down estimates of the DEC of the urban transport networks were calculated for Hobart and Darwin, despite there not being detailed bottom-up modelling for these two capital cities.

Figure ES 2 provides an overview of the interactions between the transport modelling undertaken by VLC and the economic modelling undertaken by ACIL Allen.

Figure ES 2 **Overview of economic modelling of urban transport**



Source: ACIL Allen Consulting, 2014

Key project outputs

The key output of the project is an audit data set that provides estimates of the capacity, utilisation, economic contribution and congestion of urban transport in 2011, and projections for these same measures in 2031.The measures are provided by conurbation, regions within conurbations, corridor, route and segment. Estimates and projections of DEC are also provided by pairs of origins and destinations within each greater capital city area.

This audit data highlights where urban transport provides the greatest economic contribution and where the greatest congestion costs are incurred. It also indicates where the contribution and congestion is projected to experience the greatest change.

The audit data provides an evidence base that may be used for further analysis of where transport solutions can maximise value. It does this by highlighting 'hotspots' which need to be further investigated. It does not, however, conclude where infrastructure projects or policy solutions, such as demand management, would be of net benefit. This would need to be done through rigorous cost benefit analysis.

Economic importance of urban transport

Urban transport infrastructure plays an important role in the Australian economy. It directly impacts the daily trips made (for both work and leisure) by the three-quarters of Australia's population who live in the urban areas of the eight State and Territory capital cities. Urban transport infrastructure not only services the needs of households but also those of businesses in the transportation of goods and services. It is a critical facilitator of other economic activities and interactions between economic agents. For example, the production of most high-value professional services (including legal, financial and education) would not be possible if workers could not travel from their homes to their workplaces each day of the work week.

The DEC of urban transport infrastructure ($78.25 billion in 2010-11 across the six conurbations included in this report) is large when compared to other infrastructure sectors covered in ACIL Allen's broader review of infrastructure in Australia.

The DEC of urban transport infrastructure, for Hobart and Darwin, were interpolated from the results of the other cities, having regard to the local demographic and economic conditions of these two capital cities. When Hobart's and Darwin's urban transport DEC is included, the DEC of urban transport across Australia's 8 capital cities in 2010-11 is $79.69 billion.

Urban transport infrastructure has a DEC that is nearly as high as the DEC of energy, water, telecommunications and transport[1] (excl. urban transport) combined. The magnitude of the DEC of urban transport infrastructure analysed for this report is attributable to a number of factors:

- The urban transport infrastructure analysed for this report covers the urban transport for a large proportion of the Australian population. The area for which the urban transport sector has been analysed by ACIL Allen had a population of 17 million people in 2010-11.

[1] The transport sector analysed as part of the broader AIA includes transport through, ports, airports and the national highway where it is not covered as part of the audit of urban transport infrastructure.

— Households spend significant time using urban transport in Australia's cities. Household travel survey results for major Australian cities indicate that residents spend over one hour a day travelling on urban transport infrastructure. In 2011-12 the average daily travel time for households in Sydney was 79 minutes (Bureau of Transport Statistics, 2013). In Brisbane and South-East Queensland residents travelled an average of 65 minutes a day in 2009 (Department of Transport and Main Roads, 2012).

The ABS Household Expenditure Survey confirms the importance of the urban transport sector, showing that expenditure on transport accounted for 15.6 per cent of households' total goods and service expenditure in 2009-10 (ABS, 2011).

ACIL Allen's modelling of the urban transport sector in the six conurbations has found that the top 10 road journeys by origin-destination are concentrated in inner urban and industrial areas. The origin-destination analysis also shows that urban transport networks are typically radial in nature, with the city centre as the hub and spokes reaching a large number of destinations in outer regions.

ACIL Allen's modelling indicates that there is significant congestion today across many areas and in various transport modes (including public transport) during peak times. The costs of car congestion alone across the six conurbations are estimated to have totalled $13.7 billion in 2010-11.

Demand for urban transport is expected to grow considerably between 2010-11 and 2030-31 (with the highest growth expected in the Perth conurbation, followed by Brisbane). This means that the demand for urban transport infrastructure will outpace that for other key types of infrastructure analysed by ACIL Allen in the broader AIA. In 2030-31, the DEC of urban transport in the six conurbations is expected to be $175.1 billion (in 2010-11 dollars) compared with $78.25 billion in 2010-11.

Assuming that current urban transport infrastructure will be augmented only by projects already committed to by governments, growth in urban transport utilisation is expected to outstrip growth in capacity, leading to a quadrupling of car congestion costs from 13.7 billion in 2010-11 to $53.3 billion in 2030-31 (both figures in 2010-11 dollars) along with severe worsening of congestion in public transport systems.

Major findings

Capacity and utilisation of urban transport in 2010-11

Capacity of urban transport in 2010-11

The capacity of urban transport by mode for each of the conurbations (extended urban areas beyond the GCCSAs[2]) is shown in Table ES 1. Sydney-Newcastle-Wollongong has the greatest carrying capacity for both roads and public transport. With the exception of light rail in Melbourne-Geelong and Adelaide-Yorketown, Sydney-Newcastle-Wollongong also has the greatest carrying capacity for each of the different public transport modes. Melbourne-Geelong contains a significant road network, of similar scale to Sydney-Newcastle-Wollongong.

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2 Melbourne-Geelong conurbation is an exception, which includes most of the Melbourne GCCSA but does not include the Macedon Ranges SA3.

Table ES 1 **Capacity by conurbation and mode (2010-11)**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	VKT per day	**Passenger seat kms per day**	**Passenger seat kms per day**	**Passenger seat kms per day**	**Passenger seat kms per day**
Sydney-Newcastle-Wollongong	615,617,472	103,294,968	24,176,934	2,270,280	82,870
Melbourne-Geelong	600,408,778	47,335,571	3,227,466	n/a	21,597,822
Brisbane-South-East-Queensland	457,374,113	16,494,696	12,753,276	487,447	n/a
Perth-Wheatbelt	300,045,588	8,999,781	8,691,320	6,533	n/a
Adelaide-Yorketown	169,385,298	2,565,689	7,237,787	n/a	163,743
Canberra-Goulburn-Yass	84,218,393	n/a	3,414,642	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Utilisation of urban transport in 2010-11

The utilisation of urban transport by mode for each of the conurbations (extended urban areas beyond the GCCSAs) in 2010-11 is shown in Table ES 2.

Table ES 2 **Utilisation by conurbation and mode (2010-11)**

Conurbation	Road	Rail	Bus	Ferry	Light rail
	VKT per day	**Passenger kms per day**	**Passenger kms per day**	**Passenger kms per day**	**Passenger kms per day**
Sydney-Newcastle-Wollongong	132,187,467	20,836,852	8,118,279	223,304	28,512
Melbourne-Geelong	116,880,115	17,622,360	2,312,022	n/a	4,075,718
Brisbane-South-East-Queensland	83,745,007	4,320,496	3,214,913	75,928	n/a
Perth-Wheatbelt	49,845,107	2,965,370	1,367,563	303	n/a
Adelaide-Yorketown	28,225,360	582,748	1,141,167	n/a	24,613
Canberra-Goulburn-Yass	9,906,834	n/a	652,146	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

DEC of urban transport in 2010-11

Direct Economic Contribution of urban transport in 2010-11

The DEC of urban transport by mode for each of the conurbations is shown in Table ES 3.

Table ES 3 **DEC by conurbation and mode and types of road vehicle (2010-11)**

Conurbation	Car	LCV	HCV	Rail	Bus	Ferry	Light rail	Total urban transport
	$m	$m	$m	$m	$m	$m	$m	$m
Sydney-Newcastle-Wollongong	20,530	854	2,825	1,950	1,329	4	12	27,504
Melbourne-Geelong	15,537	641	779	1,744	985	n/a	322	20,007
Brisbane-South-East-Queensland	11,429	528	516	190	398	14	n/a	13,075
Perth-Wheatbelt	7,647	400	448	290	350	-0	n/a	9,134
Adelaide-Yorketown	5,830	194	383	42	254	n/a	1	6,705
Canberra-Goulburn-Yass	1,502	51	175	n/a	95	n/a	n/a	1,824
Total	**62,475**	**2,667**	**5,126**	**4,216**	**3,411**	**18**	**355**	**78,250**

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: ACIL Allen Consulting, 2014

Using top-down economic modelling, the DEC of urban transport infrastructure in Hobart and Darwin is estimated to be $835 million and $600 million respectively in 2010-11. This increases the total DEC of urban transport infrastructure across the 8 capital cities to $79.69 bill39.6ion in 2010-11.

Congestion in 2010-11

A summary of the congestion (car delay cost) of urban transport for each of the conurbations is provided in Table ES 4. Adelaide-Yorketown and Sydney-Newcastle-Wollongong are expected to have the highest car delay costs as a percentage of total DEC, while Melbourne-Geelong and Canberra-Goulburn-Yass are expected to have the lowest.

Table ES 4 **Congestion by conurbation (2010-11)**

Conurbation	Congestion (car delay cost)	DEC	Congestion (% of DEC)
	$m	$m	%
Sydney-Newcastle-Wollongong	5,555	27,504	20.2%
Melbourne-Geelong	2,837	20,007	14.18%
Brisbane-South-East-Queensland	1,914	13,075	14.64%
Perth-Wheatbelt	1,784	9,134	19.5%
Adelaide-Yorketown	1,442	6,705	21.5%
Canberra-Goulburn-Yass	208	1,824	11.4%

Source: ACIL Allen Consulting, 2014

Growth in capacity and utilisation of urban transport to 2030-31

Assumed growth in capacity of urban transport to 2030-31

Growth in capacity is assumed to follow a low investment scenario where only those projects go ahead for which funding has been allocated or where significant political capital has been invested. The capacity of urban transport by mode for each of the conurbations in 2030-31 is shown in Table ES 5.

Table ES 5 **Capacity by conurbation and mode (2030-31)**

Conurbation	Road	Rail	Bus	Ferry	Light rail
	VKT per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day
Sydney-Newcastle-Wollongong	654,621,504	113,801,605	27,190,647	2,270,280	770,468
Melbourne-Geelong	636,098,134	70,739,099	4,033,120	n/a	35,654,678
Brisbane-South-East-Queensland	490,562,616	19,291,864	14,959,187	522,203	327,076
Perth-Wheatbelt	315,206,758	12,349,826	8,727,253	6,538	n/a
Adelaide-Yorketown	175,544,578	3,002,197	7,238,064	n/a	164,181
Canberra-Goulburn-Yass	91,517,327	n/a	3,414,642	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Table ES 6 provides a summary of assumed growth in capacity of urban transport by mode for each of the conurbations between 2010-11 and 2030-31.

Table ES 6 **Assumed compound annual growth rate (CAGR) of urban transport capacity between 2010-11 and 2030-31**

Conurbation	Road	Rail	Bus	Ferry	Light rail
	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	0.3%	0.5%	0.6%	0.0%	11.8%
Melbourne-Geelong	0.3%	2.0%	1.1%	n/a	2.5%
Brisbane-South-East-Queensland	0.4%	0.8%	0.8%	0.3%	n/a
Perth-Wheatbelt	0.2%	1.6%	0.0%	0.0%	n/a
Adelaide-Yorketown	0.2%	0.8%	0.0%	n/a	0.0%
Canberra-Goulburn-Yass	0.4%	n/a	0.0%	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

The assumed changes to urban transport infrastructure constitute a low investment scenario where only those projects go ahead for which capital has been allocated or where significant political capital has been invested.

Growth in utilisation of urban transport to 2030-31

The utilisation of urban transport by mode for each of the conurbations in 2030-31 is shown in Table ES 7. The ratio of utilisation to capacity is shown in brackets under the corresponding utilisation figure.

Table ES 7 **Utilisation by conurbation and mode (2030-31)**

Conurbation	Road	Rail	Bus	Ferry	Light rail
	VKT per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day
Sydney-Newcastle-Wollongong	174,448,042	33,800,277	10,662,134	396,631	415,429
Melbourne-Geelong	163,880,115	40,956,587	3,794,382	n/a	8,360,219
Brisbane-South-East-Queensland	134,939,469	9,697,901	4,770,881	206,342	59,684
Perth-Wheatbelt	94,241,231	8,843,400	2,166,951	771	n/a
Adelaide-Yorketown	36,820,591	1,073,067	1,407,936	n/a	35,181
Canberra-Goulburn-Yass	13,593,001	n/a	1,066,222	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

The ratio of utilisation to capacity provides another perspective on future pressures. The highest ratio of capacity to utilisation is observed for the Melbourne-Geelong bus network, followed by the Perth-Wheatbelt rail network. However, this should be interpreted in light of the capacity assumptions (no network augmentations beyond committed projects) and also that the selected measure of capacity is 'seats' rather than total capacity which would also include standing space.

Table ES 8 provides a summary of growth in utilisation of urban transport by mode for each of the conurbations between 2010-11 and 2030-31.

Table ES 8 **Compound Annual Growth Rate (CAGR) of urban transport utilisation between 2010-11 and 2030-31**

Conurbation	Road	Rail	Bus	Ferry	Light rail
	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	1.4%	2.4%	1.4%	2.9%	14.3%
Melbourne-Geelong	1.3%	3.6%	1.8%	n/a	3.0%
Brisbane-South-East-Queensland	2.4%	4.1%	2.0%	5.1%	n/a
Perth-Wheatbelt	3.2%	5.6%	2.3%	4.8%	n/a
Adelaide-Yorketown	1.3%	3.1%	1.1%	n/a	1.8%
Canberra-Goulburn-Yass	1.6%	n/a	2.5%	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Utilisation is expected to grow at a faster rate than the capacity delivered by committed augmentations. Where growth occurs in already congested areas, the rate of growth highlights where pressures on networks could be experienced, in the absence of commensurate capacity. The greatest growth in utilisation is seen in Sydney light rail (coinciding with the adding of capacity to that network), Perth rail and Brisbane ferries.

Growth in DEC of urban transport to 2030-31

Direct Economic Contribution of urban transport in 2030-31

The DEC of urban transport by mode for each of the 6 conurbations modelled in detail in 2030-31 is shown in Table ES 9.

Table ES 9 **DEC by conurbation, mode and types of road vehicle (2030-31)**

Conurbation	Car	LCV	HCV	Rail	Bus	Ferry	Light rail	Total urban transport
	$m	$m	$m	$m	$m	$m	$m	$m
Sydney-Newcastle-Wollongong	39,487	1,740	5,489	4,073	2,649	45	152	53,635
Melbourne-Geelong	30,605	792	1,418	4,891	1,964	n/a	1,126	40,796
Brisbane-South-East-Queensland	27,686	658	1,078	795	805	67	13	31,103
Perth-Wheatbelt	28,699	1,489	1,599	1,007	826	-0.3	n/a	33,619
Adelaide-Yorketown	10,763	345	722	118	418	n/a	7	12,373
Canberra-Goulburn-Yass	2,956	101	308	n/a	212	n/a	n/a	3,577
Total	**140,196**	**5,125**	**10,613**	**10,885**	**6,874**	**113**	**1,298**	**175,104**

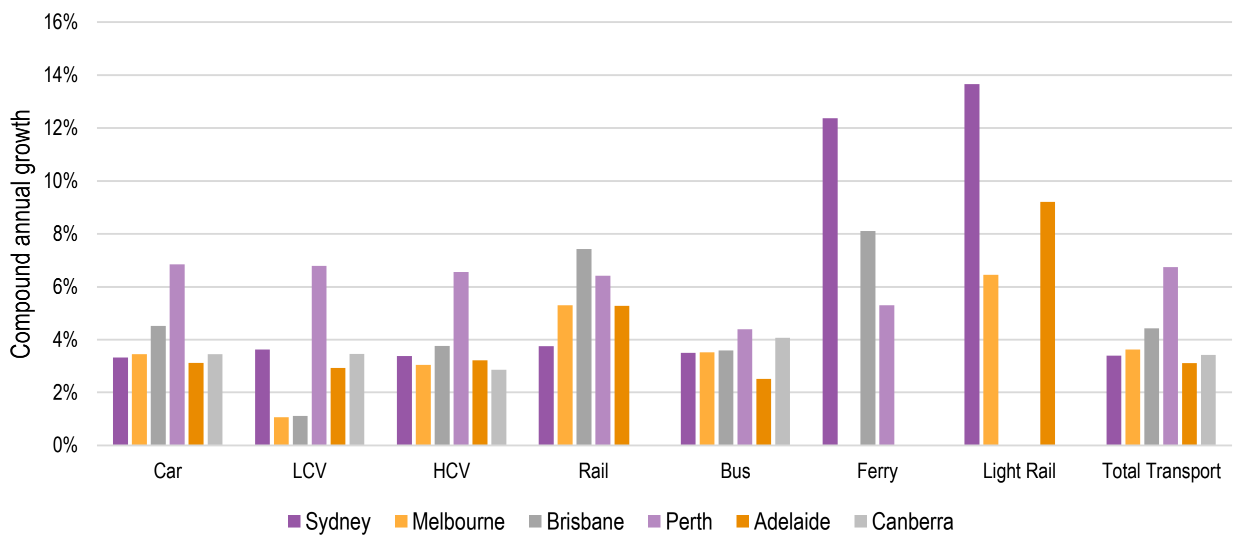
Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: ACIL Allen Consulting, 2014

Top-down economic modelling of the DEC of urban transport infrastructure for Hobart and Darwin are projected to be $1.48 billion and $1.43 billion respectively in 2030-31.

Growth in Direct Economic Contribution of urban transport to 2030-31

The growth in DEC of urban transport by mode for each of the conurbations (extended urban areas beyond the GCCSAs) between 2010-11 and 2030-31 is illustrated in Figure ES 3. Perth-Wheatbelt is projected to have the highest overall growth in DEC, followed by Brisbane-South-East-Queensland. Ferry and light rail are projected to have the highest growth rates of all modes, although they account for a small proportion of DEC and are not present in every conurbation.

Figure ES 3 **Growth in DEC by mode and types of road vehicle for each conurbation**



Note: The figure above is for the conurbations (e.g., Sydney is for Sydney-Newcastle-Wollongong). The full conurbation name is shortened for clearer graphic presentation.
Source: ACIL Allen Consulting, 2014

Congestion in 2030-31

The congestion (car delay cost) of urban transport for each of the conurbations in 2030-31 is summarised in Table ES 10.

Table ES 10 **Congestion by conurbation (2030-31)**

Conurbation	Congestion (car delay cost)	DEC	Congestion (% of DEC)
	$m	$m	%
Sydney-Newcastle-Wollongong	14,790	53,635	27.6%
Melbourne-Geelong	9,007	40,796	22.1%
Brisbane-South-East-Queensland	9,206	31,103	29.6%
Perth-Wheatbelt	15,865	33,619	47.2%
Adelaide-Yorketown	3,747	12,373	30.3%
Canberra-Goulburn-Yass	703	3,577	19.7%

Source: ACIL Allen Consulting, 2014

Growth in congestion to 2030-31

The growth in congestion of urban transport by mode for each of the conurbations between 2010-11 and 2030-31 is shown in Table ES 11.

Table ES 11 **Compound Annual Growth Rate (CAGR) of urban transport congestion and DEC between 2010-11 and 2030-31**

Conurbation	Congestion (car delay cost)	DEC
	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	5.0%	3.4%
Melbourne-Geelong	4.5%	2.9%
Brisbane-South-East-Queensland	8.2%	4.4%
Perth-Wheatbelt	11.5%	6.7%
Adelaide-Yorketown	4.9%	3.1%
Canberra-Goulburn-Yass	6.3%	3.4%

Source: ACIL Allen Consulting, 2014

In all conurbations, congestion grows at a faster rate than DEC. This follows from the assumption that the demand for travel will significantly outpace capacity brought about by existing committed augmentations. The detailed analysis for each conurbation will identify hotspots which may be further explored in the context of transport solutions.

Analysis of demand by origin destination pairs

For each conurbation, ACIL Allen has calculated the DEC of road journeys from each Australian Bureau of Statistics (ABS) SA3 spatial unit to all other SA3 spatial units within the conurbation. SA3s are generally clusters of related suburbs around urban commercial and transport hubs within the major urban areas.

As an example, Figure ES4 shows a matrix of the DEC in 2010-11 for origin-destination pairs in the Sydney Greater City Statistical Area (GCCSA). The Sydney GCCSA is a subset of the Sydney-Newcastle-Wollongong conurbation. Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys originating in the SA3 'Sydney Inner City' whereas the first column shows the DEC of trips ending in the SA3 'Sydney Inner City'. The DEC is colour coded from green to red where green indicates a low DEC and red indicates a high DEC. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure ES 4 **Roads – GCCSA origin-destination pairs – DEC 2010-11 $millions – Sydney GCCSA**

SA3 Origin / Destination	Sydney Inner City	Eastern Suburbs - North	Marrickville - Sydenham - Petersham	Leichhardt	Strathfield - Burwood - Ashfield	Botany	Eastern Suburbs - South	Kogarah - Rockdale	Canterbury	Hurstville	Cronulla - Miranda - Caringbah	Sutherland - Menai - Heathcote	Liverpool	Campbelltown (NSW)	Bankstown	Merrylands - Guildford	Auburn	Fairfield	Bringelly - Green Valley	Penrith	Camden	Blue Mountains - South	Wollondilly	Canada Bay
Sydney Inner City		58.9	35.1	41.7	48.8	103.9	63.5	38.0	22.3	15.6	19.1	13.8	11.5	9.5	17.6	10.3	13.0	6.8	5.9	9.0	5.2	1.8	9.4	25.2
Eastern Suburbs - North	58.1		5.6	6.6	8.5	24.1	38.7	10.0	4.5	4.5	5.5	3.9	2.6	2.1	3.6	1.9	2.5	1.4	1.4	2.0	1.5	0.2	1.3	4.6
Marrickville - Sydenham - Petersham	32.2	5.5		7.6	13.5	14.7	7.4	13.3	8.4	5.0	4.5	3.3	2.8	2.1	4.3	1.7	2.4	1.2	1.3	1.0	1.3	0.3	1.1	4.6
Leichhardt	35.0	5.7	6.7		14.3	9.3	4.8	5.6	5.7	3.1	2.6	2.5	2.3	1.8	4.4	2.2	3.0	1.2	1.0	1.4	1.2	0.3	1.0	9.8
Strathfield - Burwood - Ashfield	47.3	8.4	15.6	16.1		22.1	9.2	20.1	30.9	14.3	8.6	9.1	10.5	6.6	27.4	11.3	23.2	6.8	4.3	4.2	3.9	1.0	3.5	29.9
Botany	101.5	24.4	15.3	14.3	22.5		34.0	29.1	13.7	13.7	18.6	15.9	15.4	16.1	16.1	15.3	13.2	14.8	9.5	11.8	9.5	0.8	6.8	11.0
Eastern Suburbs - South	61.8	39.8	7.4	6.1	8.8	33.8		15.8	5.9	6.4	7.8	5.7	3.5	2.7	4.5	1.9	2.3	1.7	1.7	1.9	1.8	0.2	1.5	3.5
Kogarah - Rockdale	35.7	9.8	13.1	7.0	19.6	29.3	15.8		24.2	29.0	27.3	18.5	7.9	5.8	13.6	4.3	5.0	3.8	3.7	1.9	3.3	0.3	2.8	5.9
Canterbury	20.7	4.4	9.2	6.4	31.4	13.4	6.3	24.3		22.4	9.00	9.6	9.8	6.1	27.6	6.6	8.8	5.6	4.1	2.2	3.3	0.4	2.3	8.5
Hurstville	14.4	4.3	5.3	3.7	14.2	13.9	6.8	29.9	22.7		17.3	16.3	9.5	5.7	24.1	5.5	6.5	4.3	3.8	1.8	2.8	0.3	1.8	4.4
Cronulla - Miranda - Caringbah	17.8	5.3	4.8	3.7	8.5	19.5	8.1	28.5	9.6	17.8		26.7	5.9	4.4	10.6	3.9	4.3	3.0	2.7	1.7	2.3	0.2	2.0	2.7
Sutherland - Menai - Heathcote	12.8	3.6	3.5	3.0	8.9	16.4	5.9	19.2	10.0	17.2	27.2		10.2	5.8	22.0	5.6	5.7	5.1	3.8	1.7	2.3	0.2	1.6	3.0
Liverpool	9.4	2.3	2.9	2.4	9.0	14.9	3.6	7.4	8.6	8.8	9.7	11.2		46.9	35.3	27.1	11.7	51.7	54.1	9.1	20.3	0.8	10.1	3.3
Campbelltown (NSW)	8.5	2.0	2.2	2.0	5.9	16.2	2.8	5.7	5.7	5.7	6.4	11.2	45.6		15.9	10.3	6.1	17.1	32.5	7.7	79.3	1.4	24.3	2.2
Bankstown	16.2	3.6	5.8	5.0	26.9	16.8	5.6	14.4	27.8	24.6	12.3	22.0	39.8	17.3		31.0	27.2	26.8	14.9	6.0	9.0	0.9	6.6	9.1
Merrylands - Guildford	9.7	1.9	2.4	2.4	11.8	15.5	2.4	4.4	6.6	5.4	5.6	6.0	27.1	13.7	31.0		31.9	50.4	14.9	12.2	6.0	0.9	5.7	5.9
Auburn	12.1	2.4	3.3	3.2	23.9	13.2	2.7	5.2	8.8	6.5	4.8	5.9	11.4	6.3	28.3	32.3		13.4	5.2	5.6	2.8	0.7	2.9	10.8
Fairfield	6.5	1.4	1.6	1.4	7.0	14.6	2.0	3.8	5.7	4.3	5.2	6.0	53.4	21.2	27.0	53.0	14.7		47.2	15.8	11.2	1.0	7.1	2.9
Bringelly - Green Valley	5.3	1.3	1.4	1.3	4.2	9.1	1.7	3.6	3.7	3.5	4.5	5.1	54.7	32.3	13.7	16.4	7.1	48.4		15.1	31.4	1.2	10.1	1.5
Penrith	8.5	1.9	1.1	1.4	4.3	11.1	1.9	1.8	2.1	1.6	1.9	1.9	9.3	8.8	6.0	13.2	6.4	20.0	15.5		9.3	2.5	5.6	2.3
Camden	4.8	1.4	1.3	1.3	3.6	9.5	1.8	3.2	3.2	2.8	3.1	4.8	20.3	78.3	9.0	6.2	3.8	11.0	36.3	9.3		2.8	33.5	1.3
Blue Mountains - South	0.2	0.1	0.1	0.0	0.2	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.6	1.3	0.4	0.6	0.2	0.9	1.2	2.4	3.0		1.7	0.0
Wollondilly	9.3	1.2	1.1	1.0	3.4	7.1	1.6	2.8	2.3	1.9	2.4	2.4	10.3	24.7	6.7	5.7	3.0	6.8	11.0	5.4	35.1	1.6		1.1
Canada Bay	25.0	4.8	5.4	10.5	29.8	11.2	3.8	6.0	8.2	4.3	2.8	3.1	3.5	2.5	8.9	4.6	9.6	2.3	1.5	2.1	1.3	0.4	1.3	
Pennant Hills - Epping	2.3	0.7	0.5	1.0	3.0	3.6	0.6	0.6	1.1	0.5	0.3	0.4	1.0	0.5	2.2	3.5	3.7	1.6	0.7	1.0	0.3	0.2	0.4	2.6
Carlingford	7.1	1.8	1.5	2.2	6.5	8.7	1.4	1.8	2.4	1.8	1.6	1.8	4.0	2.2	7.7	13.9	15.5	6.3	2.0	3.8	0.8	0.4	1.3	5.9
Ryde - Hunters Hill	26.3	6.0	4.8	10.3	21.2	18.5	5.0	4.3	6.5	3.8	2.5	2.5	4.0	2.1	10.9	9.7	15.7	4.1	1.8	3.3	1.3	0.8	1.6	24.5
Parramatta	10.7	2.4	2.3	2.8	12.7	21.4	2.3	3.9	5.2	4.4	3.7	4.4	14.7	8.6	18.0	64.0	31.6	27.8	8.7	15.3	3.5	0.9	3.8	9.0
Blacktown	5.1	1.2	1.0	1.4	4.7	13.0	1.1	1.4	2.2	1.6	1.5	1.7	8.4	6.6	6.9	26.1	8.6	23.5	7.7	14.8	3.2	0.6	3.1	3.1
Richmond - Windsor	1.4	0.1	0.2	0.2	0.7	3.1	0.1	0.4	0.4	0.2	0.3	0.1	1.2	1.2	0.9	2.1	0.9	2.7	1.7	13.4	1.1	0.3	0.8	0.3
St Marys	2.0	0.5	0.4	0.6	1.9	4.3	0.5	0.4	0.8	0.4	0.7	0.6	4.0	3.1	2.3	6.8	2.9	8.3	4.8	19.4	1.6	0.2	1.0	1.0
Hawkesbury	1.4	0.4	0.2	0.3	0.8	2.5	0.3	0.4	0.3	0.3	0.2	0.2	1.0	1.1	1.1	2.1	1.0	2.4	1.4	9.2	0.8	0.0	0.4	0.4
Blue Mountains	1.6	0.5	0.2	0.3	1.1	4.3	0.3	0.4	0.4	0.2	0.3	0.2	2.1	1.7	1.5	3.2	1.4	3.9	2.6	18.5	1.4	3.0	0.5	0.6
Rouse Hill - McGraths Hill	1.4	0.4	0.3	0.3	1.0	2.8	0.3	0.4	0.5	0.3	0.4	0.3	1.3	1.5	1.2	3.1	1.5	2.8	1.3	5.7	0.7	0.2	0.9	0.6
Mount Druitt	5.4	1.1	0.9	1.1	4.4	14.5	0.8	1.2	2.0	1.1	2.0	1.8	8.5	8.1	5.7	19.6	7.4	23.1	10.4	32.0	4.2	0.6	3.8	2.5
Blacktown - North	2.1	0.5	0.3	0.7	1.9	5.3	0.6	0.5	0.8	0.4	0.4	0.4	2.9	2.9	2.4	7.6	3.1	7.2	3.0	8.8	1.3	0.2	1.4	1.2
North Sydney - Mosman	40.1	11.4	4.2	7.2	7.5	18.0	9.0	4.7	3.1	2.2	2.9	2.0	1.8	1.7	2.7	2.3	2.7	1.1	0.9	1.5	0.8	0.3	1.4	5.1
Chatswood - Lane Cove	42.0	12.0	4.9	9.2	13.4	20.8	9.3	5.3	4.5	2.7	3.6	2.6	2.6	2.3	5.4	4.3	5.7	2.2	1.2	2.3	1.1	0.7	2.2	12.9
Ku-ring-gai	12.6	4.3	2.0	3.5	8.2	11.0	3.3	2.2	2.7	1.6	1.2	1.0	1.5	0.8	4.8	4.1	5.7	2.0	0.6	1.7	0.5	0.3	0.5	7.3
Hornsby	2.6	0.4	0.5	1.0	2.7	5.2	0.6	0.4	1.1	0.6	0.3	0.4	1.2	1.0	2.6	3.9	3.5	2.0	0.7	1.3	0.3	0.1	0.7	2.3
Dural - Wisemans Ferry	3.0	0.9	0.5	0.9	2.1	3.3	0.8	0.6	0.8	0.5	0.3	0.3	1.3	0.8	2.5	4.0	3.7	2.3	0.8	2.1	0.4	0.0	0.4	1.7
Baulkham Hills	6.3	2.0	1.4	2.4	7.4	13.8	1.9	1.4	3.0	1.8	1.1	1.6	5.7	4.5	8.6	22.5	14.3	12.3	4.2	7.9	2.3	0.5	2.6	5.4
Manly	9.3	2.8	0.9	1.7	2.1	5.9	2.3	1.4	0.8	0.6	0.8	0.5	0.5	0.3	0.8	0.8	0.8	0.4	0.3	0.6	0.2	0.1	0.3	1.3
Warringah	25.3	7.4	3.0	4.7	7.1	19.0	5.8	3.7	2.5	2.0	2.3	1.7	1.7	1.6	4.0	3.5	4.0	1.8	1.0	1.8	0.8	0.3	1.3	5.1
Wyong	2.8	0.2	0.2	0.5	0.7	8.4	0.4	0.3	0.5	0.2	0.4	0.3	0.7	0.4	1.1	1.5	1.1	0.9	0.4	1.7	0.2	0.0	0.8	0.4
Pittwater	7.4	2.4	1.0	1.5	2.9	8.1	1.8	1.1	1.1	0.6	0.8	0.5	1.0	0.5	2.0	1.8	2.3	1.0	0.3	0.9	0.2	0.1	0.3	2.1
Gosford	3.0	0.2	0.3	0.4	0.8	7.9	0.2	0.4	0.3	0.4	0.3	0.4	0.8	0.6	1.6	1.8	1.3	1.2	0.5	1.6	0.4	0.0	0.6	0.7

SA3 Origin / Destination	Pennant Hills - Epping	Carlingford	Ryde - Hunters Hill	Parramatta	Blacktown	Richmond - Windsor	St Marys	Hawkesbury	Blue Mountains	Rouse Hill - McGraths Hill	Mount Druitt	Blacktown - North	North Sydney - Mosman	Chatswood - Lane Cove	Ku-ring-gai	Hornsby	Dural - Wisemans Ferry	Baulkham Hills	Manly	Warringah	Wyong	Pittwater	Gosford
Sydney Inner City	4.7	8.3	26.4	11.0	5.1	1.4	2.2	1.5	2.1	1.6	9.8	7.1	46.3	47.5	14.6	4.2	4.4	10.7	11.4	30.5	3.4	8.5	3.7
Eastern Suburbs - North	0.9	1.8	5.5	2.3	1.1	0.1	0.6	0.3	0.6	0.4	1.6	1.1	11.8	12.4	4.8	0.6	1.0	2.5	3.1	8.1	0.3	2.6	0.2
Marrickville - Sydenham - Petersham	0.5	1.1	3.8	1.7	0.8	0.2	0.3	0.2	0.2	0.2	0.9	0.6	4.0	4.4	1.7	0.5	0.5	1.4	1.0	2.9	0.2	1.0	0.3
Leichhardt	1.2	2.1	8.9	2.6	1.3	0.2	0.6	0.3	0.4	0.3	1.4	1.1	7.0	8.5	3.5	1.1	0.9	2.6	1.7	4.5	0.5	1.5	0.4
Strathfield - Burwood - Ashfield	3.8	6.9	20.2	11.7	4.3	0.7	1.8	0.8	1.3	0.9	4.6	2.6	8.0	13.1	8.4	3.1	2.4	7.9	2.2	7.5	0.8	3.0	0.8
Botany	3.7	8.7	17.3	20.0	12.5	3.2	4.6	2.6	5.2	2.8	15.8	6.4	17.6	20.3	11.0	5.5	3.5	14.3	6.1	19.6	8.9	8.3	7.5
Eastern Suburbs - South	0.8	1.3	4.5	2.0	0.9	0.2	0.5	0.3	0.3	0.2	1.1	0.9	8.8	9.1	3.4	0.6	0.9	2.1	2.4	6.0	0.4	1.8	0.2
Kogarah - Rockdale	0.7	1.9	3.9	3.6	1.4	0.4	0.5	0.4	0.5	0.4	1.5	0.9	4.4	5.0	2.1	0.4	0.6	1.6	1.4	3.8	0.3	1.2	0.4
Canterbury	1.3	2.6	6.4	4.8	2.1	0.4	0.8	0.3	0.5	0.5	1.9	1.1	3.2	4.5	2.8	1.1	0.8	3.2	0.9	2.7	0.5	1.2	0.3
Hurstville	0.7	1.9	3.7	4.2	1.5	0.2	0.5	0.3	0.3	0.3	1.3	0.6	2.1	2.6	1.6	0.6	0.5	2.0	0.6	2.0	0.2	0.6	0.4
Cronulla - Miranda - Caringbah	0.5	1.5	2.1	2.9	1.0	0.3	0.5	0.2	0.4	0.3	1.5	0.5	2.6	3.3	1.2	0.2	0.3	0.9	0.8	2.3	0.4	0.8	0.3
Sutherland - Menai - Heathcote	0.5	1.9	2.4	4.1	1.3	0.1	0.5	0.2	0.3	0.3	1.4	0.4	1.9	2.4	1.0	0.4	0.3	1.5	0.5	1.7	0.3	0.5	0.4
Liverpool	1.0	4.2	3.7	13.4	8.1	1.2	3.9	1.2	2.6	1.4	7.9	2.8	1.6	2.2	1.3	1.3	1.2	5.2	0.5	1.6	0.8	0.9	0.8
Campbelltown (NSW)	0.4	1.6	1.7	5.0	4.6	1.0	2.5	1.0	2.0	1.2	6.0	2.3	1.5	2.0	0.6	1.0	0.6	3.0	0.4	1.5	0.4	0.4	0.6
Bankstown	2.6	7.8	9.9	16.1	6.3	0.9	2.3	1.1	1.9	1.2	5.4	2.6	2.7	5.0	4.6	2.9	2.5	8.1	0.9	4.0	1.2	2.0	1.6
Merrylands - Guildford	3.9	16.4	11.1	61.7	24.6	2.1	6.5	2.3	4.3	3.2	17.6	7.3	2.5	4.6	4.3	5.1	3.9	21.5	0.9	3.7	1.6	1.8	1.9
Auburn	4.4	16.6	15.3	31.6	8.1	0.8	2.7	1.0	1.7	1.6	6.7	3.4	3.0	5.9	5.9	4.2	3.7	14.2	0.9	4.2	1.2	2.4	1.3
Fairfield	1.8	7.7	5.7	26.8	22.8	2.2	7.6	2.3	4.9	2.8	21.3	6.7	1.1	2.3	2.2	2.8	2.3	11.8	0.4	1.9	1.0	1.0	1.2
Bringelly - Green Valley	0.7	2.5	2.2	8.4	7.8	1.6	4.8	1.5	3.2	1.4	10.1	3.0	0.9	1.2	0.7	0.9	0.8	4.0	0.3	1.0	0.5	0.3	0.5
Penrith	1.1	4.5	4.1	15.7	15.3	13.8	20.3	9.9	20.1	6.0	32.0	8.8	1.5	2.4	1.8	1.7	2.2	7.7	0.6	1.9	1.8	0.9	1.6
Camden	0.3	1.0	1.3	3.4	3.1	1.1	1.6	0.9	1.6	0.7	3.9	1.2	0.8	1.1	0.5	0.4	0.4	2.1	0.2	0.7	0.3	0.2	0.4
Blue Mountains - South	0.0	0.1	0.1	0.5	0.5	0.2	0.3	0.0	3.3	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
Wollondilly	0.3	1.1	1.3	3.3	2.9	0.8	1.0	0.4	0.6	0.9	3.4	1.3	1.3	2.0	0.4	0.6	0.3	2.1	0.3	1.3	0.8	0.3	0.6
Canada Bay	2.9	5.3	21.7	6.7	2.2	0.2	0.8	0.3	0.6	0.5	2.1	1.5	5.2	12.4	7.3	2.3	1.6	4.7	1.4	5.1	0.5	2.1	0.7
Pennant Hills - Epping		9.0	10.0	10.3	3.2	0.3	0.5	0.3	0.4	1.0	1.5	1.6	1.4	3.7	6.3	8.8	3.4	15.5	0.3	2.1	0.4	1.2	0.7
Carlingford	9.2		19.0	41.7	9.3	0.8	1.9	0.9	1.3	1.9	4.8	4.1	2.5	6.3	6.2	6.4	4.8	23.4	0.9	3.7	0.8	1.8	1.2
Ryde - Hunters Hill	10.7	19.4		23.4	5.9	0.5	1.3	0.6	0.7	1.4	3.6	3.9	10.3	30.5	28.4	6.9	4.8	15.8	2.6	12.7	1.1	6.2	1.1
Parramatta	11.0	46.2	25.5		47.1	2.6	8.5	3.5	5.9	6.8	23.5	15.2	3.6	7.6	9.3	11.7	9.6	65.2	1.1	5.5	2.1	3.1	2.5
Blacktown	3.4	11.6	9.8	46.9		5.1	9.2	5.4	5.3	8.9	46.8	33.7	1.9	3.9	4.5	7.2	5.4	49.5	0.5	3.0	1.4	1.6	1.6
Richmond - Windsor	0.3	0.9	0.9	3.5	5.0		2.2	20.1	3.4	10.7	6.5	7.0	0.3	0.7	0.6	0.5	2.6	2.8	0.1	0.6	0.3	0.1	0.3
St Marys	0.5	2.2	1.7	8.3	9.3	2.1		1.6	2.5	1.9	27.2	4.0	0.3	0.8	0.5	0.8	0.7	3.7	0.1	0.5	0.1	0.2	0.2
Hawkesbury	0.3	0.9	0.8	3.7	4.7	20.5	1.5		2.9	8.0	5.0	5.8	0.4	1.0	0.6	0.8	1.6	3.8	0.2	0.5	1.0	0.3	1.0
Blue Mountains	0.4	1.0	0.6	4.2	3.3	3.1	2.9	2.8		1.3	4.4	1.6	0.2	0.6	0.3	0.3	0.3	1.8	0.1	0.2	0.1	0.1	0.2
Rouse Hill - McGraths Hill	1.0	2.1	1.9	6.7	7.8	10.9	1.8	8.7	1.7		6.6	15.4	0.5	1.2	1.4	2.0	5.3	14.7	0.2	0.8	0.5	0.5	0.6
Mount Druitt	1.6	6.3	5.3	23.7	48.2	6.8	27.4	5.7	7.4	7.2		19.8	1.1	2.1	2.0	2.9	2.7	15.4	0.5	1.6	1.1	0.8	1.3
Blacktown - North	1.5	4.4	3.9	15.3	34.2	7.3	4.0	6.5	2.4	16.3	19.9		1.0	2.2	2.2	2.8	4.7	32.1	0.4	1.4	0.6	0.6	0.7
North Sydney - Mosman	1.5	2.3	8.6	3.0	1.6	0.3	0.3	0.4	0.2	0.5	1.9	2.2		31.1	9.1	1.7	1.5	4.1	12.0	20.7	0.8	4.4	0.8
Chatswood - Lane Cove	4.4	6.2	28.3	6.8	3.4	0.6	0.7	1.0	0.7	1.2	3.1	4.7	31.1		31.0	8.0	3.6	9.8	7.0	33.1	1.9	9.4	2.1
Ku-ring-gai	6.8	6.1	27.2	8.7	4.0	0.5	0.4	0.6	0.4	1.2	2.0	2.7	9.1	29.5		20.9	4.0	13.1	2.5	19.2	1.3	7.3	2.0
Hornsby	8.4	6.0	6.4	9.2	4.5	0.4	0.5	0.7	0.4	1.4	2.1	2.3	1.9	8.0	20.3		7.0	16.7	0.9	6.9	2.0	3.7	2.8
Dural - Wisemans Ferry	3.5	5.1	4.7	9.5	5.3	2.7	0.6	1.9	0.4	5.4	2.6	4.8	1.3	3.4	4.3	7.5		23.9	0.4	2.1	0.7	0.8	1.1
Baulkham Hills	16.0	25.9	17.5	66.4	50.5	3.1	3.8	4.7	2.9	15.7	15.8	32.3	3.3	8.6	13.6	21.2	24.6		1.1	5.9	1.9	3.4	2.2
Manly	0.4	0.8	2.4	1.0	0.4	0.0	0.1	0.2	0.1	0.2	0.8	0.6	11.4	6.8	2.4	0.9	0.5	1.3		15.9	0.2	3.0	0.3
Warringah	2.6	3.7	11.8	5.2	2.7	0.5	0.5	0.6	0.2	0.8	2.5	3.0	20.6	30.9	18.4	6.8	2.5	8.1	15.8		1.3	24.2	1.7
Wyong	0.4	0.8	0.9	2.0	1.3	0.3	0.1	0.9	0.1	0.5	1.1	0.5	0.8	1.7	1.2	1.8	0.7	1.8	7.6	1.3		0.7	50.2
Pittwater	1.5	1.9	6.0	3.0	1.5	0.1	0.2	0.2	0.1	0.5	1.0	1.0	4.7	9.2	7.2	3.8	0.9	4.2	3.0	25.3	0.6		0.8
Gosford	0.8	1.2	1.0	2.5	1.5	0.4	0.2	1.0	0.2	0.6	1.3	0.8	0.8	2.2	1.9	2.8	1.1	2.3	2.7	1.7	56.5	0.9	

Source: ACIL Allen Consulting, 2014

The heat map provides a broad overview of the DEC of journeys between origin-destination pairs in the Sydney GCCSA. It can be seen that high DEC journeys are concentrated in the top left quadrant of the matrix where the SA3s closer to the city's centre can be found.

Hotspots include journeys to and from the Sydney Inner City, Bankstown, Fairfield, Ryde, Hunters Hill and Parramatta. Journeys between the SA3s 'Gosford' and 'Wyong' are another hotspot. It is important to note that SA3s are not the same size. SA3s such as 'Wyong' or 'Gosford' can cover geographical areas multiple times larger than some of the SA3s closer to the city centre. As a result the DEC calculated for these areas and other SA3s further from the city centre is spread out over a larger area.

For each conurbation, ACIL Allen also produced heat maps of the DEC of public transport journeys by origin-destination pairs (aggregated across all public transport modes).

Major urban transport corridors

In addition to analysing the, utilisation, DEC and delay costs of urban transport in each conurbation by origin-destination pairs, ACIL Allen also analysed these metrics for major corridors in the conurbations. A corridor is a commonly travelled route and might consist of multiple parallel roads. As an example, a set of 34 major road corridors was analysed for the Sydney conurbation.

The following table provides a summary for the top 20 corridors by DEC in 2010-11 across all conurbations. Of these, 8 are located in the Melbourne-Geelong conurbation, 6 in the Sydney-Newcastle-Wollongong conurbation and 4 in the Brisbane-Gold Coast-Sunshine Coast conurbation.

Table ES 12 **Top 20 corridors by DEC in 2010-11**

Conurbation	Description	Total capacity	Utilisation	Congestion (Volume-to-capacity during typical work day)	Delay cost	DEC
		VKT per hour	VKT per day	%	$m	$m
Melbourne-Geelong	Monash/Princes Fwy Corridor	962,280	8,974,207	39%	180	994
Melbourne-Geelong	North-South Arterials - Eastern Suburbs	560,679	4,601,362	34%	174	862
Sydney-Newcastle-Wollongong	Sydney to Central Coast	831,633	7,724,994	39%	158	852
Perth	Perth Mandurah Corridor	1,193,302	6,728,635	23%	218	769
Melbourne-Geelong	Eastlink/Frankston Fwy Corridor	683,742	5,335,131	33%	87	612
Melbourne-Geelong	East-West Arterials - Lilydale Corridor	439,378	3,350,758	32%	97	546
Melbourne-Geelong	West Gate/Princes Freeway Corridor	638,072	5,193,777	34%	105	498
Sydney-Newcastle-Wollongong	East West corridor	313,134	3,419,907	46%	128	470
Sydney-Newcastle-Wollongong	Mittagong to SW Sydney via Hume Mwy	636,827	4,591,610	30%	72	433
Sydney-Newcastle-Wollongong	South Coast to Sydney	420,307	3,246,397	32%	107	431
Melbourne-Geelong	Western/Metropolitan Ring Road	334,294	4,076,503	51%	87	426
Melbourne-Geelong	East-West Arterials - Wantirna Corridor	303,901	2,310,501	32%	65	391
Brisbane-Gold Coast-Sunshine Coast	Logan River - Gateway Mwy	438,272	3,815,916	36%	75	369
Melbourne-Geelong	Inner Beach Suburbs Corridor	304,426	2,245,022	31%	61	362
Brisbane-Gold Coast-Sunshine Coast	Pacific Mwy | City - Beenleigh	353,893	3,859,594	45%	75	349
Sydney-Newcastle-Wollongong	Homebush Bay to Mona Vale Corridor (A3)	156,685	1,685,038	45%	135	328
Perth	Mitchell Fwy Corridor	288,527	2,783,612	40%	114	319
Brisbane-Gold Coast-Sunshine Coast	North Brisbane - Sunshine Coast	570,335	4,168,199	30%	17	297
Brisbane-Gold Coast-Sunshine Coast	City - Brisbane North	154,024	1,577,282	48%	87	290
Sydney-Newcastle-Wollongong	Sutherland - Ryde/Parramatta Corridor	130,052	1,492,970	49%	113	290

Source: ACIL Allen Consulting, 2014

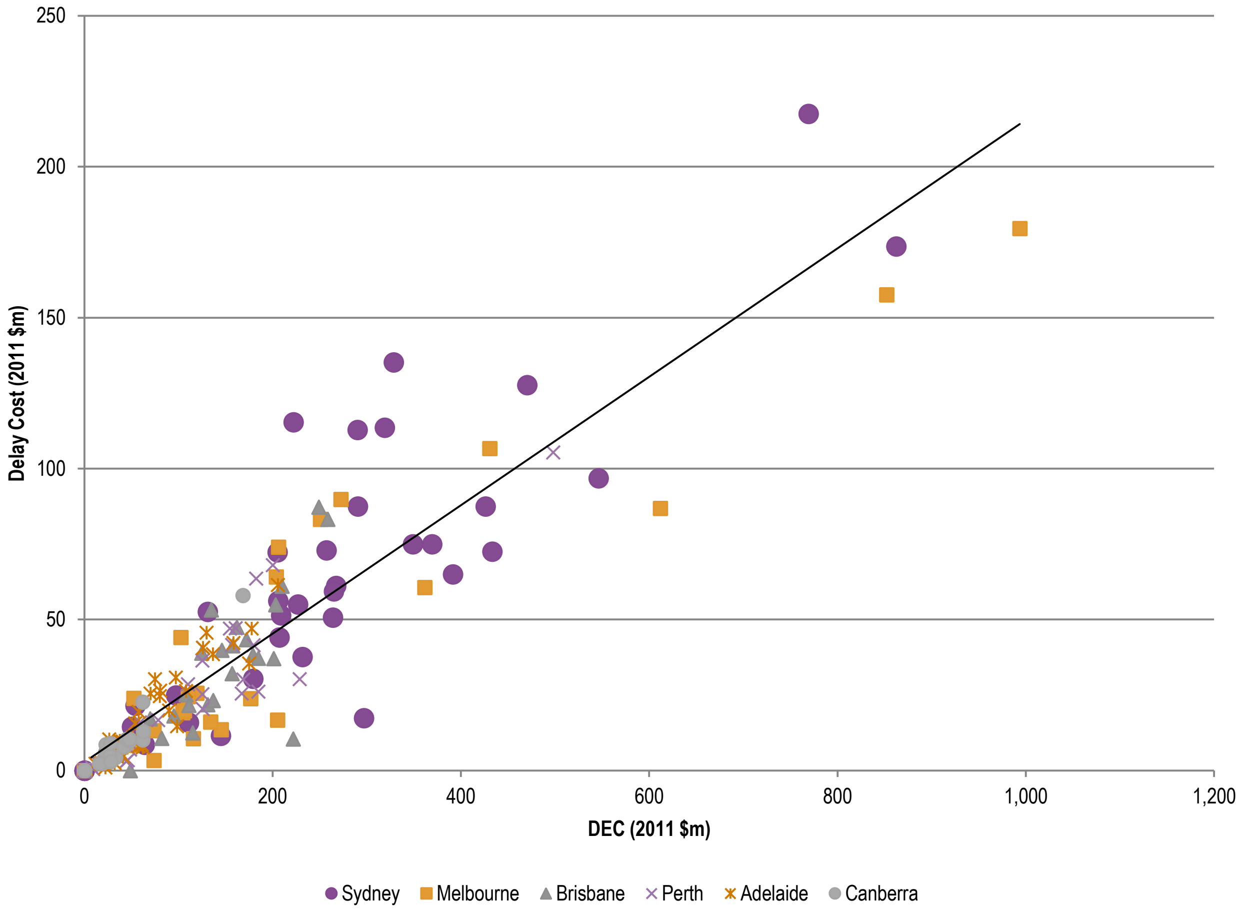
The DEC of any given corridor is influenced by a number of factors including extent of road network included, length and capacity of that network, average speeds, traffic and congestion. Overall, it is an estimate of the total value added in use of the road network for that corridor. Therefore, a high DEC indicates a high base that transports solutions may provide benefit to. High congestion indicates opportunities to reduce avoidable costs.

High DEC corridors tend to be those that are highly utilised and, to a lesser extent, of high capacity. The major arterials that connect distant regions within conurbations or to regions outside of them have the highest DECs.

Comparison of DEC and congestion of corridors

Figure ES 5 presents a plot of corridor DEC against delay cost across all conurbations. There is a clear relationship between DEC and delay costs. This is expected since delay costs directly contribute to higher DEC (due to increasing the total time in travel).

Figure ES 5 **DEC and delay cost for urban transport corridors**



Note: The figure above is for the conurbations (e.g., Sydney is for Sydney-Newcastle-Wollongong). The full conurbation name is shortened for clearer graphic presentation.
Source: ACIL Allen Consulting, 2014

Corridors represented by points above the line are estimated to have a higher than average delay cost per unit of DEC. These are dominated by corridors in Sydney-Newcastle-Wollongong conurbations.

The analysis of corridors can be used to identify where transport solutions could maximise value. It does this by showing the relative economic contribution of corridors and more importantly, corridors with disproportionately high congestion costs. The projections for corridors, show where DEC and congestion grow the fastest under the assumption that no new projects are undertaken beyond those that are already committed. This highlights gap areas where transport solutions could be considered.

Analysis of routes and segments within corridors

Corridors can consist of a set of distinct routes using a number of roads. Each route may then be further divided into individual road segments. The DEC and congestion of routes within the top two corridors in each conurbation is provided in this report. The audit data set provides capacity, utilisation, DEC and congestion for all routes and segments.

1 Introduction

1.1 Background and context

ACIL Allen has been engaged by Infrastructure Australia (IA) to provide an audit and projections of urban transport infrastructure in Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney.

This report on urban transport infrastructure compliments a broader report on infrastructure in Australia, the Australian Infrastructure Audit (AIA): National Economic Analysis, which is a review of existing airport, port, rail, electricity, gas, petroleum, water and telecommunications infrastructure, their economic contribution and future needs.

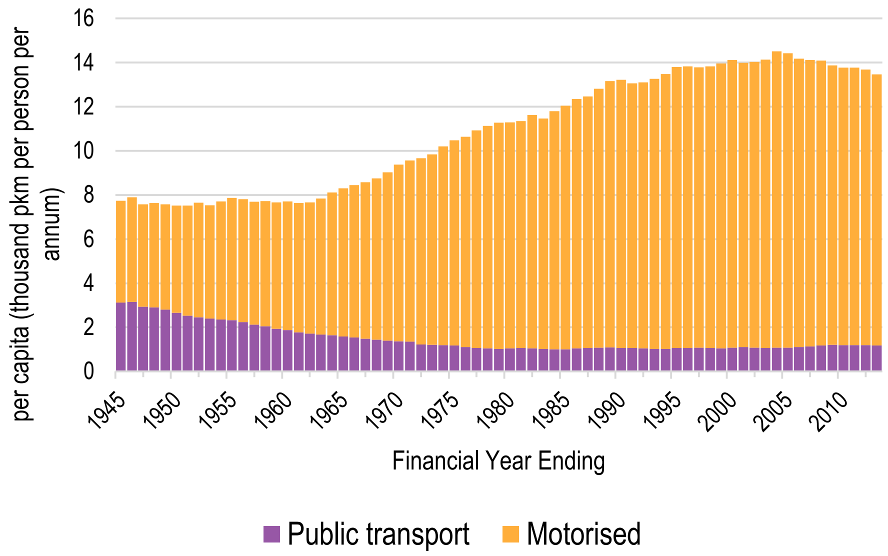
The broader AIA aimed to develop a set of baseline data on nationally significant infrastructure, together with projections of demand for future infrastructure services. The data set developed as part of the broader AIA will allow IA to conduct an evidence based assessment of Australia's future infrastructure needs.

Urban transport infrastructure plays an important role in the Australian economy. It directly impacts the daily trips made (for both work and leisure) by more than 15 million Australians who live in the urban areas of the eight State and Territory capital cities. Urban transport infrastructure not only services the needs of households but also those of businesses in the transportation of goods and services.

The spending on transport related items as reported in the household expenditure surveys carried out by the Australian Bureau of Statistics (ABS) shows the importance of urban transport for households.

Since 1900 the urban transport task in Australian cities has increased 56 fold while the population of urban centres increased 11 fold (BITRE, 2014). Rising income levels have traditionally gone hand in hand with increases in passenger travel. This increase is, however, generally not linear as travel begins to take up more time than people are willing to commit to it. Saturation in travel demand per person is a trend that has been observed in a number of countries (BITRE, 2012). Figure 1 shows the travel demand per capita across Australian cities since 1945.

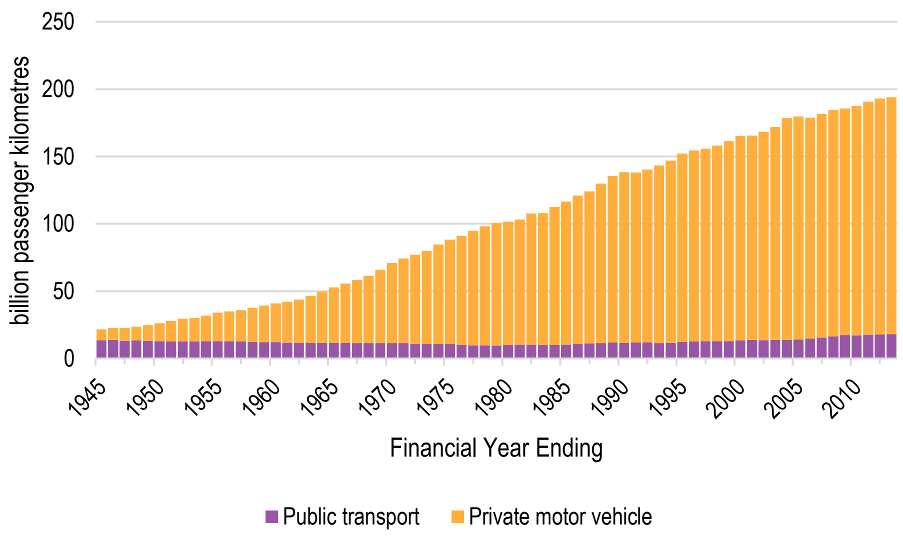
Figure 1 **Metropolitan transport task per capita**



Source: (BITRE, 2014)

While travel demand per person may have reached saturation levels, overall travel demand across Australian cities is continuing to rise as a result of population growth. Figure 2 shows the passenger kilometres travelled across the eight State and Territory capital cities since 1945.

Figure 2 **Passenger kilometres travelled across eight capital cities**



Source: (BITRE, 2014)

Against the backdrop of projected strong growth in population, investment in urban transport infrastructure will be critical to ensure that urban transport remains conducive to economic development and growth across Australia's cities.

1.2 Study objective and scope

This report aims to provide an overview of the current and projected direct economic contribution (DEC) of urban transport infrastructure in the conurbations of Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney. (A conurbation is an extended urban area, which might consist of several towns merging with the suburbs of a central city.) The report also identifies the capacity, utilisation and congestion of existing urban transport infrastructure and future infrastructure gaps under a “low investment” scenario (where only projects already committed to by governments are included).

The estimate of DEC of urban transport infrastructure provided in this report is calculated using a methodology that makes the results comparable to those obtained for other infrastructure services as part of the broader AIA.

The application of a consistent methodology for calculating DEC allows comparisons across different modes of urban transport infrastructure, cities and areas within cities. Hot-spots or areas where urban transport infrastructure has a high DEC can be identified using this methodology.

The objective of this work is to allow Infrastructure Australia to conduct an evidence based assessment of the current and future urban transport infrastructure needs in Australia’s major cities.

1.3 Study approach

The analysis undertaken for this report applies a consistent methodology to estimate the DEC of urban transport infrastructure in 2010-11 and the projected DEC of urban transport infrastructure in 2030-31. The approach taken for this study is a bottom-up approach combining transport modelling at a high spatial resolution with economic modelling. Key steps in this process are:

1. Review existing urban transport infrastructure and project future capacity
   a) Establish the current urban transport system capacity by transport mode and network
   b) Determine a set of likely network expansions under a “low investment” scenario
2. Development of existing and future travel demand data
   a) Establish a baseline set of demographic data:
      i) Estimated resident population
      ii) Enrolment in schools and tertiary education facilities
      iii) Employment by destination zone (DZN)
   b) Development of demand estimates for special travel demand generators:
      i) Airport passengers
      ii) Tourism and recreation visitation rates
      iii) Freight and logistic terminals
   c) Projections of future travel demand:
      i) Population projections based on ABS Series B projections
      ii) Projections of employment growth based on regional growth plans
3. Transport modelling
   a) Simulation of transport systems for 2010-11 and 2030-31
      i) Number of trips taken
      ii) Hours of travel time
      iii) Kilometres travelled
4. Develop a set of economic parameters to convert transport modelling results to economic impact modelling results
   a) Shadow toll as an estimate of user willingness to pay, and fares paid on public transport
   b) Input cost as operating costs excluding labour

5. Economic modelling
   a) Economic parameters combined with measures of transport activity to derive economic contribution by mode (Cars, Light Commercial Vehicles, Heavy Commercial Vehicles, Rail, Bus, Light rail and Ferry)
   b) Reconciliation of bottom-up measurements of DEC with top down estimates of DEC. where economic contribution is estimated using a combination of national accounts and household expenditure surveys. Top down estimates of the DEC of the urban transport infrastructure in Hobart and Darwin were also calculated.

1.4 Report structure

The remainder of this report is structured as follows:

- Chapter 2 provides an overview of ACIL Allen's economic modelling of the urban transport sector. This chapter includes a definition of urban transport in the context of this report and a description of the transport modelling undertaken by VLC.
- Chapter 3 presents summary results from the urban transport infrastructure audit and economic analysis. Audit findings of urban transport infrastructure capacity, utilisation and direct economic contributions (DEC) are reported at the regional level to illustrate differences across geographies.
- Chapters 4 to 9 details the results from the urban transport infrastructure audit for each of the regions/cities analysed. Each chapter includes an overview of current issues in the transport systems of the analysed cities, current network capacity, utilisation of that capacity and congestion, and the DEC of the urban transport system. For each urban transport system the DEC is analysed for each origin-destination pair within the system at the SA3[3] level. The results also include analysis of some of the key road corridors in each system. Each chapter concludes with projections of key indicators to the year 2031. Specifically:
  - Chapter 4 presents the results for the Sydney-Newcastle-Wollongong conurbation
  - Chapter 5 presents the results for the Melbourne-Geelong conurbation
  - Chapter 6 presents the results for the Brisbane-South-East-Queensland conurbation
  - Chapter 7 presents the results for the Perth-Wheatbelt conurbation
  - Chapter 8 presents the results for the Adelaide-Yorketown conurbation
  - Chapter 9 presents the results for the Canberra-Goulburn-Yass conurbation.

[3] ABS Australian Statistical Geography Standard (ASGS) Statistical Area Level 3 (SA3) (ABS, July 2011)

2 Overview of ACIL Allen's economic modelling of urban transport

2.1 Definition of urban transport

The urban transport component of the AIA encompasses transport infrastructure services in urban areas that are made available to the public. The transport networks analysed lie within the greater capital city statistical areas (GCCSA) and areas in the conurbations of Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney. We note that the conurbations cover a larger area than the GCCSAs. The analysis carried out for this audit of urban transport covers the road network, buses, heavy rail, light rail and ferries.

The road network in this urban transport component of the AIA is delineated against the national highway component of the broader AIA. The national highway component of the broader AIA excludes those roads within the national land transport network that run through areas for which the transport system has been analysed in more detail in the AIA of urban transport. The urban transport AIA includes roads of the national land transport network and the entire road network made available for use by passenger cars, light commercial vehicles and heavy commercial vehicles.

Urban transport as defined for the AIA includes all bus networks that are open to public patronage. As such the bus networks analysed for the urban transport component of the AIA include both government and privately operated parts of the bus network.

The rail network that is analysed as part of the urban transport component of the AIA includes suburban and inter-city trains where they service urban areas. The rail network that is within scope of the urban transport component of the AIA includes both heavy and light rail but does not include rail freight.

The urban transport component of the AIA does not cover roads, buses or rail servicing locations outside of the greater urban transport systems of Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney. Private rail networks that are not open to public patronage as well as walking and cycling are not analysed as part of the urban transport component of the AIA.

The conurbation areas for which the urban transport systems have been analysed are demarcated along the boundaries of Statistical Areas Level 3 (SA3):

- **Sydney –** The urban transport analysis for the Sydney conurbation includes Wollongong, the Southern Highlands, the South Coast, Newcastle and the Hunter Valley. The area for which the urban transport network has been analysed had a population of 5.7 million people in 2011. Where we refer to the urban transport area in the Sydney conurbation, we will use the term 'Sydney-Newcastle-Wollongong'.
- **Melbourne –** In the Melbourne region the Mornington Peninsula and Geelong are included in the analysis of urban transport infrastructure. We note that VLC's model of the urban transport system of Melbourne includes most of the Melbourne GCCSA but excludes the Macedon ranges SA3. The area for which urban transport has been analysed had a population of 4.4 million in 2011. Where we refer to the urban transport conurbation of Melbourne, we will use the term 'Melbourne-Geelong'.

- **Brisbane –** For Brisbane the urban transport analysis includes the Gold Coast and Sunshine Coast. The analysis for Brisbane covers an area which in 2011 had a population of around 3 million people. Where we refer to the urban transport conurbation of the Brisbane region' we will use the term 'Brisbane-South-East-Queensland'.
- **Perth –** The analysis of urban transport for the Perth conurbation includes the area of Bunbury, Mandurah and Lancelin. The transport system analysed in the conurbation of Perth housed a total population of around 2 million people in 2011. Where we refer to the Perth conurbation, we will use the term 'Perth-Wheatbelt'.
- **Adelaide –** The analysis for Adelaide comprises the Yorketown peninsula, Kangaroo Island and Murray Bridge. The area covered as part of the urban transport analysis for Adelaide had a population 1.5 million people in 2011. Where we refer to the urban transport conurbation of the Adelaide region, we will use the term 'Adelaide-Yorketown'.
- **Canberra –** The analysis of the Canberra region includes the regional centres of Yass, Goulbourn and Bungendore which had a total population of 0.5 million people in 2011. Where we refer to the urban transport conurbation of Canberra, we will use the term 'Canberra-Goulbourn-Yass'.

In total the urban transport systems analysed for this report cover an area which had a population of 17 million in 2011. Maps showing an outline of the conurbation analysed as part of the urban transport analysis are provided at the beginning of each chapter.

2.2 Transport modelling by Veitch-Lister

ACIL Allen has partnered with Veitch Lister Consulting (VLC) to model urban transport. VLC has provided transport modelling simulations that provide an input into ACIL Allen's economic analyses of the urban transport sector.

2.2.1 Overview of the Zenith transport model

Zenith is a travel modelling system developed by Veitch Lister Consulting (VLC), which has been used extensively for transport planning in Australian cities and regions. Zenith is a four step multi-modal model of the transport system.

Zenith modelling allows an assessment of the adequacy of a transport system. Modelling in Zenith allows a consideration of different scenarios of future travel demand and changes in transport infrastructure.

Inputs to VLC's transport model include assumptions regarding population, land use, employment, income and demographic profile and the structure of the transport system.

Key inputs to VLC's transport modelling include demographic estimates and projections at a high spatial resolution. Demographic estimates used within the modelling contain information on employment, education enrolment and visitor data. The estimates are derived using data from a variety of sources including:

- 2011 Australian Bureau of Statistics (ABS) Census of Population and Housing
- ABS Series B population projections and associated age structure data
- Office of Economic and Statistical Research household projections
- ABS Estimated Resident Population data
- Local government land use data
- Enrolment data for primary, secondary and tertiary institutions
- Planning scheme data
- Tourism forecast data

To project future travel demand from commuters, journey to work data from the 2011 Census was scaled up based on projections of future employment. Employment projections are based on a number of known developments and information obtained from local and regional planning instruments.

Travel demand from journeys to schools and universities was projected using an age-cohort model.

Students are allocated to existing institutions within their area of residences (at the SA2 level). Where the capacity of local schools was found to be insufficient, students were allocated to schools in neighbouring SA2's. New schools were assumed to be opened in areas of high growth or where information on new schools was available.

Travel demand from domestic and international visitors was projected forward by using the ratio between resident population and visitors from the 2011 Census.

For the purpose of modelling the future urban transport systems of the respective cities, a "low investment" scenario was adopted. In the modelling, a balance of projects which are committed and projects which are needed to support key growth centres are deemed to have been completed by 2031. Details on the projects that are assumed to go ahead in each city are provided in the chapters presenting the results for the urban transport analysis in 2031 (in particular, in Sections 4.7.2, 5.7.2, 6.7.2, 7.7.2 and 8.7.2)

Outputs from the Zenith model include measures of transport system capacity, utilisation and congestion. Zenith modelling outputs are described in more detail in the following section.

2.2.2 Zenith transport model outputs

Outputs from the Zenith transport model include measures covering the capacity, utilisation and congestion of the urban transport networks analysed (the 6 conurbations). Table 1 provides an overview of the key metrics on capacity, utilisation and congestion that form the output of VLC's transport modelling.

Table 1 **Overview of outputs of the Zenith transport model**

Model output	Description	Transport mode	Unit
Capacity			
Kilometres of road network	The length of the road network	road	km
Vehicle kilometres of carrying capacity	The length of roads multiplied by the number of vehicles that can travel on the road under normal conditions	road	km*vehicles per day
Passenger kilometres of carrying capacity	The length of public transport links multiplied the passenger capacity	public transport	km*passengers per day
Utilisation			
Vehicle kilometres travelled (VKT)	Calculated by multiplying demand on a link by the length of the link.	all modes	km*vehicles per day
Vehicle hours travelled (VHT)	Calculated by multiplying demand on a link by the time it takes to travel on the links.	all modes	Hours*vehicles per day
Passengers hours spent in travel	The amount of time passengers spend travelling	all modes	Hours*passengers per day
Passenger ‘boardings’	The number of patrons entering the public transport network	public transport	Passengers per day
Congestion			
Volume to capacity ratios (V/C)	VKT travelled divided by VKT of capacity. Can be calculated for: ▪ Morning (7am – 9am) peak ▪ Afternoon (4pm – 6pm) peak and typical work day	all modes	-
Delay time	▪ Difference between free-flow (uncongested) travel time and expected (with simulated traffic) travel time	all modes	hours

Source: ACIL Allen Consulting, 2014

Kilometres of road network simply indicate the length of the overall road network and does not account for multiple lanes e.g. the length of a one lane road is counted in the same way as the length of a four lane road.

Vehicle kilometres of carrying capacity better describe the capacity of a road to accommodate traffic than the simple length of the network.

Vehicle kilometres of carrying capacity for a road link is calculated by multiplying the length of the link by the number of vehicles that can travel over this link under normal conditions over the course of one day. This is also referred to as the ‘practical capacity’[4] of a road link. For the purpose of estimating the capacity of a link, normal conditions refer to a situation where there is no limit on travel speed through vehicular congestion. Normal conditions account for delays through speed limits, traffic lights and other intersection controls. A typical value for the vehicle kilometres of carrying capacity for an arterial road is 900 vehicles per km per hour.

For railways, passenger kilometres of carrying capacity can be measured either as crush passenger kilometres or as seated passenger kilometres. Crush capacity includes standing capacity and is the capacity of a public transport vehicle including all spaces in which

[4] In urban road networks it is usually the intersections (rather than the mid-block segments) that dictate or limit the capacity of a road link or even a whole route. The ‘Level of Service’ provided at an intersection is normally assessed via the average delay experienced by vehicles. However, the average delay can vary between differing approaches and movements, and for the same movement at differing times of the day.

The problem with assessing the performance of intersections is that the capacity of individual movements (and hence the average delays incurred by them) are dependent on other conflicting movements at the intersection. The average delay and hence level of service provided to traffic on one approach is generally influenced, if not dictated, by the volumes on other approaches.

The link capacities that VLC encode (for higher order roads) in its model networks attempt to reflect the ‘practical’ or ‘design’ capacity of the road / route concerned.

passengers can stand. For Sydney Trains the crush capacity is assumed to be 160 per cent of the seating capacity.

Vehicle kilometres travelled (VKT) is a measure of road network utilisation. It is calculated by multiplying the number of vehicles that travel over a link per day by the length of the link.

Vehicle hours travelled (VHT) is a measure of public transport and road network utilisation. VHT is calculated by multiplying the time vehicles spend travelling over a link with the length of that link.

Passenger hours spent in travel can be calculated for road travel and for travel along the public transport network. Passenger hours travelled are an estimate of the time people spend travelling.

Passenger boardings are the number of people of entering the public transport system over the course of a day.

Measures of congestion of urban transport infrastructure can be derived from capacity and utilisation figures. Volume to capacity ratios can be calculated for both public and road transport. Volume to capacity ratios are calculated by dividing the utilisation, in VKT, of a road or public transport link by its capacity in VKT.

Delay time is a measure of road network congestion for a link. It is calculated as the difference between travel time during congested periods and the travel time under normal conditions.

2.3 Economic modelling approach and methodology

2.3.1 Measuring economic contribution of urban transport infrastructure by demand for mobility

The economic contribution of urban transport is estimated through the demand for mobility by origin-destination pairs. The direct economic contribution (DEC) of transport can be calculated for each origin-destination pair.

The DEC is a measure of the contribution from infrastructure to economic output or gross domestic product (GDP). Within the broader AIA, DEC is calculated as the revenue generated by a sector minus its input costs (but including labour costs).

Revenue within the urban transport sector is difficult to calculate as urban transport infrastructure is either not priced or subsidised. This makes it necessary to use an alternate measure of revenue for urban transport infrastructure.

For the urban transport component of the AIA, the DEC of urban transport infrastructure is measured as:

$$\boldsymbol{DEC} = Shadow\ toll\ - Input\ Costs$$

Shadow toll

Shadow toll is an estimate of the value a user derives from the use of transport infrastructure. This value is estimated through the cost a user is willing to incur to use a service. Shadow toll takes into account the value of travel time (VOTT), tolls, fares and vehicle operating cost (VOC) a user of urban transport services incurs.

For road transport the Shadow toll is calculated as:

$$\boldsymbol{Shadow\ toll\ (road\ vechicles)} = Valueof\ travel\ time\ (VOTT) + Tolls\ paid + Vehicle\ Operating\ Costs\ (VOCs)\ incurred$$

For public transport the shadow toll is calculated as:

$$\boldsymbol{Shadow\ toll\ (public\ transport)} = Value\ of\ travel\ time\ (VOTT) + Fare\ paid$$

We note that the shadow toll of road vehicle travel includes a measure of delay cost as the value of time people spend in delayed road traffic. The delay cost of road travel is measured as the difference between the time it takes to travel a road link under congested conditions and the time it takes to travel the road link under uncongested conditions.

The cost of crowding on public transport is taken into account in that increased demand for public transport leads to higher DEC from public transport. The modelling framework does not allow the measurement of the cost of public transport delays in the same way as delays on roads. As a result the estimates of DEC from public transport provide are a conservative estimate.

We note that the cost of parking is not included in calculations of the DEC of urban transport infrastructure. Parking costs are not measured as parking facilities are considered to be outside the urban transport infrastructure. We note that the cost of parking is accounted for in the mode choice decisions within the transport model.

Input costs

Input costs in the urban transport sector include the cost of road maintenance, VOC and operating expenses excluding labour costs for public transport. It is important to note that in the calculation of DEC, VOC input costs are offset by revenue as measured through the shadow toll. As a result, VOC have no influence on the DEC of urban transport infrastructure and are not explicitly accounted for in the analysis for this report.

Input costs for road transport are calculated as:

$$\boldsymbol{Input\ costs\ (road\ vehicles)} = Cost\ of\ road\ maintenance + Vehicle\ Operating\ Costs\ (VOCs)\ incurred$$

Input costs for public transport are calculated as:

$$\boldsymbol{Input\ costs\ (public\ transport)} = Operating\ expenses\ excluding\ labour\ cost$$

Reconciliation

We note that our measure of DEC from urban transport infrastructure includes the value of time of journeys that are not for hire or reward, which is not normally counted in the National Accounts.
The approach to calculating the DEC represents a bottom-up approach.

Transport activity data from VLC's transport modelling is combined with economic parameters to derive the DEC of different transport modes. The bottom-up approach also allows the calculation of the DEC of individual transport links at a high spatial resolution.

For each of the transport systems analysed within this report, the results of the bottom-up approach described above are compared with those from a top-down approach on an aggregate level.

Data from the household expenditure survey is used to calculate the DEC of public transport and private motor vehicle travel. National accounts data are used to estimate the DEC of freight movements.

Reconciliation between the bottom-up and the top-down approaches allows the verification of the results of this audit at an aggregate level. We note, however, that a complete reconciliation between the two approaches is not feasible:

- The expenditure on private motor vehicles reported within the ABS Household Expenditure Survey includes vehicle operating cost but does not include the value of time spent traveling on urban transport infrastructure. The measurement of DEC from road transport in the bottom-up approach includes the value of travel time but excludes vehicle operating costs.
- Expenditure on public transport reported in the Household Expenditure Survey represents what users pay and does not include the value of time spent travelling on public transport.
- National accounts data on freight movements assigns value to freight movements where contracts are struck whereas the transport simulation model assigns the value to where physical transport activity occurs.
- Data on freight movements from national accounts is more extensive than the data obtained from the bottom-up model (particularly in rail). National accounts data includes the DEC of private rail whereas private rail is excluded from the transport modelling.

Overall the estimates of DEC obtained from the top-down approach are relatively closely aligned to the results of the bottom-up approach.

Taxes and externalities

The calculation of the DEC of urban transport infrastructure is based on the perceived cost of using urban transport infrastructure. This measure of the willingness to pay for transport includes taxes which would be removed in a traditional cost-benefit analysis.

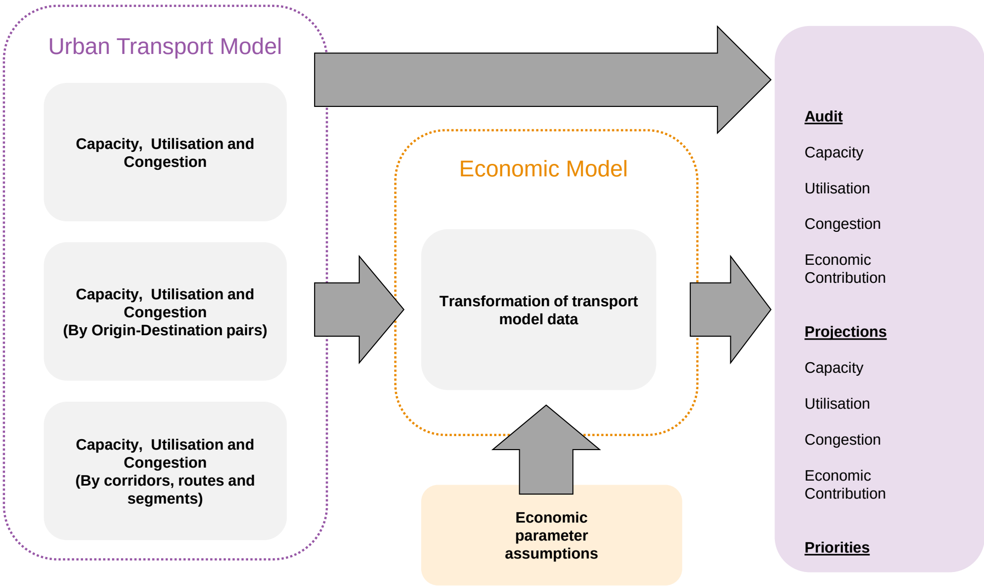
Externalities such as the cost of carbon emissions and noise pollution are not included in the measurements of DEC.

2.3.2 Transforming Zenith outputs into economic impact analysis results

Outputs from VLC's urban transport modelling serve as an input to the economic appraisal of urban transport.

Capacity, utilisation and congesting outputs from VLC's transport modelling as well as assumptions on a range of economic parameters are used to calculate the DEC of urban transport infrastructure. Figure 3 provides an overview of the interplay between the transport modelling undertaken by VLC and the economic modelling undertaken by ACIL Allen.

Figure 3 **Overview of economic modelling of urban transport**



Source: ACIL Allen Consulting, 2014

Consistent with the broader AIA, DEC, capacity, utilisation and congestion are calculated for the financial years 2010-11 and 2030-31.

To calculate the DEC of urban transport infrastructure from the outputs of the transport model, a number of assumptions regarding economic parameters are employed. Table 2 provides an overview of the economic parameters used to calculate the DEC for urban transport in the Sydney-Newcastle-Wollongong region. The parameters for the other regions are listed in Appendix B.

Table 2 **Parameters used in the economic modelling of urban transport – Sydney-Newcastle-Wollongong**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per hour	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$1.77 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Rail	$3.19 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Light rail	$2.86 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' (based on rail fare for short trip)
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	$27.23 per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' LEK (2008) – Cost Review of CityRail's Regular Passenger Services
Bus input costs	Bus	$424m per year	IPart (2011) – CityRail and Metropolitan and Outer Metropolitan Bus Services: Prices and Services Report 2011 State Transit Authority (2011) – Annual report 2010/11
Ferry input costs	Ferry	$37.83 per vessel hour	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Sydney Ferries (2011) – Annual report 2010/11
Light rail input costs	Light rail	$864,015 per year (track and train) $12.71per train hour $7.05 per train km	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Email communication with RMS Transdev website (http://www.transdevsydney.com.au/)

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013) (IPART, 2011), (Sydney Ferries, 2011) (Transdev)

The VOTT represents the largest component of the DEC for most transport links. A different VOTT is applied to each transport mode, reflecting the differences in opportunity cost for each transport mode. The VOTT is anchored in the average hourly earnings. For business trips a premium to average hourly earnings is applied while private trips are valued at a discount to the average hourly earnings (RMS, 2013). For roads, the VOTT values from the table above are applied to the total hours vehicles spend travelling along a road link. For urban transport the VOTT is multiplied by the total time passengers spend travelling on the urban transport link.

The VOTT also provides a measure of the cost of congestion. Congestion in this report is measured as the time it takes to travel on a particular link under congested conditions versus the time it takes to travel the same link under normal conditions. The cost of congestion is then calculated by valuing this time by the VOTT values shown in the table above. It is important to note that the cost of congestion forms part of the DEC of urban transport infrastructure.

Average fares applicable to each public transport mode are used to calculate the fare component of public transport shadow tolls. The average fares are multiplied by the number of trips taken on each mode to arrive at the total shadow toll for a particular public transport mode.

Road maintenance costs form part of the input cost calculation and assumptions vary for different vehicle types. The maintenance costs do not include labour costs and are expressed per VKT.

The public transport input cost shown in the table above are used to calculate the network wide DEC of different modes of public transport infrastructure. The DEC from public transport for a particular link is calculated based on the VKT travelled on that link and the network-wide ratio of DEC to VKT.

2.3.3 Hierarchy of economic analysis – corridors, routes and segments

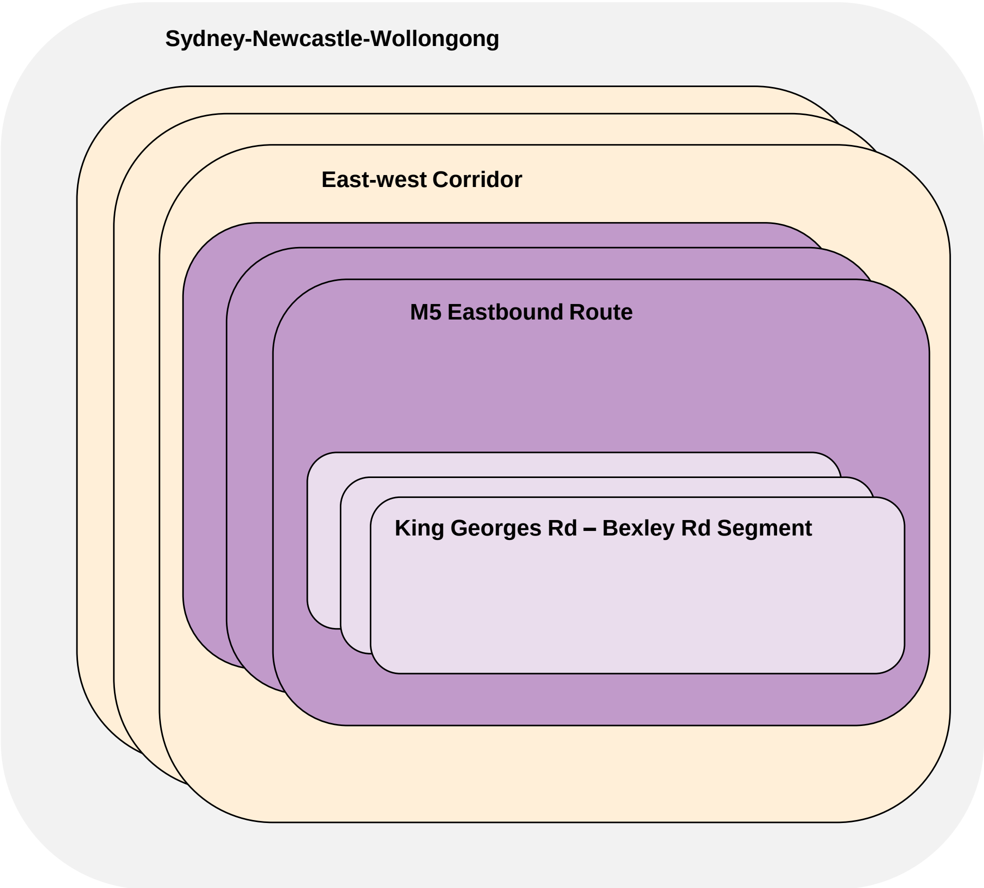
Results from the transport modelling are grouped into a hierarchical system, namely:

- major transport corridors
- routes within corridors
- segments within routes.

As an example, Figure 4 provides an overview of the hierarchical structure of transport modelling results for a particular road segment in the Sydney-Newcastle-Wollongong region.

We note that corridors can consist of a set of distinct routes using a number of roads or only one route for each direction the corridor can be travelled in.

Figure 4 **Disaggregation of transport modelling results**



Source: ACIL Allen Consulting, 2014

2.4 Relation to infrastructure audit results for other sectors

The DEC allows for a direct comparison between different infrastructure sectors and also between the urban transport systems of the cities assessed for this audit.

The DEC is a measure of the contribution from infrastructure to economic output or gross domestic product (GDP). Within the broader AIA, DEC is calculated as the revenue generated by a sector minus its input costs (but including labour costs).

Urban transport infrastructure is mostly not priced or subsidised. As a result, revenue generated by urban transport infrastructure cannot be measured easily.

For the audit of urban transport, “revenue” from urban transport infrastructure is estimated using a willingness to pay approach. The willingness to pay for the use of urban transport infrastructure indicates the value that is placed on urban transport infrastructure. Willingness to pay includes people’s willingness to spend time travelling using urban transport infrastructure.

The DEC of urban transport infrastructure is large when compared to other infrastructure sectors covered in ACIL Allen’s broader review of infrastructure in Australia.

Urban transport infrastructure has a DEC that is nearly as high as the DEC of energy, water, telecommunications and transport[5] (excl. urban transport) combined. The magnitude of the DEC of urban transport infrastructure analysed for this report is attributable to a number of factors:

- The urban transport infrastructure analysed for this report covers the urban transport for a large proportion of the Australian population. The area for which the urban transport sector has been analysed had a population of 17 million people in 2010-11.
- Households spend significant time using urban transport in Australia's cities. Household travel survey results for major Australian cities indicate that residents spend over one hour a day travelling on urban transport infrastructure. In 2011-12 the average daily travel time for households in Sydney was 79 minutes (Bureau of Transport Statistics, 2013). In Brisbane and South-East Queensland residents travelled an average of 65 minutes a day in 2009 (Department of Transport and Main Roads, 2012).

The household expenditure survey confirms the importance of the urban transport sector, showing that expenditure on transport accounted for 15.6 per cent of households' total goods and service expenditure in 2009-10 (ABS, 2011).

Growth in DEC indicates the scale of change expected in a certain infrastructure sector. Comparisons of DEC across the urban transport systems analysed for this report will provide useful information for policy-makers in terms of future planning of urban transport infrastructure.

[5] The transport sector analysed as part of the broader AIA includes transport through, ports, airports and the national highway where it is not covered as part of the audit of urban transport infrastructure.

3 Urban transport audit results

3.1 Audit of existing urban transport infrastructure

3.1.1 Capacity and utilisation of urban transport

Capacity of urban transport in 2010-11

Table 3 provides a summary of capacity of urban transport by mode for each urban transport region.

Table 3 **Capacity by urban transport region and mode (2010-11)**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	VKT per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day
Sydney-Newcastle-Wollongong	615,617,472	103,294,968	24,176,934	2,270,280	82,870
Melbourne-Geelong	600,408,778	47,335,571	3,227,466	n/a	21,597,822
Brisbane-South-East-Queensland	457,374,113	16,494,696	12,753,276	487,447	n/a
Perth-Wheatbelt	300,045,588	8,999,781	8,691,320	6,533	n/a
Adelaide-Yorketown	169,385,298	2,565,689	7,237,787	n/a	163,743
Canberra-Goulburn-Yass	84,218,393	n/a	3,414,642	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Comparing network capacity in absolute terms, the Sydney-Newcastle-Wollongong region has the greatest carrying capacity for both roads and public transport. With the exception of light rail in the Melbourne-Geelong region and the Adelaide-Yorketown region, Sydney-Newcastle-Wollongong also has the greatest carrying capacity for each of the different public transport modes. The Melbourne-Geelong region contains a significant road network, of similar scale to the Sydney-Newcastle-Wollongong region.

Utilisation of urban transport in 2010-11

Table 4 provides a summary of utilisation of urban transport by mode for each of the urban transport regions.

Table 4 **Utilisation by urban transport region and mode (2010-11)**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	VKT per day	Passenger kms per day	Passenger kms per day	Passenger kms per day	Passenger kms per day
Sydney-Newcastle-Wollongong	132,187,467	20,836,852	8,118,279	223,304	28,512
Melbourne-Geelong	116,880,115	17,622,360	2,312,022	n/a	4,075,718
Brisbane-South-East-Queensland	83,745,007	4,320,496	3,214,913	75,928	n/a
Perth-Wheatbelt	49,845,107	2,965,370	1,367,563	303	n/a
Adelaide-Yorketown	28,225,360	582,748	1,141,167	n/a	24,613
Canberra-Goulburn-Yass	9,906,834	n/a	652,146	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Ratio of utilisation to capacity of urban transport in 2010-11

Table 5 provides a ratio of utilisation to capacity of urban transport in 2010-11.

Table 5 **Ratio of utilisation to capacity (2010-11)**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	%	%	%	%	%
Sydney-Newcastle-Wollongong	21.50%	20.20%	33.60%	9.80%	34.40%
Melbourne-Geelong	19.34%	37.23%	71.64%	n/a	18.87%
Brisbane-South-East-Queensland	18.30%	26.20%	25.20%	15.60%	n/a
Perth-Wheatbelt	16.61%	32.95%	15.73%	4.64%	n/a
Adelaide-Yorketown	16.66%	22.71%	15.77%	n/a	15.03%
Canberra-Goulburn-Yass	11.76%	n/a	19.10%	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

While the ratio of utilisation to capacity indicates the level of use of each network it does not indicate where the networks are highly constrained, as constraints tend to occur during peak periods. Notwithstanding these limitations, a high ratio is associated with higher DEC. The Melbourne-Geelong bus network has the highest relative utilisation of all modes across all conurbations.

3.1.2 DEC of urban transport in 2010-11

Direct Economic Contribution of urban transport in 2010-11

Table 6 provides a summary of the DEC of urban transport by mode for each of the urban transport regions.

Table 6 **DEC by urban transport region, mode and type of road vehicle (2010-11)**

Urban transport region	Car	LCV	HCV	Rail	Bus	Ferry	Light rail	Total urban transport
	$m	$m	$m	$m	$m	$m	$m	$m
Sydney-Newcastle-Wollongong	20,530	854	2,825	1,950	1,329	4	12	27,504
Melbourne-Geelong	15,537	641	779	1,744	985	n/a	322	20,007
Brisbane-South-East-Queensland	11,429	528	516	190	398	14	n/a	13,075
Perth-Wheatbelt	7,647	400	448	290	350	0	n/a	9,134
Adelaide-Yorketown	5,830	194	383	42	254	n/a	1	6,705
Canberra-Goulburn-Yass	1,502	51	175	n/a	95	n/a	n/a	1,824
All conurbations	**62,475**	**2,667**	**5,126**	**4,216**	**3,411**	**18**	**335**	**78,250**

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: ACIL Allen Consulting, 2014

Using top-down economic modelling, the DEC of urban transport infrastructure in Hobart and Darwin is estimated to be $835 million and $600 million respectively in 2010-11. This increases the total DEC of urban transport infrastructure across the 8 capital cities to $79.69 billion in 2010-11.

The DEC of road vehicles is estimated to account for a significantly high proportion of overall DEC. The relative DEC of public transport modes within conurbations varies. Rail has the highest DEC of public transport modes in the Sydney-Newcastle-Wollongong region and the Melbourne-Geelong region, whereas the bus network has the highest DEC of public transport modes in the Brisbane-South-East-Queensland region, the Perth-Wheatbelt region, the Adelaide-Yorketown region and the Canberra-Goulburn-Yass region.

Congestion in 2010-11

Table 7 provides a summary of the congestion (car delay cost) of urban transport for each of the urban transport regions.

Table 7 **Congestion by urban transport region (2010-11)**

Urban transport region	Congestion (car delay cost)	DEC	Congestion (% of DEC)
	$m	$m	%
Sydney-Newcastle-Wollongong	5,555	27,504	20.20%
Melbourne-Geelong	2,837	20,007	14.18%
Brisbane-South-East-Queensland	1,914	13,075	14.6%
Perth-Wheatbelt	1,784	9,134	19.53%
Adelaide-Yorketown	1,442	6,705	21.51%
Canberra-Goulburn-Yass	208	1,824	11.4%

Source: ACIL Allen Consulting, 2014

Adelaide and Sydney are expected to have the highest car delay costs as a percentage of total DEC, while Melbourne and Canberra are expected to have the lowest.

3.2 Future urban transport needs (changes in 2030-31)

3.2.1 Drivers of change and travel demand

Population and economic growth will continue to drive demand for urban transport services. This rate of growth is incorporated into the projections of utilisation, DEC and congestion outlined in the following sections.

To assess the effect of increased demand and highlight areas within the network that may be candidates for solutions, the 2030-31 network is assumed to be existing network together with committed augmentations. The projections should therefore not be taken to represent an expected or likely characterisation of the future network.

The effect of projects which aim to address demand growth or congestion issues will be incorporated in the results for 2030-31. For example, projects which aim to address (or mitigate) congestion on a given corridor will result in that corridor showing lower congestion than otherwise. Demand or congestion 'hotspots' which remain unaddressed by the existing network, or by committed augmentations, will be observable in the results. These hotspots may be candidates for infrastructure or policy solutions.

3.2.2 Growth in capacity and utilisation of urban transport to 2030-31

Growth in capacity of urban transport to 2030-31

Table 8 provides a summary of capacity of urban transport by mode for each of the conurbations in 2030-31.

Table 8 **Capacity by urban transport region and mode (2030-31)**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	VKT per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day
Sydney-Newcastle-Wollongong	654,621,504	113,801,605	27,190,647	2,270,280	770,468
Melbourne-Geelong	636,098,134	70,739,099	4,033,120	n/a	35,654,678
Brisbane-Gold Coast-Sunshine Coast	490,562,616	19,291,864	14,959,187	522,203	327,076
Perth-Wheatbelt	315,206,758	12,349,826	8,727,253	6,538	n/a
Adelaide-Yorketown	175,544,578	3,002,197	7,238,064	n/a	164,181
Canberra-Goulburn-Yass	91,517,327	n/a	3,414,642	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Table 9 provides a summary of assumed growth in capacity of urban transport by mode for each of the urban transport regions between 2010-11 and 2030-31.

Table 9 **Compound Annual Growth Rate (CAGR) of urban transport capacity between 2010-11 and 2030-31**

Urban transport	Road	Rail	Bus	Ferry	Light rail
	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	0.3%	0.5%	0.6%	0.0%	11.8%
Melbourne-Geelong	0.3%	2.0%	1.1%	n/a	2.5%
Brisbane-South-East-Queensland	0.4%	0.8%	0.8%	0.3%	n/a
Perth-Wheatbelt	0.2%	1.6%	0.0%	0.0%	n/a
Adelaide-Yorketown	0.2%	0.8%	0.0%	n/a	0.0%
Canberra-Goulburn-Yass	0.4%	n/a	0.0%	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

The growth in capacity within each mode and conurbation reflects the extent of committed augmentations in those networks, rather than the expected growth in capacity to 2030-31. Assumed major committed projects for each of these networks are outlined in the detailed analysis of each conurbation.

Growth in utilisation of urban transport to 2030-31

Table 10 provides a summary of utilisation of urban transport by mode for each of the urban transport regions in 2030-31.

Table 10 **Utilisation by urban transport region and mode (2030-31)**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	VKT per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day	Passenger seat kms per day
Sydney-Newcastle-Wollongong	174,448,042	33,800,277	10,662,134	396,631	415,429
Melbourne-Geelong	163,880,115	40,956,587	3,794,382	n/a	8,360,219
Brisbane-South-East-Queensland	134,939,469	9,697,901	4,770,881	206,342	59,684
Perth-Wheatbelt	94,241,231	8,843,400	2,166,951	771	n/a
Adelaide-Yorketown	36,820,591	1,073,067	1,407,936	n/a	35,181
Canberra-Goulburn-Yass	13,593,001	n/a	1,066,222	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Table 11 provides a summary of growth in utilisation of urban transport by mode for each of the urban transport regions between 2010-11 and 2030-31.

Table 11 **Compound Annual Growth Rate (CAGR) of urban transport utilisation between 2010-11 and 2030-31**

Urban transport region	Road	Rail	Bus	Ferry	Light rail
	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	1.4%	2.4%	1.4%	2.9%	14.3%
Melbourne-Geelong	1.7%	4.3%	2.5%	n/a	3.7%
Brisbane-South-East-Queensland	2.4%	4.1%	2.0%	5.1%	n/a
Perth-Wheatbelt	3.2%	5.6%	2.3%	4.8%	n/a
Adelaide-Yorketown	1.3%	3.1%	1.1%	n/a	1.8%
Canberra-Goulburn-Yass	1.6%	n/a	2.5%	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

Utilisation is expected to grow at a faster rate than the capacity delivered by committed augmentations. Where growth occurs in already congested areas, the rate of growth highlights where pressures on networks could be experienced, in the absence of commensurate capacity. Greatest growth in utilisation is seen in Sydney light rail (coinciding with the adding of capacity to that network), Perth rail and Brisbane ferries.

Ratio of utilisation to capacity of urban transport in 2030-11

Table 5 provides a ratio of utilisation to capacity of urban transport in 2030-31.

Table 12 **Ratio of utilisation to capacity 2030-31**

Conurbation	Road	Rail	Bus	Ferry	Light rail
	%	%	%	%	%
Sydney-Newcastle-Wollongong	26.60%	29.70%	39.20%	17.50%	53.90%
Melbourne-Geelong	25.76%	57.90%	94.08%	n/a	23.45%
Brisbane-South-East-Queensland	27.50%	50.30%	31.90%	39.50%	18.20%
Perth-Wheatbelt	29.90%	71.61%	24.83%	11.80%	n/a
Adelaide-Yorketown	20.98%	35.74%	19.45%	n/a	21.43%
Canberra-Goulburn-Yass	14.85%	n/a	31.22%	n/a	n/a

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: (VLC, 2014)

The ratio of utilisation to capacity provides another perspective on future pressures. The highest ratio of capacity to utilisation is observed for the Melbourne-Geelong bus network, followed by the Perth-Wheatbelt rail network. However, this should be interpreted in light of the capacity assumptions (no network augmentations beyond committed projects) and also that the selected measure of capacity is ‘seats’ rather than total capacity which would also include standing space.

3.2.3 Growth in DEC of urban transport to 2030-31

Direct Economic Contribution of urban transport in 2030-31

Table 13 provides a summary of the DEC of urban transport by mode for each of the urban transport regions in 2030-31.

Table 13 **DEC by conurbation, mode and type of road vehicle (2030-31)**

Urban transport region	Car	LCV	HCV	Rail	Bus	Ferry	Light rail	Total urban transport
	$m	$m	$m	$m	$m	$m	$m	$m
Sydney-Newcastle-Wollongong	39,487	1,740	5,489	4,073	2,649	45	152	53,635
Melbourne-Geelong	30,605	792	1,418	4,891	1,964	n/a	1,126	40,796
Brisbane-South-East-Queensland	27,686	658	1,078	795	805	67	13	31,103
Perth-Wheatbelt	28,699	1,489	1,599	1,007	826	0.3	n/a	33,619
Adelaide-Yorketown	10,763	345	722	118	418	n/a	7	12,373
Canberra-Goulburn-Yass	2,956	101	308	n/a	212	n/a	n/a	3,577
Total	140,196	5,125	10,613	10,885	6,874	113	1,298	175,104

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: ACIL Allen Consulting, 2014

Top-down economic modelling of the DEC of urban transport infrastructure for Hobart and Darwin are projected to be $1.48 billion and $1.43 billion respectively in 2030-31.

Growth in Direct Economic Contribution of urban transport to 2030-31

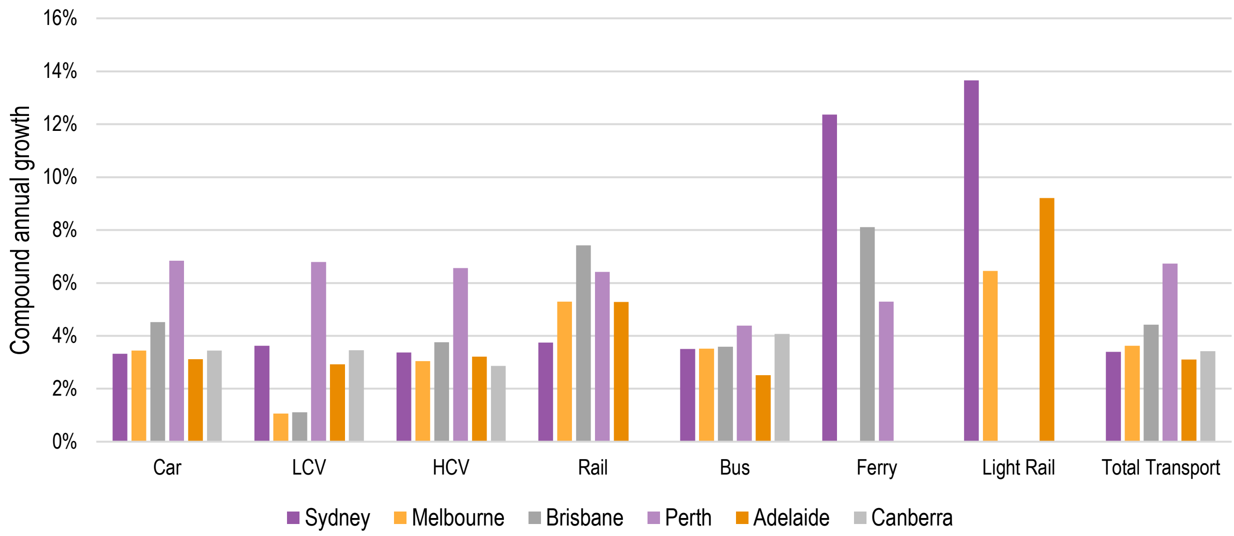
Table 14 and Figure 5 provide a summary of growth in DEC of urban transport by mode for each of the urban transport regions between 2010-11 and 2030-31.

Table 14 **Compound Annual Growth Rate (CAGR) of urban transport DEC between 2010-11 and 2030-31**

Urban transport region	Car	LCV	HCV	Rail	Bus	Ferry	Light rail	Total urban transport	Population growth
	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	3.3%	3.6%	3.4%	3.7%	3.5%	12.4%	13.7%	3.4%	1.4%
Melbourne-Geelong	3.4%	1.1%	3.0%	5.3%	3.5%	n/a	6.5%	3.6%	1.7%
Brisbane-South-East-Queensland	4.5%	1.1%	3.8%	7.4%	3.6%	8.7%	n/a	4.4%	2.0%
Perth-Wheatbelt	6.8%	6.8%	6.6%	6.4%	4.4%	5.3%	n/a	6.7%	2.9%
Adelaide-Yorketown	3.1%	2.9%	3.2%	5.3%	2.5%	n/a	9.2%	3.1%	1.2%
Canberra-Goulburn-Yass	3.4%	3.5%	2.9%	n/a	4.1%	n/a	n/a	3.4%	1.8%
Total	**4.0%**	**3.3%**	**3.7%**	**4.5%**	**3.4%**	**9.9%**	**5.9%**	**3.9%**	**1.8%**

Note: n/a (not applicable) indicated where mode does not exist for conurbation
Source: ACIL Allen Consulting, 2014

Figure 5 **Growth in DEC by mode and type of road vehicle in each urban transport region**



Note: The figure above is for the conurbations (e.g., Sydney is for Sydney-Newcastle-Wollongong). The full conurbation name is shortened for clearer graphic presentation.
Source: ACIL Allen Consulting, 2014

The Perth-Wheatbelt region is projected to have the highest overall growth in DEC, followed by the Brisbane-South-East-Queensland region. Ferry and light rail are projected to have the highest growth rates of all modes, although they account for a small proportion of DEC and are not present in every conurbation.

Congestion in 2030-31

Table 15 provides a summary of the congestion (car delay cost) of urban transport for each of the urban transport regions in 2030-31.

Table 15 **Congestion by urban transport region (2030-31)**

Urban transport region	Congestion (car delay cost)	DEC	Congestion (% of DEC)
	$m	$m	%
Sydney-Newcastle-Wollongong	14,790	53,635	27.58%
Melbourne-Geelong	9,007	40,796	22.1%
Brisbane-South-East-Queensland	9,206	31,103	29.60%
Perth-Wheatbelt	15,865	33,619	47.19%
Adelaide-Yorketown	3,747	12,373	30.28%
Canberra-Goulburn-Yass	703	3,577	19.65%

Source: ACIL Allen Consulting, 2014

Growth in congestion to 2030-31

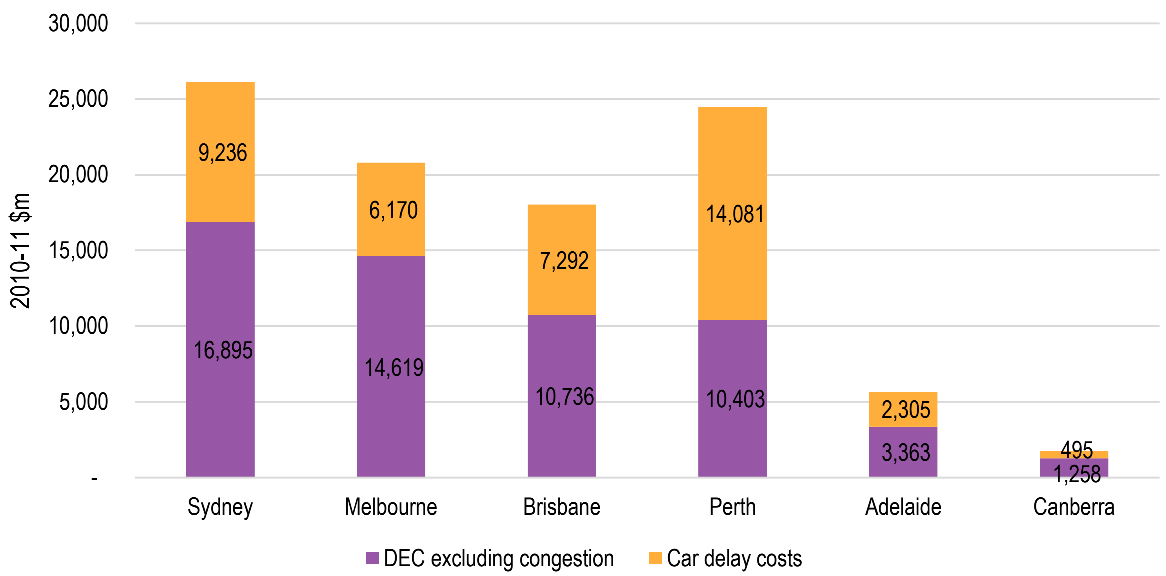
Table 16 and Figure 6 provide a summary of growth in congestion of urban transport by mode for each of the urban transport regions.

Table 16 **Compound Annual Growth Rate (CAGR) of urban transport congestion and DEC between 2010-11 and 2030-31**

Urban transport region	Congestion (car delay cost)	DEC
	CAGR (%)	CAGR (%)
Sydney-Newcastle-Wollongong	5.0%	3.4%
Melbourne-Geelong	6.0%	3.6%
Brisbane-South-East-Queensland	8.2%	4.4%
Perth-Wheatbelt	11.5%	6.7%
Adelaide-Yorketown	4.9%	3.1%
Canberra-Goulburn-Yass	6.3%	3.4%

Source: ACIL Allen Consulting, 2014

Figure 6 **Growth ($m) in DEC by mode and type of road vehicle for each urban transport region**



Note: The figure above is for the conurbations (e.g., Sydney is for Sydney-Newcastle-Wollongong). The full conurbation name is shortened for clearer graphic presentation.
Source: ACIL Allen Consulting, 2014

In all urban transport regions analysed, congestion grows at a faster rate than DEC. In the case of the Perth-Wheatbelt region, congestion also grows by a higher amount in absolute terms than DEC. This follows from the assumption that the demand for travel will significantly outpace capacity brought about by existing committed augmentations. The detailed analysis for each urban transport region will identify hotspots which may be further explored in the context of transport solutions.

3.3 DEC of major urban transport corridors

3.3.1 Assessment of corridors

The analysis of corridors provides an assessment of the capacity, utilisation, economic contribution and congestion of major corridors in each conurbation. This analysis highlights currently significant corridors (as measured by DEC and congestion) and in particular, corridors that are likely to remain significant in the future.

The change to corridor DEC and congestion reflect, in part, the assumed committed network augmentations to 2030-31. For example, some augmentations may result in an alleviation of congestion on corridors that would have otherwise been highly congested.

The analysis also highlights corridors which may yet need to be addressed.

For example, corridors that become or remain highly congested in 2030-31, despite the existing network and committed augmentations, may present opportunities for policy or infrastructure solutions. Similarly, corridors which have a high DEC suggest that there is a large value that is being derived or likely to be derived from use of transport services within that corridor. Therefore, road improvements projects or policy solutions for these corridors may benefit a large base.

3.3.2 Major corridors in Australia

Table 17 provides a summary for the top 20 corridors by DEC in 2010-11 across all conurbations.

Table 17 **Top 20 corridors by DEC in 2010-11**

Conurbation	Description	Total capacity	Utilisation	Congestion (Volume-to-capacity during typical work day)	Delay cost	DEC
		VKT per hour	VKT per day	%	$m	$m
Melbourne-Geelong	Monash/Princes Fwy Corridor	962,280	8,974,207	39%	180	994
Melbourne-Geelong	North-South Arterials - Eastern Suburbs	560,679	4,601,362	34%	174	862
Sydney-Newcastle-Wollongong	Sydney to Central Coast	831,633	7,724,994	39%	158	852
Perth	Perth Mandurah Corridor	1,193,302	6,728,635	23%	218	769
Melbourne-Geelong	Eastlink/Frankston Fwy Corridor	683,742	5,335,131	33%	87	612
Melbourne-Geelong	East-West Arterials - Lilydale Corridor	439,378	3,350,758	32%	97	546
Melbourne-Geelong	West Gate/Princes Freeway Corridor	638,072	5,193,777	34%	105	498
Sydney-Newcastle-Wollongong	East West corridor	313,134	3,419,907	46%	128	470
Sydney-Newcastle-Wollongong	Mittagong to SW Sydney via Hume Mwy	636,827	4,591,610	30%	72	433
Sydney-Newcastle-Wollongong	South Coast to Sydney	420,307	3,246,397	32%	107	431
Melbourne-Geelong	Western/Metropolitan Ring Road	334,294	4,076,503	51%	87	426
Melbourne-Geelong	East-West Arterials - Wantirna Corridor	303,901	2,310,501	32%	65	391
Brisbane-Gold Coast-Sunshine Coast	Logan River - Gateway Mwy	438,272	3,815,916	36%	75	369
Melbourne-Geelong	Inner Beach Suburbs Corridor	304,426	2,245,022	31%	61	362
Brisbane-Gold Coast-Sunshine Coast	Pacific Mwy | City - Beenleigh	353,893	3,859,594	45%	75	349
Sydney-Newcastle-Wollongong	Homebush Bay to Mona Vale Corridor (A3)	156,685	1,685,038	45%	135	328
Perth	Mitchell Fwy Corridor	288,527	2,783,612	40%	114	319
Brisbane-Gold Coast-Sunshine Coast	North Brisbane - Sunshine Coast	570,335	4,168,199	30%	17	297
Brisbane-Gold Coast-Sunshine Coast	City - Brisbane North	154,024	1,577,282	48%	87	290
Sydney-Newcastle-Wollongong	Sutherland - Ryde/Parramatta Corridor	130,052	1,492,970	49%	113	290

Source: ACIL Allen Consulting

The DEC of any given corridor is influenced by a number of factors including extent of road network included, length and capacity of that network, average speeds, traffic and congestion. Overall, it is an estimate of the total value added in the use of the road network for that corridor. Therefore, a high DEC indicates a high base that transports solutions may provide benefit to. High congestion indicates opportunities to reduce avoidable costs.

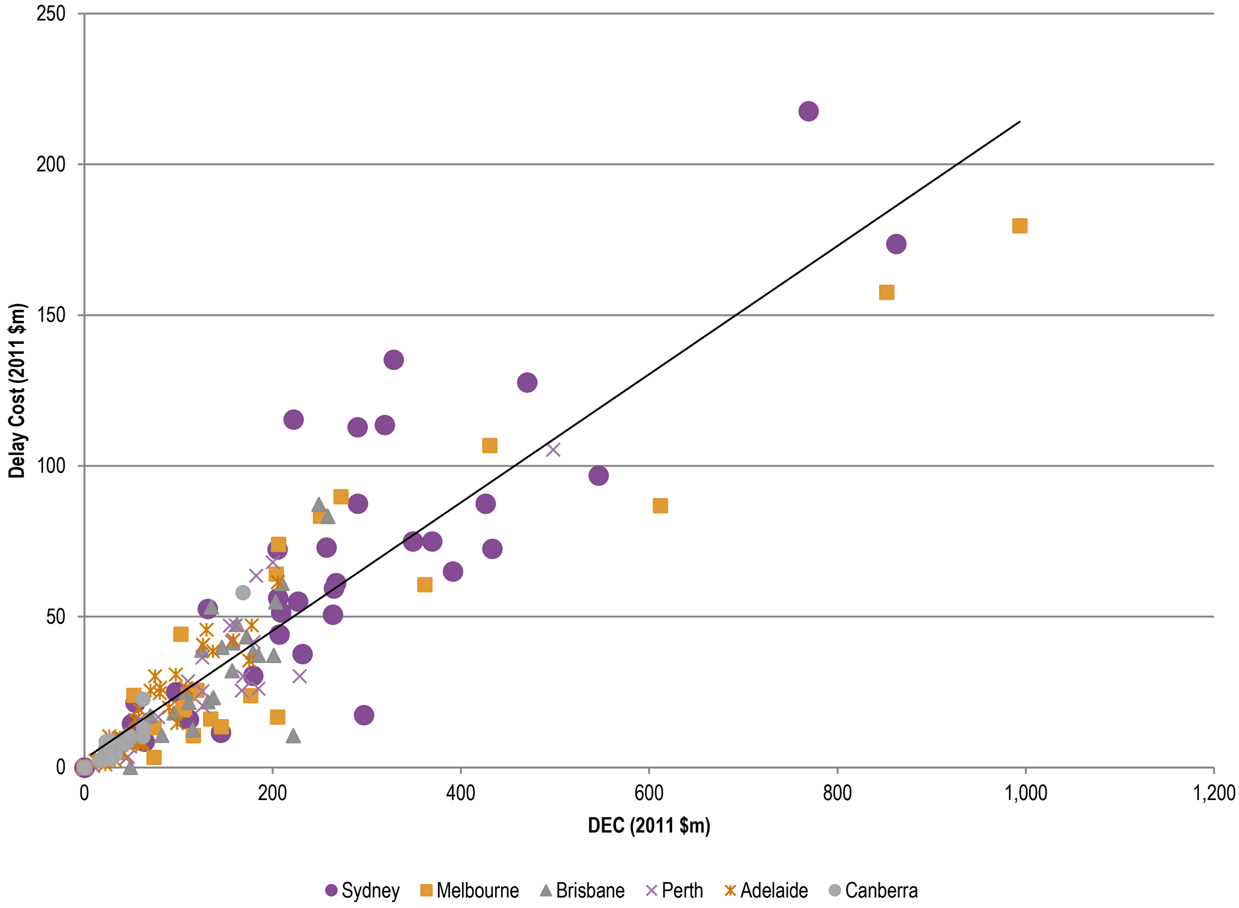
The top 20 corridors by DEC are dominated by the most highly populated areas of the Sydney-Newcastle-Wollongong region and the Melbourne-Geelong region.

High DEC corridors tend to be those that are highly utilised and, to a lesser extent, of high capacity. The major arterials that connect distant regions within conurbations or to regions outside of them have the highest DECs.

3.3.3 Comparison DEC and congestion of corridors

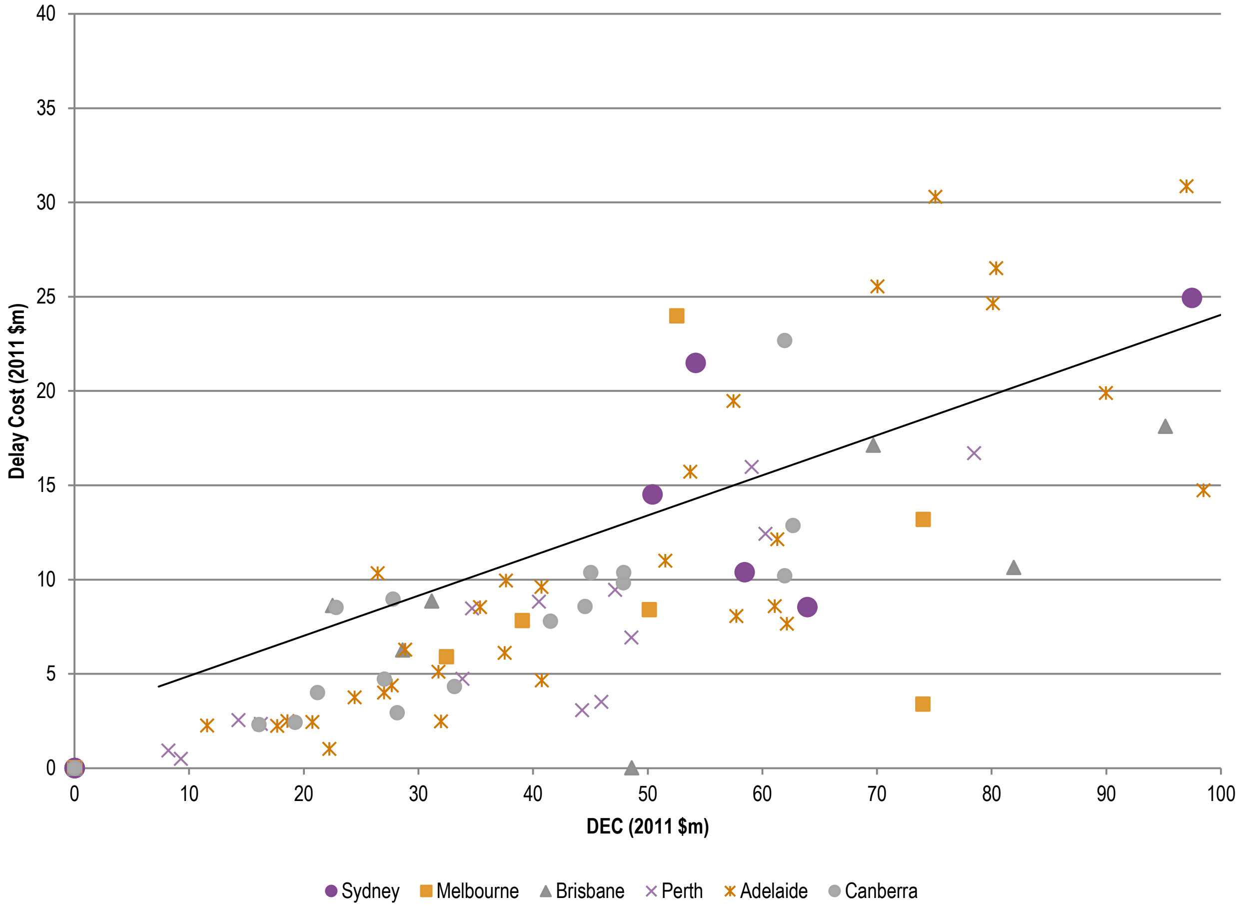
Figure 7 provides a plot of corridor DEC and delay cost across all conurbations. Figure 8 provides the same plot for corridors with < $100m in DEC.

Figure 7 **DEC and delay cost for urban transport corridors**



Note: The figure above is for the conurbations (e.g., Sydney is for Sydney-Newcastle-Wollongong). The full conurbation name is shortened for clearer graphic presentation.
Source: ACIL Allen Consulting, 2014

Figure 8 **DEC and delay cost for urban transport corridors by conurbation (< $100m in DEC)**



Note: The figure above is for the conurbations (e.g., Sydney is for Sydney-Newcastle-Wollongong). The full conurbation name is shortened for clearer graphic presentation.
Source: ACIL Allen Consulting, 2014

There is a clear relationship between DEC and delay costs. This is expected since delay costs directly contribute to higher DEC (due to increasing the total time in travel). This relationship is illustrated in the line of best fit depicted in Figure 7Figure 12 and Figure 8.

Corridors represented by points above the line are estimated to have a higher than average delay cost per unit of DEC. These are dominated by corridors in the Sydney-Newcastle-Wollongong and Adelaide-Yorketown conurbations.

3.4 Limitations and use of results

The objective of this analysis was to estimate the economic contribution of major Australian urban transport networks, the projected growth in this contribution and highlight areas which may be candidates for urban transport solutions.

The results provide baseline information and projections under specific assumptions, which may then be used in further analysis to identify and assess investments or policy reform.

The following qualifications accompany the results.

Interpretation of the DEC

The DEC is a measure of the direct economic contribution of a network or network component to the Australian economy.

A high DEC should not necessarily be interpreted as positive or negative. Rather DEC provides a way to measure the relative significance of infrastructure.

In the context of urban transport, a high DEC (or large change in DEC) indicates infrastructure where improvements or augmentations may deliver benefits (or equally costs) over a large base.

Relationship between DEC and congestion

Higher congestion costs result in increased DEC as more time is expended for the same journey. Congestion may be interpreted as the proportion of DEC 'absorbed' in delays. That is, by expending more time, consumers reveal that they have a higher willingness to pay for a particular journey or for use of a particular network component. However, more of the derived value is absorbed in delays. The delays may be avoided at a certain cost, allowing consumer to capture a greater share of that value.

Limitations in the modelling of public transport

In the transport model, use of public transport services is not constrained by capacity assumptions. Therefore, in many cases, public transport use extends beyond the point at which networks are known to run reliably. In reality, reliability and the risk of having to wait for services would be factored into mode choice decisions, or even the choice of where to live and employment decisions. These effects are not captured in the transport model. The result therefore is a projection of the demand for public transport services. This demand is informative in the planning of future projects.

The corridor analysis is limited to roads as public transport use of corridors has not been analysed to the same extent within the transport modelling.

Delay costs limited to car congestion

In the transport model, estimates of delay time are only computed for cars. A reliable estimate of public transport delay time could not be produced due to the unconstrained modelling of public transport, as described above. While commercial vehicles contribute to road congestion, the delay time for these vehicle types is not included in the total delay time.

Additional factors that may influencing demand

An estimate of the value of journeys to urban transport users has been made by combining travel time with the value of travel time and adding monetary travel costs (i.e. fares, tolls and vehicle operating costs). The following factors have not been included but would result in a different estimate of value:

- That road users may also pay for parking;
- That public transport users walk to a station or wharf to make a journey; and
- That transport users are likely to incorporate reliability of services in mode and route choice decisions.

While not a large proportion of overall costs, these factors need to be borne in mind, particularly when assessing relativities between modes or conurbations.

Active transport

The DEC of walking and cycling has not been included in the analysis. The AIA seeks to obtain baseline information and projections for nationally significant infrastructure and the facilities included within scope provide excludable services.

Active transport (walking and cycling) is currently a small proportion of overall urban transport use (e.g. approximately 10 per cent of urban transport use in Melbourne by person-kilometres travelled) and is largely non-excludable. However, it is recognised that use of active transport is expected to grow significantly in the future.

4 Sydney-Newcastle-Wollongong

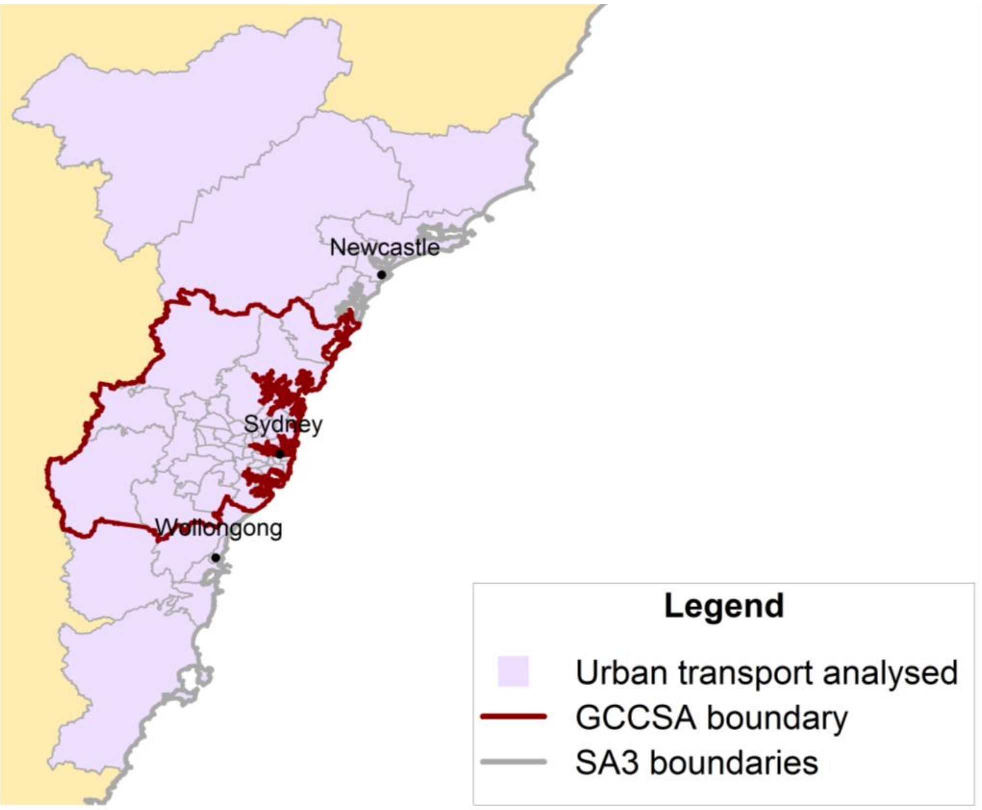
The Sydney-Newcastle-Wollongong area is connected through a system of trains, motorways, buses, light rail and ferries.

Sydney's suburban rail network consists of a system of seven suburban railway lines which connect to regional train lines serving the Southern Highlands, the South Coast and Wollongong, Blue Mountains and Newcastle. Sydney's bus network comprises more than 300 regular routes with additional routes in Newcastle and Wollongong. Light rail services operate between Sydney's central station and Dulwich Hill. Ferries operate in Sydney harbour connecting the CBD to suburbs along the Parramatta River and the Northern beaches. A small number of ferry services also operate in Pittwater, connecting the Northern Beaches to the Central Coast. In Sydney's south, ferries operate between the township of Bundeena and Cronulla.

The M1 freeway connects Sydney and Newcastle via the central coast. The M1 starts in the suburb of Wahroonga in Sydney's north and ends in Minmi, a south western suburb of Newcastle. The M4 connects the Suburb of Concord in Sydney's inner west to Lapstone in the foothills of the Blue Mountains in Sydney's west. In Sydney's south, the Princess Motorway and Highway link Sydney and Wollongong. The Hume Highway provides an interstate connection between Sydney and Melbourne. It starts in Liverpool in Sydney's south west and ends on the Western Ring Road in Melbourne. Sydney's orbital motorway network connects the suburbs of Crows Nest in the north East, Glendenning in the North West, Prestons in the South West and Sydney airport in the south east and runs through Sydney's inner city via a tunnel.

Areas in the conurbation of Sydney were included in the analysis based on the boundaries of the SA3s corresponding to the Greater Sydney audit region and surrounding transport hubs. Figure 9 provides an overview of the SA3's in the Sydney-Newcastle-Wollongong region for which the urban transport system has been analysed.

Figure 9 **Map of Sydney-Newcastle-Wollongong Region**



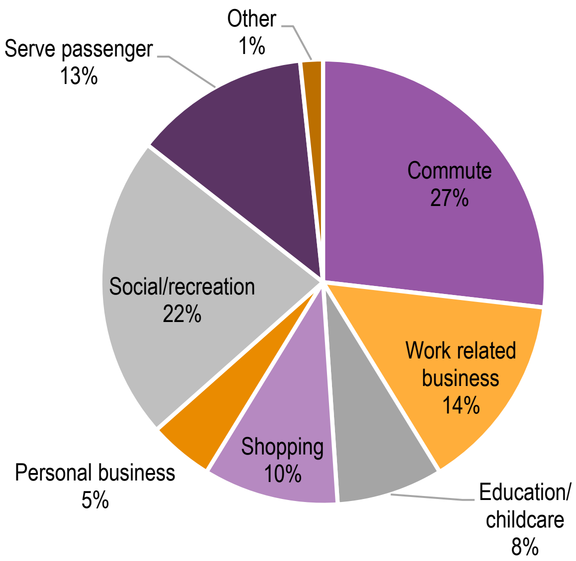
Source: ACIL Allen Consulting, 2014

We note that the area covered by the urban transport analysis covers some non-urban areas such as the 'Great Lakes' SA3 and areas in the Hunter Valley. The boundaries of the urban transport analysis were chosen to ensure that the entire conurbation of a city is included in the analysis. This is to ensure that the transport system of the city is captured as accurately as possible. To capture major transport links between regional centres within the Sydney-Newcastle-Wollongong region it was necessary to include some regional areas within the analysis.

4.1 Key issues and challenges

On an average weekday in 2011-12, Sydney residents travelled a total of 142 million kilometres. In addition to travel demands of residents, Sydney's urban transport infrastructure facilitates the transport of goods and services. Figure 10 provides an overview of the purpose for which households in the Sydney Greater Metropolitan area travel.

Figure 10 **Share of distance travelled by purpose - Sydney GCCSA**



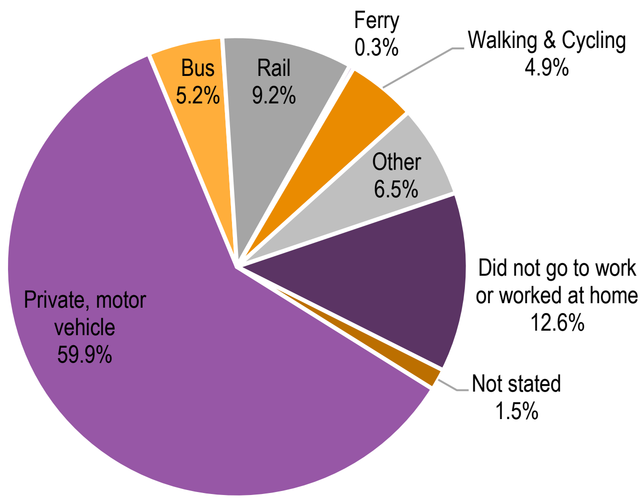
Source: (Bureau of Transport Statistics, 2013)

Commuting is the single largest generator of travel demand in the Greater Sydney area. In the 2011 Census of Population and housing (ABS, 2011) 19 per cent of Sydney's working population stated that they work in the inner city[6] and 329,000 jobs are located in Sydney's CBD alone. This concentration of employment is remarkable as Sydney's inner city only represents 0.2 per cent of the Greater Sydney area. The geography of Sydney' inner city with a CBD enclosed by water on two sides poses a challenge for urban transport infrastructure. Sydney's CBD hosts almost three times as many jobs as other major employment centres in North Sydney, Parramatta and Macquarie Park combined.

In Sydney the majority of people use private motor vehicles to get to and from work. Figure 11 provides an overview of the method by which people living in the greater Sydney area get to work.

[6] Defined here as the 'Sydney Inner City' SA3

Figure 11 **Method of travel to work Sydney-Newcastle-Wollongong - 2011**



Note: Transport methods have been grouped e.g. 'private motor vehicle' include trucks and motorbikes, 'other' includes multimodal public and private transport, does not include: Unemployed persons looking for either part-time or full-time work, Persons not in the labour force, Persons with Labour Force Status (LFSP) not stated, Persons aged under 15 years

Source: (ABS, 2011)

Private motor vehicles offer a comfortable and convenient way to get to work for many people with 53 per cent of car commuters surveyed in the Household Travel Survey (HTS) (Bureau of Transport Statistics, 2013) indicated that they choose to travel by car for its convenience. While commuting by car is convenient, there are limits to the amount of cars that can be accommodated on roads during peak traffic hours. Public transport provides a denser means of transport and improving public transport has continuously ranked as the highest priority issue in transport in the University of Sydney's transport opinion survey (ITLS, March 2014).

In its 2012 Transport Master Plan (Transport for NSW, 2012) Transport for NSW addressed a number of key challenges for transport in Sydney including better integration of public transport modes, addressing CBD congestion and enabling growth in greater Sydney.

Mode changes in the public transport system add to travel time and are one of the key reasons people prefer to commute by car. In the HTS 37 per cent of car commuters indicated that they preferred to travel by car because public transport services were indirect. The roll out of the Opal card – a smart card ticketing system – is meant to ease switching between different modes of transport and reduce queuing for tickets. Transport for NSW is also promoting modernisation of transport interchanges. The provision of real time travel information to public transport users and timetables that are aligned for ease of interchange between ferries, buses and rail are crucial to promote better integration of the different transport modes.

In some parts of Sydney the transport system has reached its capacity. The morning peak is the most critical period for congestion in Sydney. In Sydney's CBD the problem of congestion is well recognised. Over 1,600 buses access the CBD during the morning rush hour. Due to Sydney's geography there are only a limited amount of pathways into the CBD and while rail services provide some relief to road congestion railway stations in Sydney's CBD are often operating at capacity. Outside the CBD road congestion is also problematic. Key road links that struggle with congestion during the morning peak include:

— the harbour bridge and the harbour tunnel connecting North Sydney with the CBD,

- the Spit Bridge connecting Seaforth to Mosman and ultimately leading to Sydney's CBD,
- the City West Link which provides access to Pyrmont and the inner City via Anzac Bridge
- Victoria Road which feeds onto Anzac Bridge leading into Pyrmont and ultimately into the inner City
- the M5 East and General Holmes drive which connects Sydney's south western Suburbs to the CBD and the airport

Sydney's rail system has changed little since it was established more than 100 years ago and between 1979 and 2012 only 39kms of new tracks have been added. Recent additions to the network include the Epping to Chatswood line in 2009 and the Airport line in 2000. In 2009 construction began on the South West Rail Link between Glenfield and Leppington which will provide services to Sydney's South West Growth Centre. Tunnelling work for the North West rail servicing Sydney's North West Growth Centre by connecting Epping and Rouse Hill began in September 2014. The NSW Government's plan Sydney's Rail Future released in 2012, envisages a second rail crossing of Sydney Harbour and a new rail line within the CBD.

Sydney's population has grown 11.6 per cent over the period 1999-00 to 2011-12 with the growth population the demand on the urban transport infrastructure has also increased. The number of weekday trips has increased by 8.2 per cent while weekend trips have increased by 13.9 per cent between 1999-00 and 2011-12. The NSW government has designated two growth areas in Sydney's north-west and south west. Over the next 25 years the growth centres around Rouse Hill and Leppington are projected to accommodate 500,000 people. Future transport planning needs to ensure that growth in these areas does not put additional strain on Sydney's transport network.

4.2 Regulation, policy and governance context

Urban transport in Sydney, Newcastle and Wollongong is primarily planned and regulated by state and local governments. It is funded by a combination of user charges and subsidies from all levels of government.

Transport for NSW, a NSW Government Department, is responsible for transport policy, planning and coordination functions, and the oversight of infrastructure delivery and asset management.

Pricing and financing transport infrastructure are key issues in NSW urban transport. In relation to pricing, potential approaches include consistent distance based charging for Sydney motorways, more direct charging of heavy vehicle roadway use, more efficient parking charges, reforming motor vehicle registration fees, and capturing value uplift from publicly funded investments.

4.2.1 Planning

In December 2012, the NSW Government released the NSW Long Term Transport Master Plan. This plan sought to provide an overarching framework guiding future transport plans, policy decisions, reforms, and funding.

Responsibility for planning roads is divided between the NSW Government (for State Roads) and local councils (for local roads).

Transport for NSW is responsible for coordinating, allocating funding, policy and planning, and other non-service transport functions.

It plans for both public and private transport including road, rail, buses, taxis, ferries, light rail, cycling and pedestrian transport. Service delivery is undertaken by other organisations.

Local councils generally have responsibility for planning their local road systems, including bikeways and pedestrian transport.

4.2.2 Regulation

State roads are regulated by the NSW Government while local roads are regulated by local councils.

NSW has a more transparent approach to public transport fare pricing than other jurisdictions. The Independent Pricing and Regulatory Tribunal (IPART) is responsible for recommending maximum fares for passenger trains, private ferries and taxies.

IPART is responsible for setting maximum fares, using a price cap approach, for Sydney Trains and NSW TrainLink Intercity services, Sydney Ferries, and metropolitan and outer metropolitan bus services in NSW. The latter include the State Transit Authority and private operators under contracts with Transport for NSW in Sydney, Newcastle, the Central Coast, and Wollongong.

IPART is also responsible for the economic regulation of the services provided by the former CityRail. It used the building block approach to determine CityRail's annual revenue requirement by assessing operating and capital expenses. It sets the division of revenue between users and taxpayers by estimating the value of externalities, along with considering the potential impacts on the affordability of fares and levels of patronage. Maintenance costs are taken into account in determining the efficient costs.

In recent years, IPART set the government subsidy at 72 per cent of the efficient costs for rail, around 60 per cent of the efficient costs for Sydney metro and outer metro buses, and 35 per cent of the efficient costs for Sydney Ferries (IPART, 2014).

Fares for the light rail and some private ferry services – such as the fast ferry services between Manly and Circular Quay – are not regulated.

4.2.3 Funding

In NSW, $13.1 billion was allocated to transport in 2011-12 (Transport for NSW, 2012). This total covered services outside Sydney, Newcastle and Wollongong. In 2011-12 funding was sourced to:

- 50 per cent from the NSW Government;
- 16 per cent from the Australian Government;
- 14 per cent from, fares/user charges and the sales of goods and services;
- 12 per cent from taxes and levies.

Approximately one-quarter of NSW public transport costs are recovered from customer revenues.

Transport for NSW spent approximately $4.7 billion to maintain, upgrade and operate the NSW and local roads and traffic network in 2010-11.

Road users paid the majority of these costs (less than 70 per cent) through a combination of road user charges, taxation and tolls on state-owned motorways. Local governments also made material expenditures on local and regional roads.

The urban train network is funded by a combination of user charges and state government public subsidies.

4.2.4 Service delivery

Roads and Maritime Services (RMS), a NSW statutory authority, is responsible for State Roads and about 4,300 km of the national road network across NSW, in addition to privately funded toll roads. Local councils generally have responsibility for planning their local road systems, including bikeways and pedestrian transport.[7]

Bus public transport is provided by a combination of public and private parties under contract to Transport for NSW. The State Transit Authority (STA), a publicly owned entity, provides bus services in Sydney and Newcastle.

RailCorp (trading as CityRail), a NSW Government entity, was responsible for delivering urban train services in Sydney, Newcastle and Wollongong in 2010-11. On 1 July 2013, Sydney Trains became responsible for providing metropolitan rail services for Sydney, and NSW TrainLink became responsible for providing regional services (including from the Sydney CBD) to Brisbane, Canberra and Melbourne.

The State Transit Authority contracts Harbour City Ferries to operate the Sydney Ferries franchise, which provides services in Sydney Harbour. The STA operates Stockton ferries in Newcastle. Privately-owned ferry services in NSW operate under a contract with Transport for NSW.

The NSW Government owns the Sydney light rail, and Transport for NSW contracts Transdev Sydney to provide light rail services on its behalf.

4.3 Current network capacity, utilisation and congestion

4.3.1 Capacity

The Sydney-Newcastle-Wollongong area is served by an extensive road network. Table 18 provides an overview of road network capacity in the Sydney-Newcastle-Wollongong area.

Table 18 **Road network capacity – 2010-11 – Sydney-Newcastle-Wollongong**

Road network	CAPACITY	CAPACITY
	VKT per day	kms of road
Road network	615,617,472	28,226

Source: (VLC, 2014)

Table 19 shows the network capacity for the public transport network in the Sydney-Newcastle-Wollongong area. Capacity is expressed as the number of kilometres of seats (and standing capacity in the case of crush capacity) that are available on all services offered in the region multiplied by the distance these services travel.

[7] There is a NSW Government and City of Sydney coordinating committee for the Sydney CBD,

Table 19 **Public transport network capacity – 2010-11 – Sydney-Newcastle-Wollongong**

Public Transport Networks	Capacity	Capacity
	Passenger seat kms per day	Passenger crush kms per day
Rail network	103,294,968	165,693,788
Bus network	24,176,934	32,605,451
Ferry network	2,270,280	2,724,285
Light rail network	82,870	243,012

Source: (VLC, 2014)

Sydney's train network has the largest capacity of the public transport modes available in the Sydney-Newcastle-Wollongong area. Trains run through the Sydney GCCSA with a high frequency and longer distance train connections connect the urban centres of Newcastle and Wollongong with the inner city of Sydney. Sydney's bus network has a considerably smaller capacity than the rail network as bus lines generally cover shorter distances than train lines. The capacity of Sydney's ferry network is roughly one tenth of that of the bus network, due to the smaller geographical extent of the ferry network. Sydney's light rail network has the smallest capacity of the public transport modes on offer in Sydney.

4.3.2 Utilisation and congestion

Table 20 provides an overview of utilisation and congestion in the road network of the Sydney-Newcastle-Wollongong area.

Table 20 **Road network utilisation and congestion Sydney-Newcastle-Wollongong**

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	Delay as a % of travel time (daily)	Cost of delay ($m)
Road network	132,187,467	39%	21%	26%	5,555

Source: ACIL Allen Consulting, 2014

Congestion on Sydney's roads tends to be worst during the AM peak as this is the time when travel demand from different demand generators such as employment and education coincides. The cost of congestion across the road network of the Sydney-Newcastle-Wollongong area in 2010-11 amounted to a total of $5.6 billion.

Table 21 shows the overall utilisation of the public transport networks in the Sydney-Newcastle Wollongong area.

Table 21 **Public transport network utilisation and congestion Sydney-Newcastle-Wollongong**

Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
	passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
Rail network	20,836,852	36%	23%	20%	13%
Bus network	8,118,279	48%	35%	34%	25%
Ferry network	223,304	16%	13%	10%	8%
Light rail network	28,512	42%	14%	34%	12%

Source: (VLC, 2014) , ACIL Allen Consulting, 2014

The bus network is the most highly utilised public transport network in the Sydney-Newcastle-Wollongong area while the ferry network is the most lightly utilised network. Utilisation across all transport modes is highest during the morning peak. The light rail network exhibits the highest increase in utilisation in the morning peak compared to utilisation on an average day.

Congestion on the public transport system can cause delays as people take longer to board trains and buses or when passengers have to be left behind at stops. The cost of these delays has not been measured separately as part of this analysis but is expected to be significantly smaller than the cost of congestion on the road system.

4.4 Current network Direct Economic Contribution

The DEC represents the contribution of the urban transport infrastructure to the gross domestic product (GDP).

4.4.1 Aggregate DEC

In 2010-11 the total DEC from urban transport infrastructure in the Sydney-Newcastle-Wollongong region was $27.5 billion dollars.

4.4.2 DEC by mode

Table 22 provides an overview of the DEC by transport mode for the Sydney-Newcastle-Wollongong area.

Table 22 **Urban transport DEC by transport mode – 2010-11 – Sydney-Newcastle-Wollongong**

Mode	DEC
	$m
Car	20,530
LCV	854
HCV	2,825
Rail	1,950
Bus	1,329
Sydney Ferries	4
Light Rail	12
Total	**27,504**

Source: ACIL Allen Consulting, 2014

The road network covered within this analysis is extensive and also heavily utilised. The DEC of car travel represented the highest DEC in the Sydney-Newcastle-Wollongong area. Together with light commercial vehicles (LCV) and heavy commercial vehicles (HCV), car travel represented 88 per cent of the total DEC in the Sydney-Newcastle-Wollongong area. It is important to note that $5.6 billion of the total DEC of road travel arises from congestion cost.

4.4.3 Reconciliation with macroeconomic data

Calculating the DEC contribution based on travel activity data from VLC's transport model represents a bottom-up approach. DEC can be calculated for discrete links within the transport network and aggregate figures for local areas can also be provided.

In this section of the report the results of the bottom-up analysis are compared to top down estimates of DEC from urban transport infrastructure in the Sydney-Newcastle-Wollongong area.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements.

The macro reconciliation is aiming to provide a broad indication as to whether the results of the bottom-up modelling reconcile with macro-economic data. National account statistics available at the time of writing this report were available on the basis of statistical divisions (SD's). SDs were used as a basic geographical unit for understanding and interpreting the geographical context of statistics published by the ABS before 2011. Generally SDs are broadly consistent with the GCCSA; detailed mapping of the SDs and their consistency with the GCCSAs can be found on the ABS website[8]. To reduce the potential mismatch between the national account statistics provided on a SD basis and the bottom-up modelling results the macro data has been scaled to the population of the relevant bottom-up modelling areas.

Table 23 compares the results of the macro reconciliation for the Sydney-Newcastle-Wollongong area in 2010-11. The left hand column of the table shows the DEC by mode as calculated using a bottom-up approach based on VLC's transport modelling. The right hand column of the table shows the estimated DEC of urban transport infrastructure based on data from the household expenditure survey and the national accounts.

[8] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1216.0July%202011?OpenDocument

Table 23 **Macro-reconciliation –DEC of urban transport infrastructure 2010-11 – Sydney-Newcastle-Wollongong area**

DEC (Based on transport simulation modelling)					DEC (Based on national statistics)				
	Sydney	Hunter	Illawarra	**Total**		Sydney	Hunter	Illawarra	**Total**
Car/private vehicle	15,661	3,442	1,427	**20,530**	Household private vehicle expenditure	14,732	2,138	992	**17,862**
LCV	680	130	44	**854**	Road transport (freight)	4,057	517	201	**4,774**
HCV	1,555	1,056	215	**2,825**	Rail transport (freight)	2,582	361	144	**3,088**
Rail	1,488	327	136	**1,950**	Rail (household expenditure)	448	42	20	**510**
Bus/Tram	1,026	223	92	**1,341**	Bus/tram/light rail (household expenditure)	313	31	14	**358**
Sydney Ferries	4	0	0	**4**	Ferry (household expenditure)	31	3	1	**35**
Total	**20,413**	**5,177**	**1,914**	**27,504**	**Total**	**22,163**	**3,091**	**1,372**	**26,627**

Source: ACIL Allen Consulting, 2014

The estimated total DEC of urban transport infrastructure (calculated using the top-down approach based on national statistics) is closely aligned with the DEC calculated using the bottom-up approach. Overall the estimate of DEC from urban transport activity data is 3.2 per cent higher than the top-down estimate.

The estimate of DEC from travel in private motor vehicles and on public transport is higher in the bottom-up approach.

The bottom-up DEC estimate of travel includes the value of time spent travelling while the household expenditure survey does not capture the value of travel time. The largest component of the DEC estimate of private vehicle travel in the household expenditure survey are expenditure on vehicle operating cost and expenditures related to vehicle purchases. For public transport the household expenditure survey only captures money spent on fares.

The difference between the bottom-up approach and the top-down approach is largest in the DEC for freight movements. The top-down approach accounts for freight movements on road and rail transport while the bottom-up approach excludes freight transport by rail. The estimated DEC from road transport also differs between the bottom-up and top-down approaches. In the national accounts statistics the value of road transport is allocated to an area based on where the contract for transport is struck. This differs from the bottom-up approach where the value of freight transport is allocated to the area through which the freight is moved. We would expect that some of the contracts for freight transport that are struck in Sydney do not involve freight that is actually moved through the urban transport infrastructure of the city. This would explain why the DEC estimate of road freight transport obtained from national account statistics is higher than the bottom-up estimate of the DEC of road transport.

4.5 Demand analysis by origin/destination

4.5.1 Overview of demand analysis

The demand analysis assesses the value (measured as DEC) of journeys from combinations of origins and destinations.

The demand analysis is distinguished from other levels of analysis as it shows the demand for mobility (the value that is placed on trips that transport people or goods from one SA3 to another) as opposed to the value that is being derived from use of a physical network or infrastructure component.

A significant proportion of this demand (30.4% of road journeys and 12.3% of public transport journeys in the Sydney GCCSA) is within each SA3 (i.e. where the SA3 is both the origin and destination). The focus of this demand analysis however, is on infrastructure connecting separate origins and destinations. Specifically, the DEC of road journeys and public transport for combinations of different SA3 origins and destinations, for the GCCSA area, is shown in the form of 'heat-map' matrices.

4.5.2 Roads

Overview of DEC for all origin-destination pairs

Figure 12 shows a matrix of the DEC in 2010-11 for origin - destination pairs in the Sydney Greater City Statistical Area (GCCSA). Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys originating in the SA3 'Sydney Inner City' whereas the first column shows the DEC of trips ending in the SA3 'Sydney Inner City'. The DEC is colour coded from green to red where green indicates a low DEC and red indicates a high DEC. The right hand side of the figure provides an overview range of the DEC values across the matrix. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure 12 **Roads – GCCSA origin-destination pairs – DEC 2010-11 $millions – Sydney GCCSA**

SA3 Origin / Destination	Sydney Inner City	Eastern Suburbs - North	Marrickville - Sydenham - Petersham	Leichhardt	Strathfield - Burwood - Ashfield	Botany	Eastern Suburbs - South	Kogarah - Rockdale	Canterbury	Hurstville	Cronulla - Miranda - Caringbah	Sutherland - Menai - Heathcote	Liverpool	Campbelltown (NSW)	Bankstown	Merrylands - Guildford	Auburn	Fairfield	Bringelly - Green Valley	Penrith	Camden	Blue Mountains - South	Wollondilly	Canada Bay	Pennant Hills - Epping	Carlingford	Ryde - Hunters Hill	Parramatta	Blacktown	Richmond - Windsor	St Marys	Hawkesbury	Blue Mountains	Rouse Hill - McGraths Hill	Mount Druitt	Blacktown - North	North Sydney - Mosman	Chatswood - Lane Cove	Ku-ring-gai	Hornsby	Dural - Wisemans Ferry	Baulkham Hills	Manly	Warringah	Wyong	Pittwater	Gosford
Sydney Inner City		58.9	35.1	41.7	48.8	103.9	63.5	38.0	22.3	15.6	19.1	13.8	11.5	9.5	17.6	10.3	13.0	6.8	5.9	9.0	5.2	1.8	9.4	25.2	4.7	8.3	26.4	11.0	5.1	1.4	2.2	1.5	2.1	1.6	9.8	7.1	46.3	47.5	14.6	4.2	4.4	10.7	11.4	30.5	3.4	8.5	3.7
Eastern Suburbs - North	58.1		5.6	6.6	8.5	24.1	38.7	10.0	4.5	4.5	5.5	3.9	2.6	2.1	3.6	1.9	2.5	1.4	1.4	2.0	1.5	0.2	1.3	4.6	0.9	1.8	5.5	2.3	1.1	0.1	0.6	0.3	0.6	0.4	1.6	1.1	11.8	12.4	4.8	0.6	1.0	2.5	3.1	8.1	0.3	2.6	0.2
Marrickville - Sydenham - Petersham	32.2	5.5		7.6	13.5	14.7	7.4	13.3	8.4	5.0	4.5	3.3	2.8	2.1	4.3	1.7	2.4	1.2	1.3	1.0	1.3	0.3	1.1	4.6	0.5	1.1	3.8	1.7	0.8	0.2	0.3	0.2	0.2	0.2	0.9	0.6	4.0	4.4	1.7	0.5	0.5	1.4	1.0	2.9	0.2	1.0	0.3
Leichhardt	35.0	5.7	6.7		14.3	9.3	4.8	5.6	5.7	3.1	2.6	2.5	2.3	1.8	4.4	2.2	3.0	1.2	1.0	1.4	1.2	0.3	1.0	9.8	1.2	2.1	8.9	2.6	1.3	0.2	0.6	0.3	0.4	0.3	1.4	1.1	7.0	8.5	3.5	1.1	0.9	2.6	1.7	4.5	0.5	1.5	0.4
Strathfield - Burwood - Ashfield	47.3	8.4	15.6	16.1		22.1	9.2	20.1	30.9	14.3	8.6	9.1	10.5	6.6	27.4	11.3	23.2	6.8	4.3	4.2	3.9	1.0	3.5	29.9	3.8	6.9	20.2	11.7	4.3	0.7	1.8	0.8	1.3	0.9	4.6	2.6	8.0	13.1	8.4	3.1	2.4	7.9	2.2	7.5	0.8	3.0	0.8
Botany	101.5	24.4	15.3	14.3	22.5		34.0	29.1	13.7	13.7	18.6	15.9	15.4	16.1	16.1	15.3	13.2	14.8	9.5	11.8	9.5	0.8	6.8	11.0	3.7	8.7	17.3	20.0	12.5	3.2	4.6	2.6	5.2	2.8	15.8	6.4	17.6	20.3	11.0	5.5	3.5	14.3	6.1	19.6	8.9	8.3	7.5
Eastern Suburbs - South	61.8	39.8	7.4	6.1	8.8	33.8		15.8	5.9	6.4	7.8	5.7	3.5	2.7	4.5	1.9	2.3	1.7	1.7	1.9	1.8	0.2	1.5	3.5	0.8	1.3	4.5	2.0	0.9	0.2	0.5	0.3	0.3	0.2	1.1	0.9	8.8	9.1	3.4	0.6	0.9	2.1	2.4	6.0	0.4	1.8	0.2
Kogarah - Rockdale	35.7	9.8	13.1	7.0	19.6	29.3	15.8		24.2	29.0	27.3	18.5	7.9	5.8	13.6	4.3	5.0	3.8	3.7	1.9	3.3	0.3	2.8	5.9	0.7	1.9	3.9	3.6	1.4	0.4	0.5	0.4	0.5	0.4	1.5	0.9	4.4	5.0	2.1	0.4	0.6	1.6	1.4	3.8	0.3	1.2	0.4
Canterbury	20.7	4.4	9.2	6.4	31.4	13.4	6.3	24.3		22.4	9.00	9.6	9.8	6.1	27.6	6.6	8.8	5.6	4.1	2.2	3.3	0.4	2.3	8.5	1.3	2.6	6.4	4.8	2.1	0.4	0.8	0.3	0.5	0.5	1.9	1.1	3.2	4.5	2.8	1.1	0.8	3.2	0.9	2.7	0.5	1.2	0.3
Hurstville	14.4	4.3	5.3	3.7	14.2	13.9	6.8	29.9	22.7		17.3	16.3	9.5	5.7	24.1	5.5	6.5	4.3	3.8	1.8	2.8	0.3	1.8	4.4	0.7	1.9	3.7	4.2	1.5	0.2	0.5	0.3	0.3	0.3	1.3	0.6	2.1	2.6	1.6	0.6	0.5	2.0	0.6	2.0	0.2	0.6	0.4
Cronulla - Miranda - Caringbah	17.8	5.3	4.8	3.7	8.5	19.5	8.1	28.5	9.6	17.8		26.7	5.9	4.4	10.6	3.9	4.3	3.0	2.7	1.7	2.3	0.2	2.0	2.7	0.5	1.5	2.1	2.9	1.0	0.3	0.5	0.2	0.4	0.3	1.5	0.5	2.6	3.3	1.2	0.2	0.3	0.9	0.8	2.3	0.4	0.8	0.3
Sutherland - Menai - Heathcote	12.8	3.6	3.5	3.0	8.9	16.4	5.9	19.2	10.0	17.2	27.2		10.2	5.8	22.0	5.6	5.7	5.1	3.8	1.7	2.3	0.2	1.6	3.0	0.5	1.9	2.4	4.1	1.3	0.1	0.5	0.2	0.3	0.3	1.4	0.4	1.9	2.4	1.0	0.4	0.3	1.5	0.5	1.7	0.3	0.5	0.4
Liverpool	9.4	2.3	2.9	2.4	9.0	14.9	3.6	7.4	8.6	8.8	9.7	11.2		46.9	35.3	27.1	11.7	51.7	54.1	9.1	20.3	0.8	10.1	3.3	1.0	4.2	3.7	13.4	8.1	1.2	3.9	1.2	2.6	1.4	7.9	2.8	1.6	2.2	1.3	1.3	1.2	5.2	0.5	1.6	0.8	0.9	0.8
Campbelltown (NSW)	8.5	2.0	2.2	2.0	5.9	16.2	2.8	5.7	5.7	5.7	6.4	11.2	45.6		15.9	10.3	6.1	17.1	32.5	7.7	79.3	1.4	24.3	2.2	0.4	1.6	1.7	5.0	4.6	1.0	2.5	1.0	2.0	1.2	6.0	2.3	1.5	2.0	0.6	1.0	0.6	3.0	0.4	1.5	0.4	0.4	0.6
Bankstown	16.2	3.6	5.8	5.0	26.9	16.8	5.6	14.4	27.8	24.6	12.3	22.0	39.8	17.3		31.0	27.2	26.8	14.9	6.0	9.0	0.9	6.6	9.1	2.6	7.8	9.9	16.1	6.3	0.9	2.3	1.1	1.9	1.2	5.4	2.6	2.7	5.0	4.6	2.9	2.5	8.1	0.9	4.0	1.2	2.0	1.6
Merrylands - Guildford	9.7	1.9	2.4	2.4	11.8	15.5	2.4	4.4	6.6	5.4	5.6	6.0	27.1	13.7	31.0		31.9	50.4	14.9	12.2	6.0	0.9	5.7	5.9	3.9	16.4	11.1	61.7	24.6	2.1	6.5	2.3	4.3	3.2	17.6	7.3	2.5	4.6	4.3	5.1	3.9	21.5	0.9	3.7	1.6	1.8	1.9
Auburn	12.1	2.4	3.3	3.2	23.9	13.2	2.7	5.2	8.8	6.5	4.8	5.9	11.4	6.3	28.3	32.3		13.4	5.2	5.6	2.8	0.7	2.9	10.8	4.4	16.6	15.3	31.6	8.1	0.8	2.7	1.0	1.7	1.6	6.7	3.4	3.0	5.9	5.9	4.2	3.7	14.2	0.9	4.2	1.2	2.4	1.3
Fairfield	6.5	1.4	1.6	1.4	7.0	14.6	2.0	3.8	5.7	4.3	5.2	6.0	53.4	21.2	27.0	53.0	14.7		47.2	15.8	11.2	1.0	7.1	2.9	1.8	7.7	5.7	26.8	22.8	2.2	7.6	2.3	4.9	2.8	21.3	6.7	1.1	2.3	2.2	2.8	2.3	11.8	0.4	1.9	1.0	1.0	1.2
Bringelly - Green Valley	5.3	1.3	1.4	1.3	4.2	9.1	1.7	3.6	3.7	3.5	4.5	5.1	54.7	32.3	13.7	16.4	7.1	48.4		15.1	31.4	1.2	10.1	1.5	0.7	2.5	2.2	8.4	7.8	1.6	4.8	1.5	3.2	1.4	10.1	3.0	0.9	1.2	0.7	0.9	0.8	4.0	0.3	1.0	0.5	0.3	0.5
Penrith	8.5	1.9	1.1	1.4	4.3	11.1	1.9	1.8	2.1	1.6	1.9	1.9	9.3	8.8	6.0	13.2	6.4	20.0	15.5		9.3	2.5	5.6	2.3	1.1	4.5	4.1	15.7	15.3	13.8	20.3	9.9	20.1	6.0	32.0	8.8	1.5	2.4	1.8	1.7	2.2	7.7	0.6	1.9	1.8	0.9	1.6
Camden	4.8	1.4	1.3	1.3	3.6	9.5	1.8	3.2	3.2	2.8	3.1	4.8	20.3	78.3	9.0	6.2	3.8	11.0	36.3	9.3		2.8	33.5	1.3	0.3	1.0	1.3	3.4	3.1	1.1	1.6	0.9	1.6	0.7	3.9	1.2	0.8	1.1	0.5	0.4	0.4	2.1	0.2	0.7	0.3	0.2	0.4
Blue Mountains - South	0.2	0.1	0.1	0.0	0.2	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.6	1.3	0.4	0.6	0.2	0.9	1.2	2.4	3.0		1.7	0.0	0.0	0.1	0.1	0.5	0.5	0.2	0.3	0.0	3.3	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
Wollondilly	9.3	1.2	1.1	1.0	3.4	7.1	1.6	2.8	2.3	1.9	2.4	2.4	10.3	24.7	6.7	5.7	3.0	6.8	11.0	5.4	35.1	1.6		1.1	0.3	1.1	1.3	3.3	2.9	0.8	1.0	0.4	0.6	0.9	3.4	1.3	1.3	2.0	0.4	0.6	0.3	2.1	0.3	1.3	0.8	0.3	0.6
Canada Bay	25.0	4.8	5.4	10.5	29.8	11.2	3.8	6.0	8.2	4.3	2.8	3.1	3.5	2.5	8.9	4.6	9.6	2.3	1.5	2.1	1.3	0.4	1.3		2.9	5.3	21.7	6.7	2.2	0.2	0.8	0.3	0.6	0.5	2.1	1.5	5.2	12.4	7.3	2.3	1.6	4.7	1.4	5.1	0.5	2.1	0.7
Pennant Hills - Epping	2.3	0.7	0.5	1.0	3.0	3.6	0.6	0.6	1.1	0.5	0.3	0.4	1.0	0.5	2.2	3.5	3.7	1.6	0.7	1.0	0.3	0.2	0.4	2.6		9.0	10.0	10.3	3.2	0.3	0.5	0.3	0.4	1.0	1.5	1.6	1.4	3.7	6.3	8.8	3.4	15.5	0.3	2.1	0.4	1.2	0.7
Carlingford	7.1	1.8	1.5	2.2	6.5	8.7	1.4	1.8	2.4	1.8	1.6	1.8	4.0	2.2	7.7	13.9	15.5	6.3	2.0	3.8	0.8	0.4	1.3	5.9	9.2		19.0	41.7	9.3	0.8	1.9	0.9	1.3	1.9	4.8	4.1	2.5	6.3	6.2	6.4	4.8	23.4	0.9	3.7	0.8	1.8	1.2
Ryde - Hunters Hill	26.3	6.0	4.8	10.3	21.2	18.5	5.0	4.3	6.5	3.8	2.5	2.5	4.0	2.1	10.9	9.7	15.7	4.1	1.8	3.3	1.3	0.8	1.6	24.5	10.7	19.4		23.4	5.9	0.5	1.3	0.6	0.7	1.4	3.6	3.9	10.3	30.5	28.4	6.9	4.8	15.8	2.6	12.7	1.1	6.2	1.1
Parramatta	10.7	2.4	2.3	2.8	12.7	21.4	2.3	3.9	5.2	4.4	3.7	4.4	14.7	8.6	18.0	64.0	31.6	27.8	8.7	15.3	3.5	0.9	3.8	9.0	11.0	46.2	25.5		47.1	2.6	8.5	3.5	5.9	6.8	23.5	15.2	3.6	7.6	9.3	11.7	9.6	65.2	1.1	5.5	2.1	3.1	2.5
Blacktown	5.1	1.2	1.0	1.4	4.7	13.0	1.1	1.4	2.2	1.6	1.5	1.7	8.4	6.6	6.9	26.1	8.6	23.5	7.7	14.8	3.2	0.6	3.1	3.1	3.4	11.6	9.8	46.9		5.1	9.2	5.4	5.3	8.9	46.8	33.7	1.9	3.9	4.5	7.2	5.4	49.5	0.5	3.0	1.4	1.6	1.6
Richmond - Windsor	1.4	0.1	0.2	0.2	0.7	3.1	0.1	0.4	0.4	0.2	0.3	0.1	1.2	1.2	0.9	2.1	0.9	2.7	1.7	13.4	1.1	0.3	0.8	0.3	0.3	0.9	0.9	3.5	5.0		2.2	20.1	3.4	10.7	6.5	7.0	0.3	0.7	0.6	0.5	2.6	2.8	0.1	0.6	0.3	0.1	0.3
St Marys	2.0	0.5	0.4	0.6	1.9	4.3	0.5	0.4	0.8	0.4	0.7	0.6	4.0	3.1	2.3	6.8	2.9	8.3	4.8	19.4	1.6	0.2	1.0	1.0	0.5	2.2	1.7	8.3	9.3	2.1		1.6	2.5	1.9	27.2	4.0	0.3	0.8	0.5	0.8	0.7	3.7	0.1	0.5	0.1	0.2	0.2
Hawkesbury	1.4	0.4	0.2	0.3	0.8	2.5	0.3	0.4	0.3	0.3	0.2	0.2	1.0	1.1	1.1	2.1	1.0	2.4	1.4	9.2	0.8	0.0	0.4	0.4	0.3	0.9	0.8	3.7	4.7	20.5	1.5		2.9	8.0	5.0	5.8	0.4	1.0	0.6	0.8	1.6	3.8	0.2	0.5	1.0	0.3	1.0
Blue Mountains	1.6	0.5	0.2	0.3	1.1	4.3	0.3	0.4	0.4	0.2	0.3	0.2	2.1	1.7	1.5	3.2	1.4	3.9	2.6	18.5	1.4	3.0	0.5	0.6	0.4	1.0	0.6	4.2	3.3	3.1	2.9	2.8		1.3	4.4	1.6	0.2	0.6	0.3	0.3	0.3	1.8	0.1	0.2	0.1	0.1	0.2
Rouse Hill - McGraths Hill	1.4	0.4	0.3	0.3	1.0	2.8	0.3	0.4	0.5	0.3	0.4	0.3	1.3	1.5	1.2	3.1	1.5	2.8	1.3	5.7	0.7	0.2	0.9	0.6	1.0	2.1	1.9	6.7	7.8	10.9	1.8	8.7	1.7		6.6	15.4	0.5	1.2	1.4	2.0	5.3	14.7	0.2	0.8	0.5	0.5	0.6
Mount Druitt	5.4	1.1	0.9	1.1	4.4	14.5	0.8	1.2	2.0	1.1	2.0	1.8	8.5	8.1	5.7	19.6	7.4	23.1	10.4	32.0	4.2	0.6	3.8	2.5	1.6	6.3	5.3	23.7	48.2	6.8	27.4	5.7	7.4	7.2		19.8	1.1	2.1	2.0	2.9	2.7	15.4	0.5	1.6	1.1	0.8	1.3
Blacktown - North	2.1	0.5	0.3	0.7	1.9	5.3	0.6	0.5	0.8	0.4	0.4	0.4	2.9	2.9	2.4	7.6	3.1	7.2	3.0	8.8	1.3	0.2	1.4	1.2	1.5	4.4	3.9	15.3	34.2	7.3	4.0	6.5	2.4	16.3	19.9		1.0	2.2	2.2	2.8	4.7	32.1	0.4	1.4	0.6	0.6	0.7
North Sydney - Mosman	40.1	11.4	4.2	7.2	7.5	18.0	9.0	4.7	3.1	2.2	2.9	2.0	1.8	1.7	2.7	2.3	2.7	1.1	0.9	1.5	0.8	0.3	1.4	5.1	1.5	2.3	8.6	3.0	1.6	0.3	0.3	0.4	0.2	0.5	1.9	2.2		31.1	9.1	1.7	1.5	4.1	12.0	20.7	0.8	4.4	0.8
Chatswood - Lane Cove	42.0	12.0	4.9	9.2	13.4	20.8	9.3	5.3	4.5	2.7	3.6	2.6	2.6	2.3	5.4	4.3	5.7	2.2	1.2	2.3	1.1	0.7	2.2	12.9	4.4	6.2	28.3	6.8	3.4	0.6	0.7	1.0	0.7	1.2	3.1	4.7	31.1		31.0	8.0	3.6	9.8	7.0	33.1	1.9	9.4	2.1
Ku-ring-gai	12.6	4.3	2.0	3.5	8.2	11.0	3.3	2.2	2.7	1.6	1.2	1.0	1.5	0.8	4.8	4.1	5.7	2.0	0.6	1.7	0.5	0.3	0.5	7.3	6.8	6.1	27.2	8.7	4.0	0.5	0.4	0.6	0.4	1.2	2.0	2.7	9.1	29.5		20.9	4.0	13.1	2.5	19.2	1.3	7.3	2.0
Hornsby	2.6	0.4	0.5	1.0	2.7	5.2	0.6	0.4	1.1	0.6	0.3	0.4	1.2	1.0	2.6	3.9	3.5	2.0	0.7	1.3	0.3	0.1	0.7	2.3	8.4	6.0	6.4	9.2	4.5	0.4	0.5	0.7	0.4	1.4	2.1	2.3	1.9	8.0	20.3		7.0	16.7	0.9	6.9	2.0	3.7	2.8
Dural - Wisemans Ferry	3.0	0.9	0.5	0.9	2.1	3.3	0.8	0.6	0.8	0.5	0.3	0.3	1.3	0.8	2.5	4.0	3.7	2.3	0.8	2.1	0.4	0.0	0.4	1.7	3.5	5.1	4.7	9.5	5.3	2.7	0.6	1.9	0.4	5.4	2.6	4.8	1.3	3.4	4.3	7.5		23.9	0.4	2.1	0.7	0.8	1.1
Baulkham Hills	6.3	2.0	1.4	2.4	7.4	13.8	1.9	1.4	3.0	1.8	1.1	1.6	5.7	4.5	8.6	22.5	14.3	12.3	4.2	7.9	2.3	0.5	2.6	5.4	16.0	25.9	17.5	66.4	50.5	3.1	3.8	4.7	2.9	15.7	15.8	32.3	3.3	8.6	13.6	21.2	24.6		1.1	5.9	1.9	3.4	2.2
Manly	9.3	2.8	0.9	1.7	2.1	5.9	2.3	1.4	0.8	0.6	0.8	0.5	0.5	0.3	0.8	0.8	0.8	0.4	0.3	0.6	0.2	0.1	0.3	1.3	0.4	0.8	2.4	1.0	0.4	0.0	0.1	0.2	0.1	0.2	0.8	0.6	11.4	6.8	2.4	0.9	0.5	1.3		15.9	0.2	3.0	0.3
Warringah	25.3	7.4	3.0	4.7	7.1	19.0	5.8	3.7	2.5	2.0	2.3	1.7	1.7	1.6	4.0	3.5	4.0	1.8	1.0	1.8	0.8	0.3	1.3	5.1	2.6	3.7	11.8	5.2	2.7	0.5	0.5	0.6	0.2	0.8	2.5	3.0	20.6	30.9	18.4	6.8	2.5	8.1	15.8		1.3	24.2	1.7
Wyong	2.8	0.2	0.2	0.5	0.7	8.4	0.4	0.3	0.5	0.2	0.4	0.3	0.7	0.4	1.1	1.5	1.1	0.9	0.4	1.7	0.2	0.0	0.8	0.4	0.4	0.8	0.9	2.0	1.3	0.3	0.1	0.9	0.1	0.5	1.1	0.5	0.8	1.7	1.2	1.8	0.7	1.8	7.6	1.3		0.7	50.2
Pittwater	7.4	2.4	1.0	1.5	2.9	8.1	1.8	1.1	1.1	0.6	0.8	0.5	1.0	0.5	2.0	1.8	2.3	1.0	0.3	0.9	0.2	0.1	0.3	2.1	1.5	1.9	6.0	3.0	1.5	0.1	0.2	0.2	0.1	0.5	1.0	1.0	4.7	9.2	7.2	3.8	0.9	4.2	3.0	25.3	0.6		0.8
Gosford	3.0	0.2	0.3	0.4	0.8	7.9	0.2	0.4	0.3	0.4	0.3	0.4	0.8	0.6	1.6	1.8	1.3	1.2	0.5	1.6	0.4	0.0	0.6	0.7	0.8	1.2	1.0	2.5	1.5	0.4	0.2	1.0	0.2	0.6	1.3	0.8	0.8	2.2	1.9	2.8	1.1	2.3	2.7	1.7	56.5	0.9	

Source: ACIL Allen Consulting, 2014

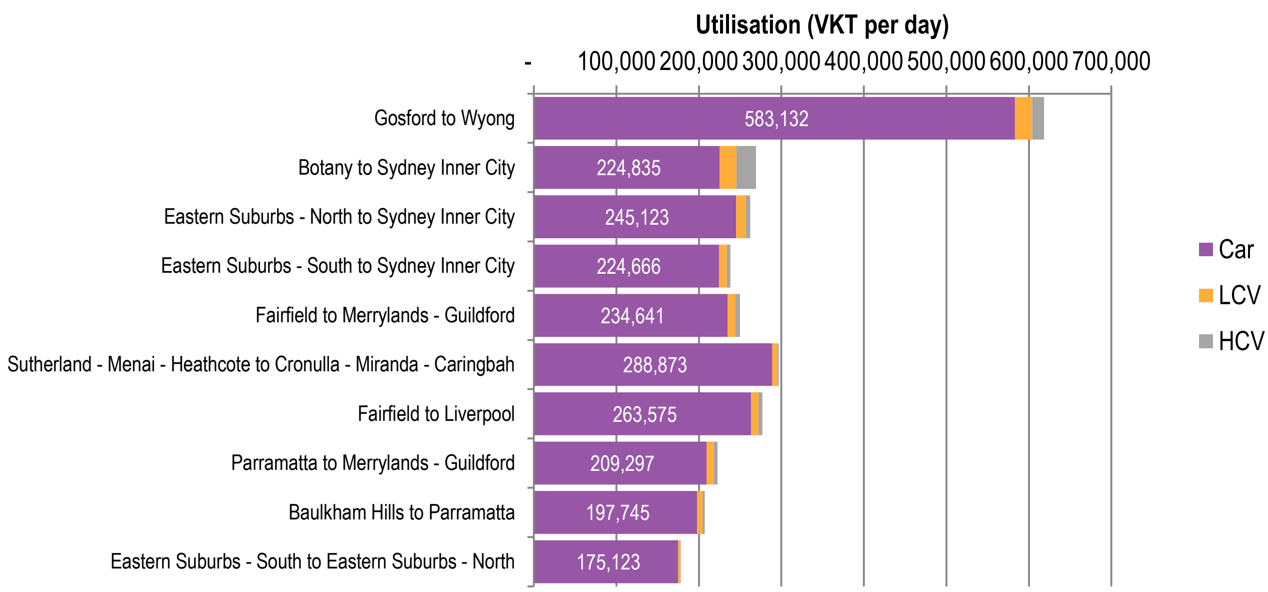
The figure shown above provides a broad overview of the DEC of journeys between origin-destination pairs in the Sydney GCCSA. It can be seen that high DEC journeys are concentrated in the top left quadrant of matrix where the SA3s closer to the city's centre can be found.

Hotspots include journeys to and from the Sydney Inner City, Bankstown, Fairfield, Ryde, Hunters Hill and Parramatta. Journeys between the SA3s 'Gosford' and 'Wyong' are another hotspot. It is important to note that SA3s are not the same size. SA3s like 'Wyong' or 'Gosford' can cover geographical areas multiple times larger than some of the SA3s closer to the city centre. As a result the DEC calculated for these areas and other SA3s further from the city centre is spread out over a larger area.

Utilisation for top 10 origin-destination trips

Figure 13 provides an overview of the ten origin-destination pairs with the greatest utilisation in the Sydney GCCSA in 2011.

Figure 13 **Roads – top ten origin-destination pairs – utilisation 2011 – Sydney GCCSA**



Source: ACIL Allen Consulting, 2014

Utilisation in VKT terms is highest for trips between Gosford and Wyong; trips across different transport modes amount to a total of more than 600,000 VKT. Trips to the inner city feature prominently in the figure above with trips from Botany and the Eastern Suburbs making up a large proportion of trips to the inner city. It is important to note that some of the journeys to the inner city and other SA3s may share the same corridor for travel and hence contribute to congestion on the same road segments. Section 4.6 covers an analysis of key road corridors and will expand on this issue further.

DEC for top 10 origin-destination trips

Table 24 provides an overview of the ten origin-destination pairs with the greatest DEC in the Sydney GCCSA in 2011.

Table 24 **Roads – top ten origin-destination pairs – DEC 2011 – Sydney GCCSA**

From	To	DEC
		$m
Gosford	Wyong	85.2
Botany	Sydney Inner City	67.5
Eastern Suburbs - North	Sydney Inner City	62.3
Eastern Suburbs - South	Sydney Inner City	54.9
Fairfield	Merrylands - Guildford	54.9
Sutherland - Menai - Heathcote	Cronulla - Miranda - Caringbah	53.7
Fairfield	Liverpool	53.7
Parramatta	Merrylands - Guildford	51.7
Baulkham Hills	Parramatta	48.4
Eastern Suburbs - South	Eastern Suburbs - North	43.0

Source: ACIL Allen Consulting, 2014

The DEC for trips between the SA3s of Gosford and Wyong is the highest of all origin-destination pairs in the Sydney GCCSA.

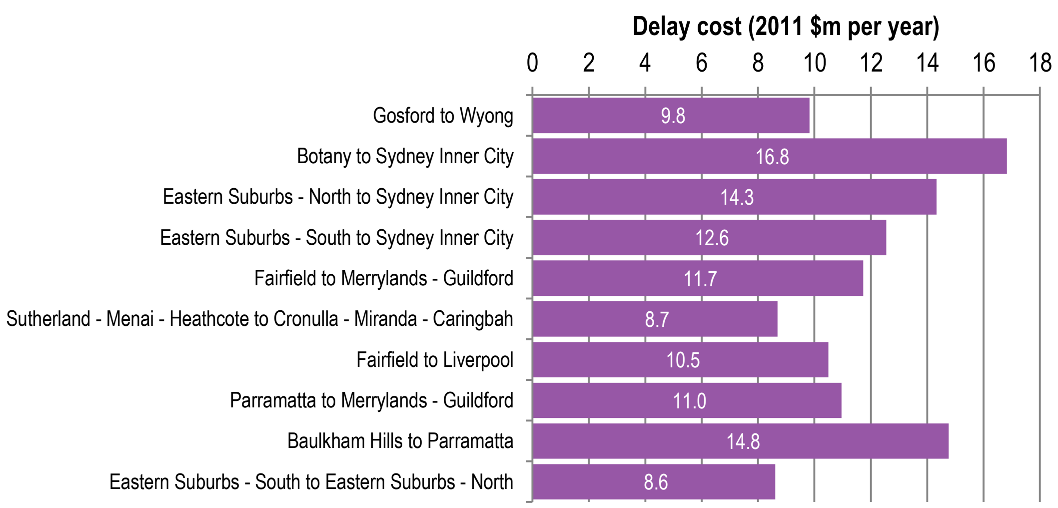
The DEC of trips between Botany and the Sydney Inner City is nearly as high as that of trips between Gosford and Wyong although travel demand is much lower for this link. This is because the DEC of trips between Botany and the inner city contains a higher proportion of freight related travel demand and because there are larger delays on trips closer to the city centre.

Delay costs for top 10 origin-destination trips

Delay cost are measured by evaluating delay time – the additional time it takes to travel a road link due to congestion – with the value of travel time. The measurement of delay cost does not include costs associated with increased vehicle wear and tear or increased fuel consumption through stop and go travel.

Figure 14 shows the delay cost for car travel for the ten origin-destination pairs with the highest utilisation in the Sydney GCCSA in 2011.

Figure 14 **Roads – top ten origin-destination pairs – car delay cost 2011 – Sydney GCCSA**



Source: ACIL Allen Consulting, 2014

Delay costs for car travel are highest for trips between Botany and the inner city followed by trips between Baulkham Hills and Parramatta.

DEC by cluster

Origins and destination areas in the Sydney region were grouped into eleven clusters. The clusters were designed to be geographically continuous areas with similar characteristics in terms of employment opportunities and demographics. Table 25 shows what regions make up the clusters in the Sydney-Newcastle-Wollongong area.

Table 25 **Definition of clusters – Sydney-Newcastle-Wollongong**

Cluster	Regions
Eastern Suburbs	Eastern Suburbs – North, Eastern Suburbs - South
Hunter Region	Lower Hunter, Port Stephens, Lake Macquarie – East, Lake Macquarie – West, Maitland, Newcastle, Great Lakes, Upper Hunter
Illawarra Region	Kiama – Shellharbour, Shoalhaven, Southern Highlands, Illawarra Catchment Reserve, Wollongong, Dapto - Port Kembla
Inner City	Sydney Inner City
Inner South	Marrickville - Sydenham – Petersham, Botany
Inner West	Leichhardt, Strathfield - Burwood – Ashfield, Canada Bay
North	Pennant Hills – Epping, Carlingford, Ryde - Hunters Hill, North Sydney – Mosman, Chatswood - Lane Cove, Ku-ring-gai Hornsby, Manly, Warringah, Pittwater
North West	Richmond – Windsor, Hawkesbury, Rouse Hill - McGraths Hill Dural - Wisemans Ferry, Baulkham Hills, Wyong, Gosford
South	Kogarah – Rockdale, Canterbury, Hurstville, Cronulla - Miranda – Caringbah, Sutherland - Menai – Heathcote, Liverpool, Campbelltown (NSW), Bankstown
South West	Camden, Blue Mountains – South, Wollondilly, Blue Mountains
West	Merrylands – Guildford, Auburn, Fairfield, Bringelly - Green Valley, Penrith, Parramatta, Blacktown, St Marys, Mount Druitt, Blacktown - North

Source: ACIL Allen Consulting, 2014

Analysis of trips between clusters provides an overview of the transport system in the city. Trips to and from the Sydney inner city make up a large proportion of the total DEC in the Sydney-Newcastle-Wollongong area but a large proportion of the DEC of trips to and from the inner city is absorbed in congestion costs.

Table 26 provides an overview of the delay costs incurred by car transport in 2010-11 for trips from clusters to the ‘Sydney Inner City’ SA3. The table also shows the percentage of DEC that is absorbed in delay cost.

Table 26 **Car delay cost – 2010-11 – Clusters to inner city (Sydney-Newcastle-Wollongong)**

Cluster	Car delay cost	Car DEC	Car delay cost
	($m)	($m)	% of DEC
Inner City	30.0	127.3	24%
Eastern Suburbs	26.9	106.6	25%
Inner South	23.7	79.2	30%
Inner West	23.3	80.8	29%
South	32.6	105.8	31%
West	15.0	42.2	36%
South West	1.8	6.4	28%
North	39.3	121.7	32%
North West	4.2	13.2	32%
Hunter Region	0.5	3.7	13%
Illawarra Region	1.6	7.5	21%

Source: ACIL Allen Consulting, 2014

The table above shows that trips that originate within the inner city and end in the inner city have the highest DEC of the trips from all clusters to the inner city. Trips from the 'South' cluster to the inner city are associated with the highest absolute delay cost, while the delay costs as a percentage of DEC are highest for trips from the 'West' cluster to the inner city.

4.5.3 Public transport

Overview of DEC for all origin-destination pairs

Figure 15 provides an overview of the DEC of public transport for all SA3 origin-destination pairs in the Sydney GCCSA. The figure shows a matrix of the DEC in 2010-11 for origin - destination pairs in the Sydney Greater City Statistical Area (GCCSA). Each cell represents the DEC of public transport journeys from an origin (rows of the matrix) to a destination (column of the matrix).

Figure 15 **Public transport – all origin-destination pairs – DEC 2011 – Sydney GCCSA**

SA3 Origin / Destination	Sydney Inner City	Eastern Suburbs - North	Marrickville - Sydenham - Petersham	Leichhardt	Strathfield - Burwood - Ashfield	Botany	Eastern Suburbs - South	Kogarah - Rockdale	Canterbury	Hurstville	Cronulla - Miranda - Caringbah	Sutherland - Menai - Heathcote	Liverpool	Campbelltown (NSW)	Bankstown	Merrylands - Guildford	Auburn	Fairfield	Bringelly - Green Valley	Penrith	Camden	Blue Mountains - South	Wollondilly	Canada Bay	Pennant Hills - Epping	Carlingford	Ryde - Hunters Hill	Parramatta	Blacktown	Richmond - Windsor	St Marys	Hawkesbury	Blue Mountains	Rouse Hill - McGraths Hill	Mount Druitt	Blacktown - North	North Sydney - Mosman	Chatswood - Lane Cove	Ku-ring-gai	Hornsby	Dural - Wisemans Ferry	Baulkham Hills	Manly	Warringah	Wyong	Pittwater	Gosford
Sydney Inner City		58.9	35.1	41.7	48.8	103.9	63.5	38.0	22.3	15.6	19.1	13.8	11.5	9.5	17.6	10.3	13.0	6.8	5.9	9.0	5.2	1.8	9.4	25.2	4.7	8.3	26.4	11.0	5.1	1.4	2.2	1.5	2.1	1.6	9.8	7.1	46.3	47.5	14.6	4.2	4.4	10.7	11.4	30.5	3.4	8.5	3.7
Eastern Suburbs - North	58.1		5.6	6.6	8.5	24.1	38.7	10.0	4.5	4.5	5.5	3.9	2.6	2.1	3.6	1.9	2.5	1.4	1.4	2.0	1.5	0.2	1.3	4.6	0.9	1.8	5.5	2.3	1.1	0.1	0.6	0.3	0.6	0.4	1.6	1.1	11.8	12.4	4.8	0.6	1.0	2.5	3.1	8.1	0.3	2.6	0.2
Marrickville - Sydenham - Petersham	32.2	5.5		7.6	13.5	14.7	7.4	13.3	8.4	5.0	4.5	3.3	2.8	2.1	4.3	1.7	2.4	1.2	1.3	1.0	1.3	0.3	1.1	4.6	0.5	1.1	3.8	1.7	0.8	0.2	0.3	0.2	0.2	0.2	0.9	0.6	4.0	4.4	1.7	0.5	0.5	1.4	1.0	2.9	0.2	1.0	0.3
Leichhardt	35.0	5.7	6.7		14.3	9.3	4.8	5.6	5.7	3.1	2.6	2.5	2.3	1.8	4.4	2.2	3.0	1.2	1.0	1.4	1.2	0.3	1.0	9.8	1.2	2.1	8.9	2.6	1.3	0.2	0.6	0.3	0.4	0.3	1.4	1.1	7.0	8.5	3.5	1.1	0.9	2.6	1.7	4.5	0.5	1.5	0.4
Strathfield - Burwood - Ashfield	47.3	8.4	15.6	16.1		22.1	9.2	20.1	30.9	14.3	8.6	9.1	10.5	6.6	27.4	11.3	23.2	6.8	4.3	4.2	3.9	1.0	3.5	29.9	3.8	6.9	20.2	11.7	4.3	0.7	1.8	0.8	1.3	0.9	4.6	2.6	8.0	13.1	8.4	3.1	2.4	7.9	2.2	7.5	0.8	3.0	0.8
Botany	101.5	24.4	15.3	14.3	22.5		34.0	29.1	13.7	13.7	18.6	15.9	15.4	16.1	16.1	15.3	13.2	14.8	9.5	11.8	9.5	0.8	6.8	11.0	3.7	8.7	17.3	20.0	12.5	3.2	4.6	2.6	5.2	2.8	15.8	6.4	17.6	20.3	11.0	5.5	3.5	14.3	6.1	19.6	8.9	8.3	7.5
Eastern Suburbs - South	61.8	39.8	7.4	6.1	8.8	33.8		15.8	5.9	6.4	7.8	5.7	3.5	2.7	4.5	1.9	2.3	1.7	1.7	1.9	1.8	0.2	1.5	3.5	0.8	1.3	4.5	2.0	0.9	0.2	0.5	0.3	0.3	0.2	1.1	0.9	8.8	9.1	3.4	0.6	0.9	2.1	2.4	6.0	0.4	1.8	0.2
Kogarah - Rockdale	35.7	9.8	13.1	7.0	19.6	29.3	15.8		24.2	29.0	27.3	18.5	7.9	5.8	13.6	4.3	5.0	3.8	3.7	1.9	3.3	0.3	2.8	5.9	0.7	1.9	3.9	3.6	1.4	0.4	0.5	0.4	0.5	0.4	1.5	0.9	4.4	5.0	2.1	0.4	0.6	1.6	1.4	3.8	0.3	1.2	0.4
Canterbury	20.7	4.4	9.2	6.4	31.4	13.4	6.3	24.3		22.4	9.00	9.6	9.8	6.1	27.6	6.6	8.8	5.6	4.1	2.2	3.3	0.4	2.3	8.5	1.3	2.6	6.4	4.8	2.1	0.4	0.8	0.3	0.5	0.5	1.9	1.1	3.2	4.5	2.8	1.1	0.8	3.2	0.9	2.7	0.5	1.2	0.3
Hurstville	14.4	4.3	5.3	3.7	14.2	13.9	6.8	29.9	22.7		17.3	16.3	9.5	5.7	24.1	5.5	6.5	4.3	3.8	1.8	2.8	0.3	1.8	4.4	0.7	1.9	3.7	4.2	1.5	0.2	0.5	0.3	0.3	0.3	1.3	0.6	2.1	2.6	1.6	0.6	0.5	2.0	0.6	2.0	0.2	0.6	0.4
Cronulla - Miranda - Caringbah	17.8	5.3	4.8	3.7	8.5	19.5	8.1	28.5	9.6	17.8		26.7	5.9	4.4	10.6	3.9	4.3	3.0	2.7	1.7	2.3	0.2	2.0	2.7	0.5	1.5	2.1	2.9	1.0	0.3	0.5	0.2	0.4	0.3	1.5	0.5	2.6	3.3	1.2	0.2	0.3	0.9	0.8	2.3	0.4	0.8	0.3
Sutherland - Menai - Heathcote	12.8	3.6	3.5	3.0	8.9	16.4	5.9	19.2	10.0	17.2	27.2		10.2	5.8	22.0	5.6	5.7	5.1	3.8	1.7	2.3	0.2	1.6	3.0	0.5	1.9	2.4	4.1	1.3	0.1	0.5	0.2	0.3	0.3	1.4	0.4	1.9	2.4	1.0	0.4	0.3	1.5	0.5	1.7	0.3	0.5	0.4
Liverpool	9.4	2.3	2.9	2.4	9.0	14.9	3.6	7.4	8.6	8.8	9.7	11.2		46.9	35.3	27.1	11.7	51.7	54.1	9.1	20.3	0.8	10.1	3.3	1.0	4.2	3.7	13.4	8.1	1.2	3.9	1.2	2.6	1.4	7.9	2.8	1.6	2.2	1.3	1.3	1.2	5.2	0.5	1.6	0.8	0.9	0.8
Campbelltown (NSW)	8.5	2.0	2.2	2.0	5.9	16.2	2.8	5.7	5.7	5.7	6.4	11.2	45.6		15.9	10.3	6.1	17.1	32.5	7.7	79.3	1.4	24.3	2.2	0.4	1.6	1.7	5.0	4.6	1.0	2.5	1.0	2.0	1.2	6.0	2.3	1.5	2.0	0.6	1.0	0.6	3.0	0.4	1.5	0.4	0.4	0.6
Bankstown	16.2	3.6	5.8	5.0	26.9	16.8	5.6	14.4	27.8	24.6	12.3	22.0	39.8	17.3		31.0	27.2	26.8	14.9	6.0	9.0	0.9	6.6	9.1	2.6	7.8	9.9	16.1	6.3	0.9	2.3	1.1	1.9	1.2	5.4	2.6	2.7	5.0	4.6	2.9	2.5	8.1	0.9	4.0	1.2	2.0	1.6
Merrylands - Guildford	9.7	1.9	2.4	2.4	11.8	15.5	2.4	4.4	6.6	5.4	5.6	6.0	27.1	13.7	31.0		31.9	50.4	14.9	12.2	6.0	0.9	5.7	5.9	3.9	16.4	11.1	61.7	24.6	2.1	6.5	2.3	4.3	3.2	17.6	7.3	2.5	4.6	4.3	5.1	3.9	21.5	0.9	3.7	1.6	1.8	1.9
Auburn	12.1	2.4	3.3	3.2	23.9	13.2	2.7	5.2	8.8	6.5	4.8	5.9	11.4	6.3	28.3	32.3		13.4	5.2	5.6	2.8	0.7	2.9	10.8	4.4	16.6	15.3	31.6	8.1	0.8	2.7	1.0	1.7	1.6	6.7	3.4	3.0	5.9	5.9	4.2	3.7	14.2	0.9	4.2	1.2	2.4	1.3
Fairfield	6.5	1.4	1.6	1.4	7.0	14.6	2.0	3.8	5.7	4.3	5.2	6.0	53.4	21.2	27.0	53.0	14.7		47.2	15.8	11.2	1.0	7.1	2.9	1.8	7.7	5.7	26.8	22.8	2.2	7.6	2.3	4.9	2.8	21.3	6.7	1.1	2.3	2.2	2.8	2.3	11.8	0.4	1.9	1.0	1.0	1.2
Bringelly - Green Valley	5.3	1.3	1.4	1.3	4.2	9.1	1.7	3.6	3.7	3.5	4.5	5.1	54.7	32.3	13.7	16.4	7.1	48.4		15.1	31.4	1.2	10.1	1.5	0.7	2.5	2.2	8.4	7.8	1.6	4.8	1.5	3.2	1.4	10.1	3.0	0.9	1.2	0.7	0.9	0.8	4.0	0.3	1.0	0.5	0.3	0.5
Penrith	8.5	1.9	1.1	1.4	4.3	11.1	1.9	1.8	2.1	1.6	1.9	1.9	9.3	8.8	6.0	13.2	6.4	20.0	15.5		9.3	2.5	5.6	2.3	1.1	4.5	4.1	15.7	15.3	13.8	20.3	9.9	20.1	6.0	32.0	8.8	1.5	2.4	1.8	1.7	2.2	7.7	0.6	1.9	1.8	0.9	1.6
Camden	4.8	1.4	1.3	1.3	3.6	9.5	1.8	3.2	3.2	2.8	3.1	4.8	20.3	78.3	9.0	6.2	3.8	11.0	36.3	9.3		2.8	33.5	1.3	0.3	1.0	1.3	3.4	3.1	1.1	1.6	0.9	1.6	0.7	3.9	1.2	0.8	1.1	0.5	0.4	0.4	2.1	0.2	0.7	0.3	0.2	0.4
Blue Mountains - South	0.2	0.1	0.1	0.0	0.2	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.6	1.3	0.4	0.6	0.2	0.9	1.2	2.4	3.0		1.7	0.0	0.0	0.1	0.1	0.5	0.5	0.2	0.3	0.0	3.3	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
Wollondilly	9.3	1.2	1.1	1.0	3.4	7.1	1.6	2.8	2.3	1.9	2.4	2.4	10.3	24.7	6.7	5.7	3.0	6.8	11.0	5.4	35.1	1.6		1.1	0.3	1.1	1.3	3.3	2.9	0.8	1.0	0.4	0.6	0.9	3.4	1.3	1.3	2.0	0.4	0.6	0.3	2.1	0.3	1.3	0.8	0.3	0.6
Canada Bay	25.0	4.8	5.4	10.5	29.8	11.2	3.8	6.0	8.2	4.3	2.8	3.1	3.5	2.5	8.9	4.6	9.6	2.3	1.5	2.1	1.3	0.4	1.3		2.9	5.3	21.7	6.7	2.2	0.2	0.8	0.3	0.6	0.5	2.1	1.5	5.2	12.4	7.3	2.3	1.6	4.7	1.4	5.1	0.5	2.1	0.7
Pennant Hills - Epping	2.3	0.7	0.5	1.0	3.0	3.6	0.6	0.6	1.1	0.5	0.3	0.4	1.0	0.5	2.2	3.5	3.7	1.6	0.7	1.0	0.3	0.2	0.4	2.6		9.0	10.0	10.3	3.2	0.3	0.5	0.3	0.4	1.0	1.5	1.6	1.4	3.7	6.3	8.8	3.4	15.5	0.3	2.1	0.4	1.2	0.7
Carlingford	7.1	1.8	1.5	2.2	6.5	8.7	1.4	1.8	2.4	1.8	1.6	1.8	4.0	2.2	7.7	13.9	15.5	6.3	2.0	3.8	0.8	0.4	1.3	5.9	9.2		19.0	41.7	9.3	0.8	1.9	0.9	1.3	1.9	4.8	4.1	2.5	6.3	6.2	6.4	4.8	23.4	0.9	3.7	0.8	1.8	1.2
Ryde - Hunters Hill	26.3	6.0	4.8	10.3	21.2	18.5	5.0	4.3	6.5	3.8	2.5	2.5	4.0	2.1	10.9	9.7	15.7	4.1	1.8	3.3	1.3	0.8	1.6	24.5	10.7	19.4		23.4	5.9	0.5	1.3	0.6	0.7	1.4	3.6	3.9	10.3	30.5	28.4	6.9	4.8	15.8	2.6	12.7	1.1	6.2	1.1
Parramatta	10.7	2.4	2.3	2.8	12.7	21.4	2.3	3.9	5.2	4.4	3.7	4.4	14.7	8.6	18.0	64.0	31.6	27.8	8.7	15.3	3.5	0.9	3.8	9.0	11.0	46.2	25.5		47.1	2.6	8.5	3.5	5.9	6.8	23.5	15.2	3.6	7.6	9.3	11.7	9.6	65.2	1.1	5.5	2.1	3.1	2.5
Blacktown	5.1	1.2	1.0	1.4	4.7	13.0	1.1	1.4	2.2	1.6	1.5	1.7	8.4	6.6	6.9	26.1	8.6	23.5	7.7	14.8	3.2	0.6	3.1	3.1	3.4	11.6	9.8	46.9		5.1	9.2	5.4	5.3	8.9	46.8	33.7	1.9	3.9	4.5	7.2	5.4	49.5	0.5	3.0	1.4	1.6	1.6
Richmond - Windsor	1.4	0.1	0.2	0.2	0.7	3.1	0.1	0.4	0.4	0.2	0.3	0.1	1.2	1.2	0.9	2.1	0.9	2.7	1.7	13.4	1.1	0.3	0.8	0.3	0.3	0.9	0.9	3.5	5.0		2.2	20.1	3.4	10.7	6.5	7.0	0.3	0.7	0.6	0.5	2.6	2.8	0.1	0.6	0.3	0.1	0.3
St Marys	2.0	0.5	0.4	0.6	1.9	4.3	0.5	0.4	0.8	0.4	0.7	0.6	4.0	3.1	2.3	6.8	2.9	8.3	4.8	19.4	1.6	0.2	1.0	1.0	0.5	2.2	1.7	8.3	9.3	2.1		1.6	2.5	1.9	27.2	4.0	0.3	0.8	0.5	0.8	0.7	3.7	0.1	0.5	0.1	0.2	0.2
Hawkesbury	1.4	0.4	0.2	0.3	0.8	2.5	0.3	0.4	0.3	0.3	0.2	0.2	1.0	1.1	1.1	2.1	1.0	2.4	1.4	9.2	0.8	0.0	0.4	0.4	0.3	0.9	0.8	3.7	4.7	20.5	1.5		2.9	8.0	5.0	5.8	0.4	1.0	0.6	0.8	1.6	3.8	0.2	0.5	1.0	0.3	1.0
Blue Mountains	1.6	0.5	0.2	0.3	1.1	4.3	0.3	0.4	0.4	0.2	0.3	0.2	2.1	1.7	1.5	3.2	1.4	3.9	2.6	18.5	1.4	3.0	0.5	0.6	0.4	1.0	0.6	4.2	3.3	3.1	2.9	2.8		1.3	4.4	1.6	0.2	0.6	0.3	0.3	0.3	1.8	0.1	0.2	0.1	0.1	0.2
Rouse Hill - McGraths Hill	1.4	0.4	0.3	0.3	1.0	2.8	0.3	0.4	0.5	0.3	0.4	0.3	1.3	1.5	1.2	3.1	1.5	2.8	1.3	5.7	0.7	0.2	0.9	0.6	1.0	2.1	1.9	6.7	7.8	10.9	1.8	8.7	1.7		6.6	15.4	0.5	1.2	1.4	2.0	5.3	14.7	0.2	0.8	0.5	0.5	0.6
Mount Druitt	5.4	1.1	0.9	1.1	4.4	14.5	0.8	1.2	2.0	1.1	2.0	1.8	8.5	8.1	5.7	19.6	7.4	23.1	10.4	32.0	4.2	0.6	3.8	2.5	1.6	6.3	5.3	23.7	48.2	6.8	27.4	5.7	7.4	7.2		19.8	1.1	2.1	2.0	2.9	2.7	15.4	0.5	1.6	1.1	0.8	1.3
Blacktown - North	2.1	0.5	0.3	0.7	1.9	5.3	0.6	0.5	0.8	0.4	0.4	0.4	2.9	2.9	2.4	7.6	3.1	7.2	3.0	8.8	1.3	0.2	1.4	1.2	1.5	4.4	3.9	15.3	34.2	7.3	4.0	6.5	2.4	16.3	19.9		1.0	2.2	2.2	2.8	4.7	32.1	0.4	1.4	0.6	0.6	0.7
North Sydney - Mosman	40.1	11.4	4.2	7.2	7.5	18.0	9.0	4.7	3.1	2.2	2.9	2.0	1.8	1.7	2.7	2.3	2.7	1.1	0.9	1.5	0.8	0.3	1.4	5.1	1.5	2.3	8.6	3.0	1.6	0.3	0.3	0.4	0.2	0.5	1.9	2.2		31.1	9.1	1.7	1.5	4.1	12.0	20.7	0.8	4.4	0.8
Chatswood - Lane Cove	42.0	12.0	4.9	9.2	13.4	20.8	9.3	5.3	4.5	2.7	3.6	2.6	2.6	2.3	5.4	4.3	5.7	2.2	1.2	2.3	1.1	0.7	2.2	12.9	4.4	6.2	28.3	6.8	3.4	0.6	0.7	1.0	0.7	1.2	3.1	4.7	31.1		31.0	8.0	3.6	9.8	7.0	33.1	1.9	9.4	2.1
Ku-ring-gai	12.6	4.3	2.0	3.5	8.2	11.0	3.3	2.2	2.7	1.6	1.2	1.0	1.5	0.8	4.8	4.1	5.7	2.0	0.6	1.7	0.5	0.3	0.5	7.3	6.8	6.1	27.2	8.7	4.0	0.5	0.4	0.6	0.4	1.2	2.0	2.7	9.1	29.5		20.9	4.0	13.1	2.5	19.2	1.3	7.3	2.0
Hornsby	2.6	0.4	0.5	1.0	2.7	5.2	0.6	0.4	1.1	0.6	0.3	0.4	1.2	1.0	2.6	3.9	3.5	2.0	0.7	1.3	0.3	0.1	0.7	2.3	8.4	6.0	6.4	9.2	4.5	0.4	0.5	0.7	0.4	1.4	2.1	2.3	1.9	8.0	20.3		7.0	16.7	0.9	6.9	2.0	3.7	2.8
Dural - Wisemans Ferry	3.0	0.9	0.5	0.9	2.1	3.3	0.8	0.6	0.8	0.5	0.3	0.3	1.3	0.8	2.5	4.0	3.7	2.3	0.8	2.1	0.4	0.0	0.4	1.7	3.5	5.1	4.7	9.5	5.3	2.7	0.6	1.9	0.4	5.4	2.6	4.8	1.3	3.4	4.3	7.5		23.9	0.4	2.1	0.7	0.8	1.1
Baulkham Hills	6.3	2.0	1.4	2.4	7.4	13.8	1.9	1.4	3.0	1.8	1.1	1.6	5.7	4.5	8.6	22.5	14.3	12.3	4.2	7.9	2.3	0.5	2.6	5.4	16.0	25.9	17.5	66.4	50.5	3.1	3.8	4.7	2.9	15.7	15.8	32.3	3.3	8.6	13.6	21.2	24.6		1.1	5.9	1.9	3.4	2.2
Manly	9.3	2.8	0.9	1.7	2.1	5.9	2.3	1.4	0.8	0.6	0.8	0.5	0.5	0.3	0.8	0.8	0.8	0.4	0.3	0.6	0.2	0.1	0.3	1.3	0.4	0.8	2.4	1.0	0.4	0.0	0.1	0.2	0.1	0.2	0.8	0.6	11.4	6.8	2.4	0.9	0.5	1.3		15.9	0.2	3.0	0.3
Warringah	25.3	7.4	3.0	4.7	7.1	19.0	5.8	3.7	2.5	2.0	2.3	1.7	1.7	1.6	4.0	3.5	4.0	1.8	1.0	1.8	0.8	0.3	1.3	5.1	2.6	3.7	11.8	5.2	2.7	0.5	0.5	0.6	0.2	0.8	2.5	3.0	20.6	30.9	18.4	6.8	2.5	8.1	15.8		1.3	24.2	1.7
Wyong	2.8	0.2	0.2	0.5	0.7	8.4	0.4	0.3	0.5	0.2	0.4	0.3	0.7	0.4	1.1	1.5	1.1	0.9	0.4	1.7	0.2	0.0	0.8	0.4	0.4	0.8	0.9	2.0	1.3	0.3	0.1	0.9	0.1	0.5	1.1	0.5	0.8	1.7	1.2	1.8	0.7	1.8	7.6	1.3		0.7	50.2
Pittwater	7.4	2.4	1.0	1.5	2.9	8.1	1.8	1.1	1.1	0.6	0.8	0.5	1.0	0.5	2.0	1.8	2.3	1.0	0.3	0.9	0.2	0.1	0.3	2.1	1.5	1.9	6.0	3.0	1.5	0.1	0.2	0.2	0.1	0.5	1.0	1.0	4.7	9.2	7.2	3.8	0.9	4.2	3.0	25.3	0.6		0.8
Gosford	3.0	0.2	0.3	0.4	0.8	7.9	0.2	0.4	0.3	0.4	0.3	0.4	0.8	0.6	1.6	1.8	1.3	1.2	0.5	1.6	0.4	0.0	0.6	0.7	0.8	1.2	1.0	2.5	1.5	0.4	0.2	1.0	0.2	0.6	1.3	0.8	0.8	2.2	1.9	2.8	1.1	2.3	2.7	1.7	56.5	0.9	

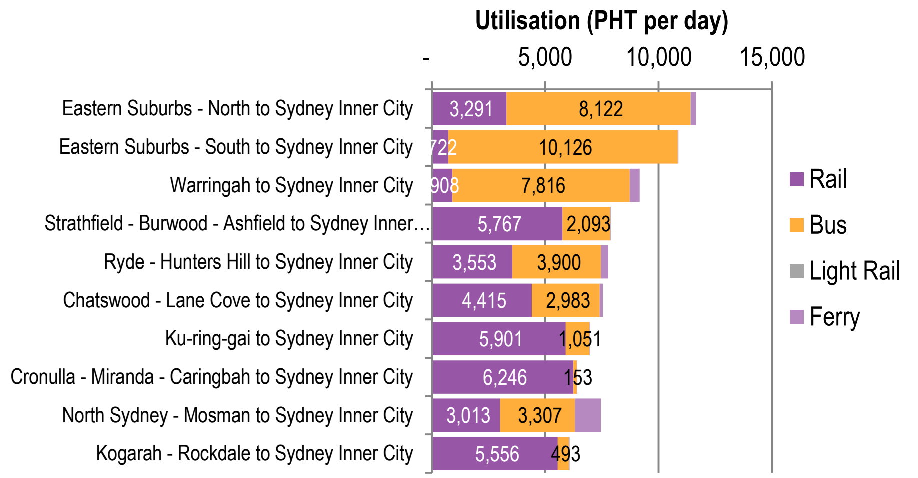
Source: ACIL Allen Consulting, 2014

The inner city is serviced by buses, trains and ferries which operate at a high frequency during peak hours. As a result, trips to and from the inner city dominate the DEC from public transport within the Sydney GCCSA. While trips to and from the inner city dominate the figure above there are a number of smaller hotspots including trips to and from Parramatta, especially from Baulkham Hills and Blacktown. Other smaller hotspots include trips from 'North-Sydney Mosman' to 'Chatswood - Lane Cove' and trips between Gosford and Wyong.

Utilisation for top 10 origin-destination trips

Figure 16 provides an overview of the ten origin-destination pairs with the greatest utilisation in the Sydney GCCSA in 2011.

Figure 16 **Public transport – top ten origin-destination pairs – utilisation 2011 – Sydney GCCSA**



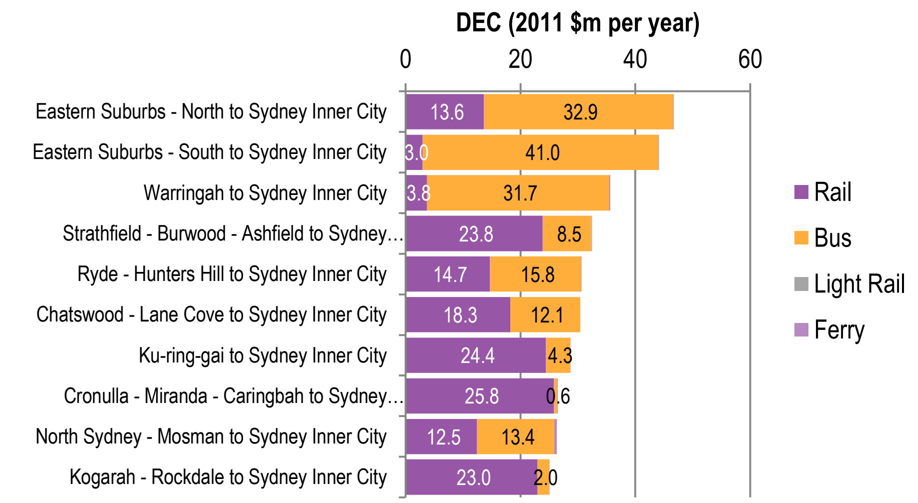
Source: ACIL Allen Consulting, 2014

All of the ten most highly utilised public transport links have the inner city as a destination. Bus travel between the Eastern Suburbs and inner city is the largest contributor to the utilisation for the three origin-destination pairs with the highest utilisation in the Sydney GCCSA. The other origination areas that appear in the list have direct trains services running to the Sydney inner city which drive the PHT figures for rail. Ferries contribute little to the overall PHT for most SA3s with the exception of trips between the inner city and the 'North Sydney – Mosman' SA3.

DEC for top 10 origin-destination trips

Figure 17 shows the ten origin-destination pairs which in 2011 had the highest DEC in the Sydney-Newcastle-Wollongong area.

Figure 17 **Public transport – top ten origin-destination pairs – DEC 2011 – Sydney GCCSA**



Source: ACIL Allen Consulting, 2014

The public transport DEC for the top ten origin-destination pairs is heavily skewed towards bus transport. The contribution to public transport DEC by train is highest for trips between 'Cronulla-Miranda-Caringbah' to 'Sydney Inner City'.

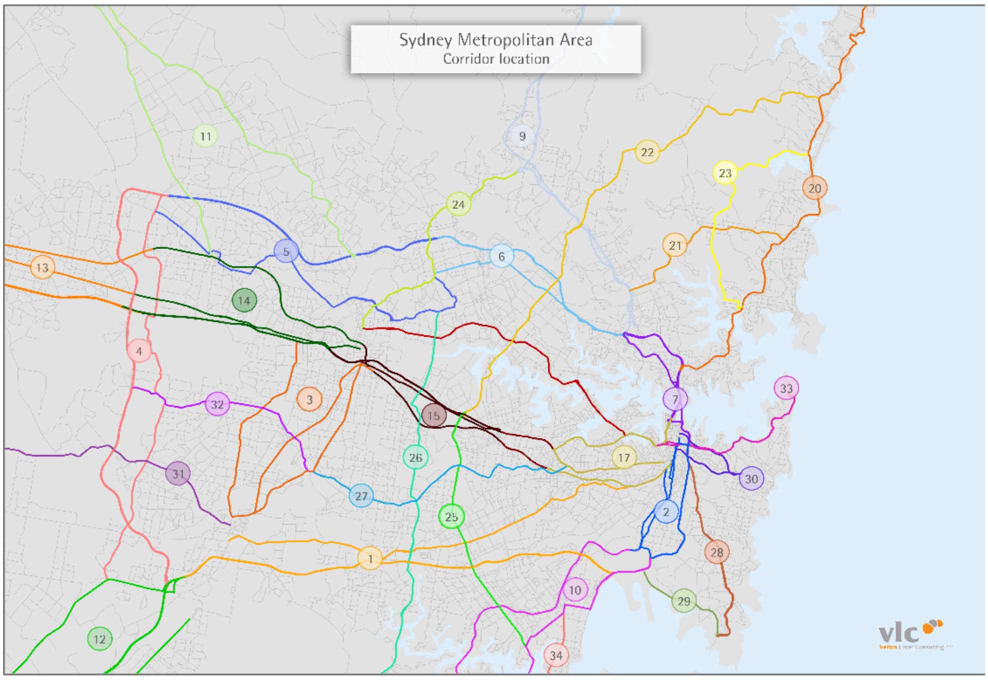
4.6 Corridor analysis

The previous chapter presented modelling results at the level of the SA3 regions. Corridors provide some increased granularity and allow the identification of urban infrastructure 'hot spots' with more precision than analysis by SA3 origin-destination pairs.

The analysis of corridors is focusses on the road network only. For the Sydney-Newcastle-Wollongong area a set of 34 major road corridors was selected. Some corridors consist of multiple parallel roads. This allows for the assessment of capacity, utilisation, congestion and DEC based on commonly travelled routes between destinations.

Figure 18 shows the 34 major transport corridors that were selected in the Sydney-Newcastle-Wollongong area.

Figure 18 **Sydney-Newcastle-Wollongong urban transport road corridors**



Source: VLC, 2014

Table 27 (next page) provides a legend and description to the corridors shown in the figure above.

Table 27 **Sydney-Newcastle-Wollongong urban transport road corridors**

Corridor	Description	Corridor	Description
1	East West corridor	18	Victoria Rd (A40) Corridor)
2	Airport to CBD	19	The Northern Rd Corridor
3	Cumberland Hwy (Hume Hwy-M4)	20	Nth Sydney - Northern Beaches Corridor
4	M7 North-South Corridor	21	Chatswood to Narraweena via Warringah Rd
5	NW Middle Corridor (M7/M2)	22	Homebush Bay to Mona Vale Corridor (A3)
6	NW Inner Corridor (M2/LCT)	23	Wakehurst Parkway Corridor
7	Gore Hill/Warringah Fwys/SHB/Eastern Dist	24	Pennant Hills Rd - Parramatta to Hornsby
8	Gt Western Hwy/Western Mwy (A32/M4)	25	Princes Hwy-M4 Corridor via King Georges Rd
9	Sydney to Central Coast	26	Sutherland - Ryde/Parramatta Corridor
10	South Coast to Sydney	27	Inner Hume Hwy Corridor
11	M2/M7 to Richmond	28	Little Bay to CBD East
12	Mittagong to SW Sydney via Hume Mwy	29	Port Botany Industrial Area
13	Western Mwy (M4) (EB) and Roper Rd (Colyton) to M7 Mwy (WB)	30	CBD to Bondi Junction
14	Western Mwy (M4)	31	SW Sydney Growth Area to Hume Hwy
15	Western Hwy (M4) Corridor	32	The Horsley Drive Corridor
16	Parramatta Rd (M4) Corridor	33	CBD West to Watsons Bay
17	Parramatta Rd (A31) Corridor	34	Cronulla to Kogarah

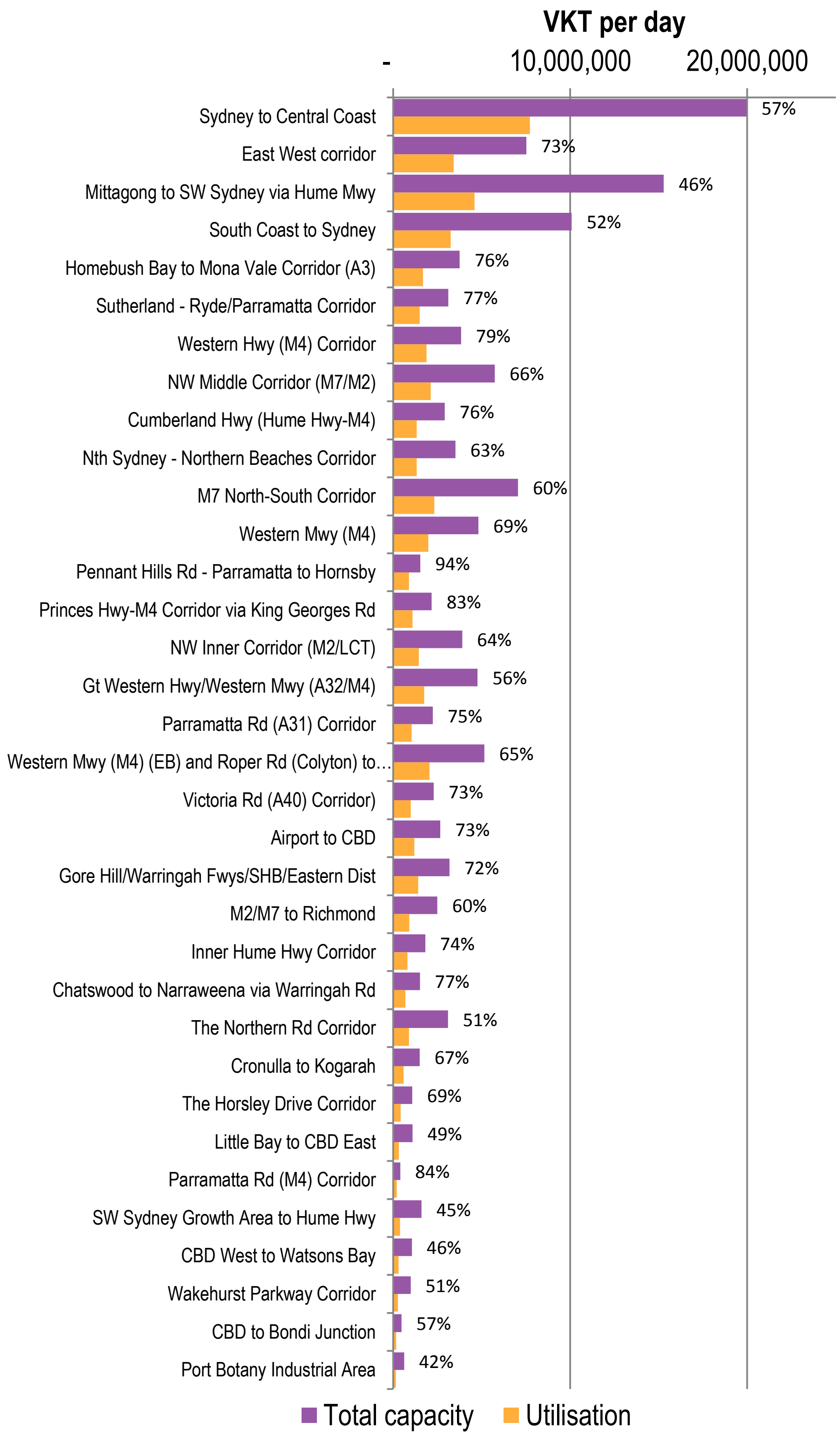
Source: ACIL Allen Consulting, 2014

4.6.1 DEC of corridors

Corridor capacity and utilisation

Figure 19 provides an overview of the capacity and utilisation of key transport links in the Sydney-Newcastle-Wollongong area. We distinguish between utilisation of corridors on a daily basis i.e. the average utilisation over the entire day and the utilisation during the two hour morning peak. The percentage figures shown in the graph indicate the utilisation during the morning peak while the bars indicate the capacity and average utilisation during the day.

Figure 19 **Transport corridors – Capacity and utilisation on average day and during morning peak 2011 – Sydney-Newcastle-Wollongong**



Note: Percentage figures indicate the utilisation during the AM peak
Source: ACIL Allen Consulting, 2014

Capacity, as measured by the VKT that can be achieved on a corridor, is influenced by the length of the corridor and the capacity of the roads making up the corridor.

Of the selected corridors, the three largest corridors in the Sydney-Newcastle-Wollongong area are the ‘Sydney to Central Coast, the ‘Mittagong to SW Sydney via Hume Mwy’ and the ‘South Coast to Sydney’ corridor.

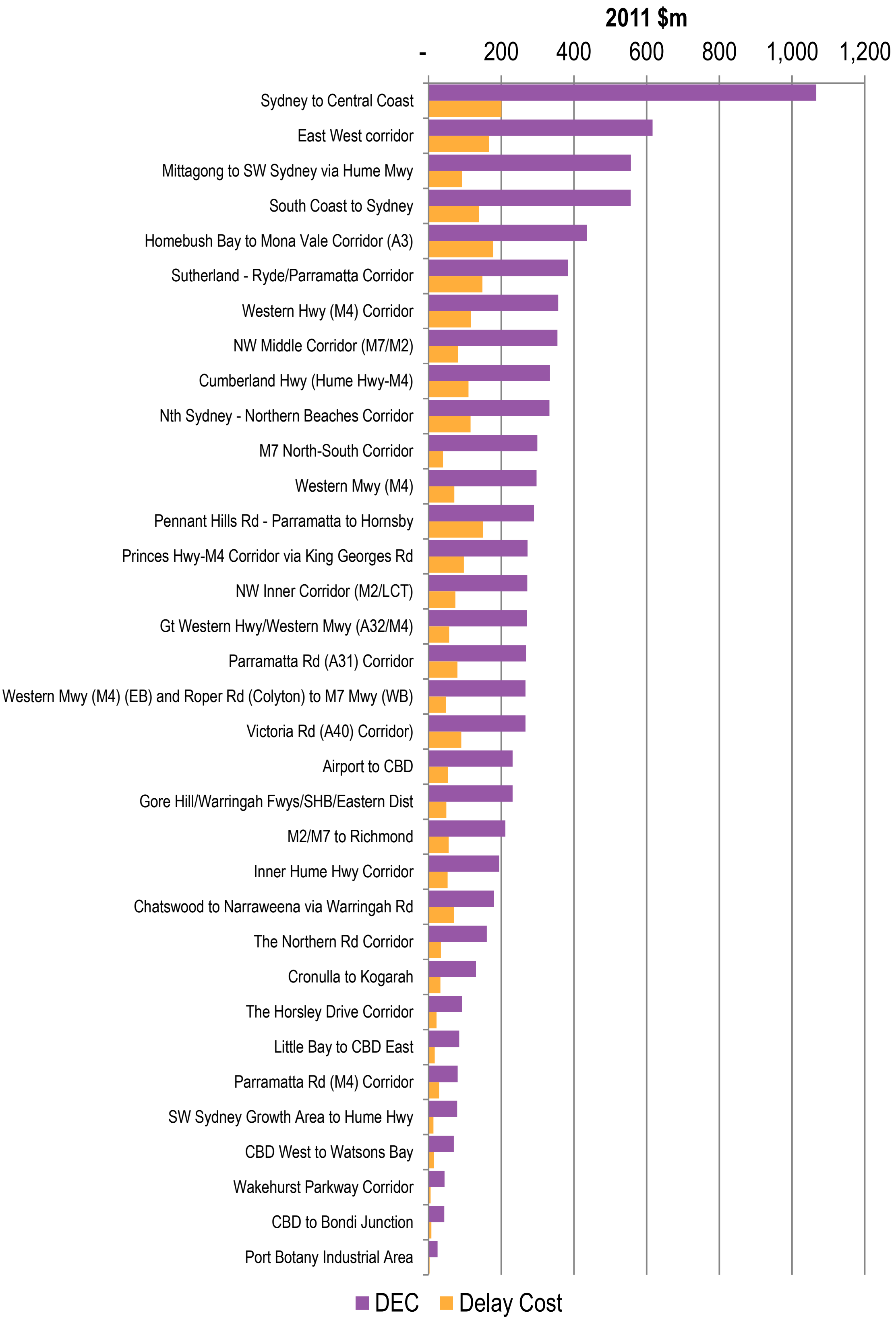
The ‘Pennant Hills Rd - Parramatta to Hornsby’ corridor, ‘Princes Hwy-M4 Corridor via King Georges Rd’ corridor and the ‘Sutherland - Ryde/Parramatta Corridor’ are the three corridors with the highest utilisation over a typical day.

While these generally roads have a high utilisation over the course of the day, congestion during the morning peak is more intense on other corridors. In the morning peak the ‘Pennant Hills Rd - Parramatta to Hornsby’ corridor, the ‘Princes Hwy-M4 Corridor via King Georges Rd’ corridor and the ‘Parramatta Rd (M4) Corridor’ had utilisation figures of more than 80 per cent of capacity in 2010-11.

Corridor DEC and delay costs

Figure 20 shows the DEC and utilisation of major transport corridors in the Sydney-Newcastle-Wollongong area.

Figure 20 **Transport corridors – DEC and delay cost 2010-11 – Sydney-Newcastle-Wollongong**



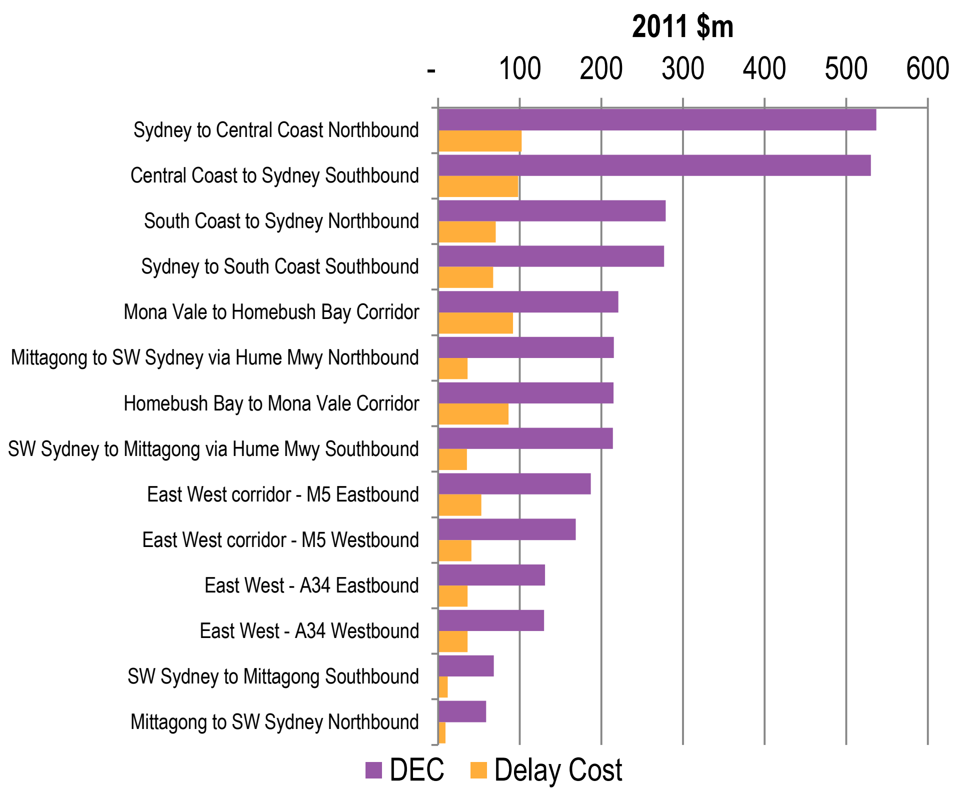
Source: ACIL Allen Consulting, 2014

The ‘Sydney to Central Coast’ corridor has the highest DEC of the major transport corridors in the Sydney-Newcastle-Wollongong area with associated delay costs of over $200 million.

4.6.2 Analysis of routes within major corridors

Figure 21 shows the DEC, and delay costs, of routes within the five corridors with the highest DEC in the Sydney-Newcastle-Wollongong area.

Figure 21 **Transport corridors – DEC and delay cost of routes within major corridors – Sydney-Newcastle-Wollongong**



Note: The routes within the five corridors with the highest DEC are shown.
Source: ACIL Allen Consulting, 2014

We note that the DEC for most corridors is split nearly identically between different routes the corridor can be travelled in. For the 'East West' corridor the route travelling along the M5 makes up the largest share of the DEC for that corridor.

4.7 Projections for 2031

4.7.1 Demand drivers for urban transport

Key drivers of demand for urban transport infrastructure are population growth and where future jobs are going to be located.

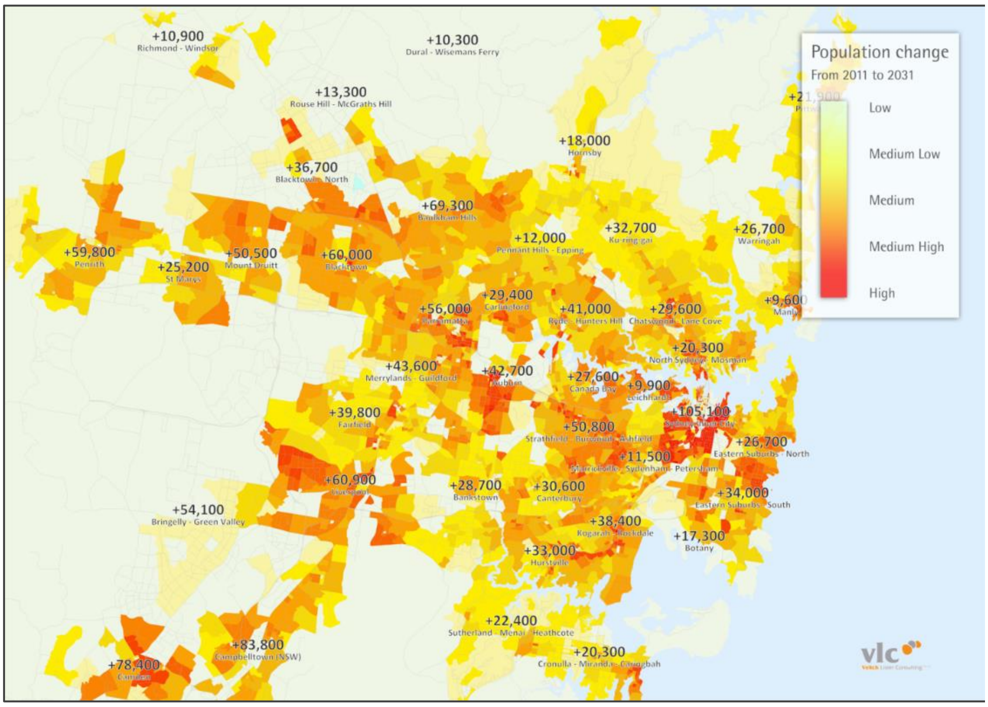
Projected population growth

Population projections in this report are based on the ABS Series B population projections (ABS, 2013). As part of the broader AIA, using demographic modelling techniques ACIL Allen has apportioned the population growth predicted by the ABS to the audit region level. As part of the urban transport analysis, VLC has produced projections for the Sydney-Newcastle-Wollongong area at a high spatial resolution.

VLCs projections at the local level are based on regional growth plans and are reconciled to add up to the population growth projected by ACIL Allen Consulting.

Figure 22 shows projected changes in population for Sydney-Newcastle-Wollongong area by transport zone. Transport zones are a set of small geographic areas defined by the Bureau of Transport Statistics for the purpose of transport modelling and data analysis. The map shown below is colour coded to indicate the amount of projected growth for each transport zone, with green indicating low growth and red indicating high growth. The figures shown on the map indicate the projected growth of a selection of SA3s between 2010-11 and 2030-31.

Figure 22 **Projected population growth 2010-11 to 2030-31 – Sydney-Newcastle-Wollongong**



Source: (VLC, 2014)

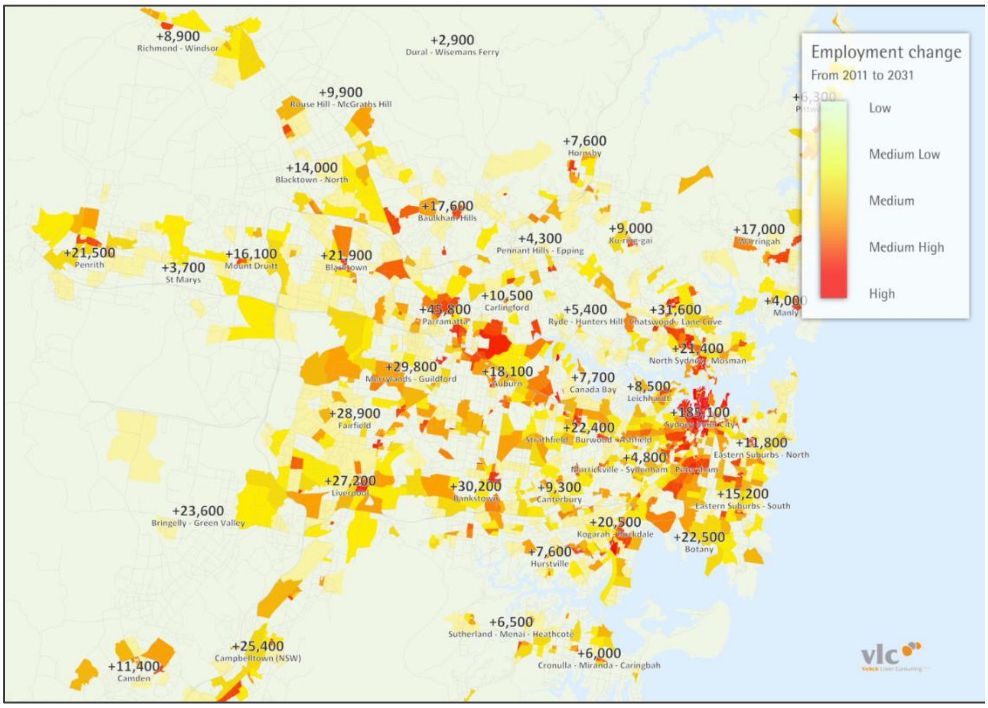
Between 2010-11 and 2030-31 an additional 1.6 million people are projected to live in the Sydney GCCSA. Key growth areas include the Sydney inner city, Baulkham Hills, Blacktown, Liverpool, Camden and Campbelltown.

Population growth outside the Sydney GCCSA is projected to be more moderate. An additional 172,700 people are projected to live in the Hunter region, while the Illawarra region is projected to grow by 72,600 people.

Projected employment growth

Figure 23 shows projected employment growth in the Greater Sydney area.

Figure 23 **Projected employment growth 2010-11 to 2030-31 – Sydney-Newcastle-Wollongong**



Source: (VLC, 2014)

Growth in employment in the Sydney region is projected to be far more concentrated than growth in population. New jobs are projected to concentrate on the inner city and Parramatta. Overall, a further 817,478 jobs are projected to be added in the Sydney GCCSA between 2010-11 and 2030-31.

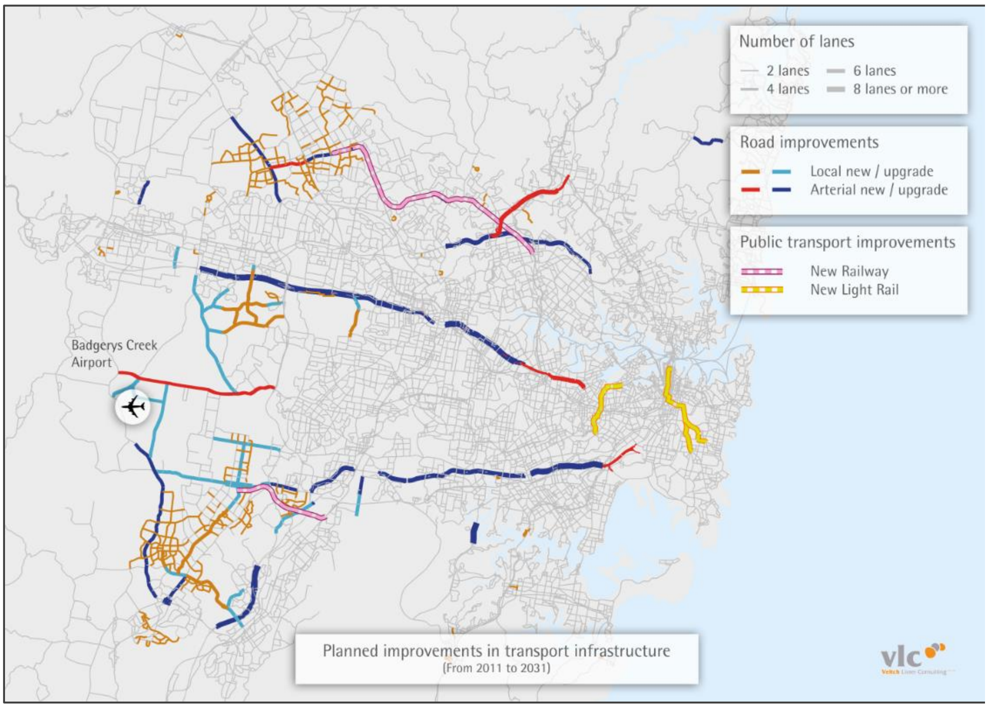
Employment in the Hunter region is projected to grow by another 112,756 jobs while employment growth in the Illawarra is projected to add another 36,137 jobs.

4.7.2 Planned expansion of urban transport infrastructure

Assumed additions to the urban transport infrastructure for this study have been limited to a low investment scenario. Under the low investment scenario only urban transport infrastructure projects for which funding has been committed or where significant political capital has been invested, are added to urban transport system.

Figure 24 gives an overview of assumed changes in rail and road infrastructure between 2010-11 and 2030-31 in the Sydney-Newcastle-Wollongong region.

Figure 24 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 – Sydney-Newcastle-Wollongong**



Source: (VLC, 2014)

Table 28 provides an overview of the key additions to the transport system in the Sydney-Newcastle-Wollongong region that are assumed to go ahead between 2010-11 and 2030-31.

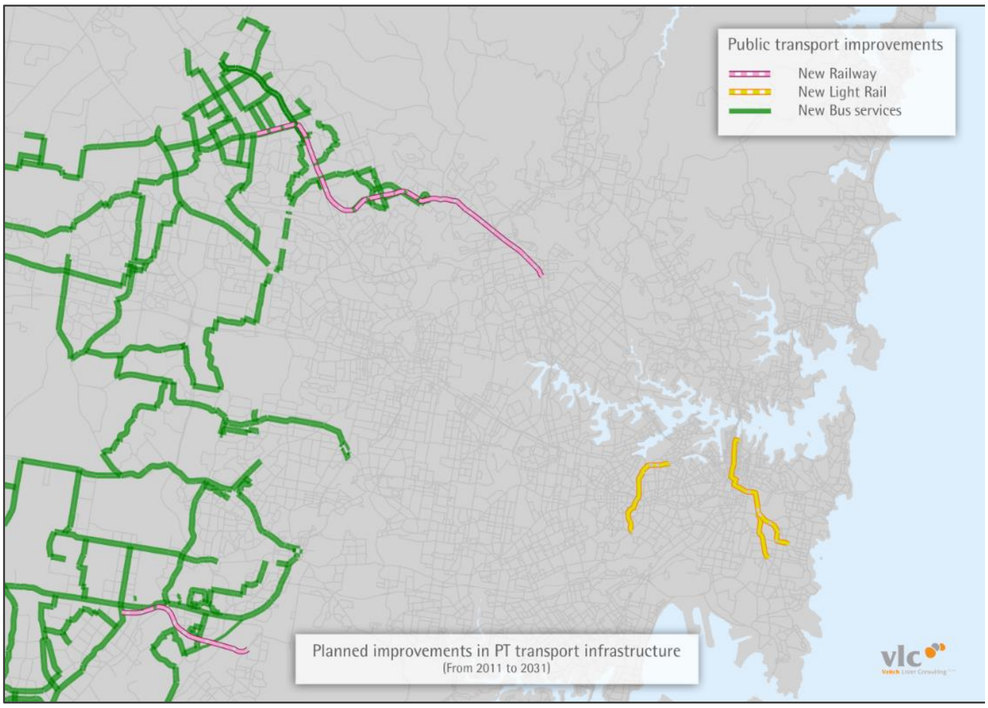
Table 28 **Major additions to road infrastructure between 2010-11 and 2030-31 assumed in transport modelling (Sydney-Newcastle-Wollongong)**

Item	Description	Standard
1	WestConnex Stage 1	6-8 lane motorway
2	WestConnex Stage 2	4-8 lane motorway
3	NorthConnex	4 lane motorway
4	M2 Motorway	6 lane motorway
5	M4 Motorway	6 lane motorway
6	M5 West Motorway	6 lane motorway
7	New motorway to South West Growth Centre and Badgerys Creek Airport	4 lane motorway
8	Northern Road (Narellan to Bringelly)	4-6 lane divided arterial
9	Moorebank Avenue	4 lane arterial
10	Alfords Point Road	6 lane arterial
11	Richmond Road	4 lane divided arterial
12	Erskine Park Link Road	4 lane divided arterial
13	Central Coast Highway upgrade	4 lane divided arterial
14	Hunter Expressway	4 lane expressway
15	Newcastle Inner City Bypass	4 lane divided arterial

Source: (VLC, 2014)

Figure 25 shows a map indicating projected additions of public transport infrastructure in the Sydney-Newcastle-Wollongong area.

Figure 25 **Projected changes in public transport infrastructure 2010-11 to 2030-31 – Sydney-Newcastle-Wollongong**



Source: (VLC, 2014)

Additions to the public transport sector include the North-West and South-West rail links servicing Sydney's designated growth areas. A number of new bus services are added in Sydney's western suburbs, and the proposed Eastern Suburbs Light Rail is assumed to go ahead. The map also shows the extension of light rail services between Lilyfield and Dulwich Hill which was completed in 2014.

Table 29 provides an overview of the major assumed additions to the public transport network between 2010-11 and 2030-31.

Table 29 **Major additions to public transport infrastructure between 2010-11 and 2030-31 assumed in transport modelling (Sydney-Newcastle-Wollongong)**

Item	Description	Frequency per hour	
		Peak	Off-peak
1	North West Rail Link	10	5
2	South West Rail Link	6	3
3	Inner West Light Rail	8	5
4	Eastern Suburbs Light Rail	8	4

Source: (VLC, 2014)

4.7.3 DEC in 2031

Table 30 shows the DEC of different transport modes within the urban transport sector of the Sydney-Newcastle-Wollongong area.

Table 30 **Urban transport DEC by transport mode – 2030-31 – Sydney-Newcastle-Wollongong**

Mode	DEC	DEC
	(2011) $m	(2031) $m
Car	20,530	39,487
LCV	854	1,740
HCV	2,825	5,489
Rail	1,950	4,073
Bus	1,329	2,649
Sydney Ferries	4	45
Light Rail	12	152
Total	**27,504**	**53,635**

Source: ACIL Allen Consulting, 2014

The total DEC of urban transport infrastructure is projected to nearly double between 2010-11 and 2030-31 to reach a level of $53.6 billion in 2030-31. The DEC of light rail is projected to increase 13 fold due to the assumed extension of the current light rail network. The DEC of ferry travel is also assumed to increase strongly as ferry patronage is assumed to increase while ferry input costs are assumed to remain stable. While the DEC of ferries and light rail is projected to increase strongly in relative terms the increase of DEC from car travel is the highest in absolute terms. Between 2010-11 and 2030-31 the DEC of car travel is projected to increase by $19 billion.

4.7.4 Capacity, utilisation and congestion in 2031

Table 31 provides an overview of the road network capacity in 2030-31 compared to the capacity in 2010-11.

Table 31 **Road network capacity – 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**

Road network	Capacity	Capacity
	VKT per day	kms of road
2011	615,617,472	28,226
2031	654,621,504	29,055

Source: ACIL Allen Consulting, 2014

The capacity increase in the road network is based on a low investment scenario and only includes expansions for which funding has been committed. A full list of assumed projects can be found in Appendix B. Between 2010-11 and 2030-31 631 kilometres of road are assumed to be added to the urban transport network of the Sydney-Newcastle-Wollongong area. These new roads and expansions of existing roads are projected to add 39 million VKT of capacity to the overall network.

Table 32 compares road network utilisation in the Sydney-Newcastle-Wollongong area in 2030-31 with 2010-11.

Table 32 **Road network utilisation and congestion – 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion Cost of delay
	VKT per day	V/C at AM Peak	V/C during typical day	Delay as % of travel time (daily)	($m)
2011	132,187,467	39%	21%	26%	5,555
2031	174,448,042	48%	27%	37%	14,790

Source: ACIL Allen Consulting, 2014

Utilisation of the road network of the Sydney-Newcastle-Wollongong area is projected to increase by 32 per cent. As a result, congestion on Sydney's roads is projected to increase despite additions to the road network capacity assumed in this study. The cost of congestion in the road network is projected to more than double to reach a level of $14.8 billion per year in 2030-31.

Table 33 provides a comparison of the projected capacity of public transport in the Sydney-Newcastle-Wollongong area in 2030-31 and 2010-11.

Table 33 **Public transport network capacity – 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**

Year	Public Transport Networks	Capacity	Capacity
		Passenger seat kms per day	Passenger crush kms per day
2011	Rail Network	103,294,968	165,693,788
2011	Bus Network	24,176,934	32,605,451
2011	Ferry Network	2,270,280	2,724,285
2011	Light rail Network	82,870	243,012
2031	Rail Network	113,801,605	187,068,181
2031	Bus Network	27,190,647	36,624,654
2031	Ferry Network	2,270,280	2,724,285
2031	Light rail Network	770,468	2,311,405

Source: ACIL Allen Consulting, 2014

Under the low investment scenario the seated capacity of the rail and bus networks are projected to increase by 10 per cent and 12 per cent respectively. The crush capacity of both networks are assumed to increase slightly more based on assumptions of future rolling stock. The ferry network is assumed to remain unchanged between 2010-11 and 2030-31. The capacity of the light rail network is projected to increase nine fold between 2010-11 and 2030-31. We note that the projected increase in the light rail network includes the extension of the light rail network between Lilyfield and Dulwich Hill which commenced operation in early 2014.

Table 34 compares the utilisation of different public transport modes in 2010-11 and 2030-31.

Table 34 **Public transport network utilisation – 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**

Year	Network	Utilisation	Congestion	Congestion	Congestion	Congestion
		Passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
2011	Rail Network	20,836,852	36%	23%	20%	13%
2011	Bus Network	8,118,279	48%	35%	34%	25%
2011	Ferry Network	223,304	16%	13%	10%	8%
2011	Light rail Network	28,512	42%	14%	34%	12%
2031	Rail Network	33,800,277	51%	31%	30%	18%
2031	Bus Network	10,662,134	53%	39%	39%	29%
2031	Ferry Network	396,631	34%	28%	17%	15%
2031	Light rail Network	415,429	57%	19%	54%	18%

Source: ACIL Allen Consulting, 2014

Aggregate utilisation of all transport networks is projected to increase. In absolute terms, the rail network will see the largest increase in passenger kilometres travelled due to network additions and higher projected patronage. Passenger kilometres travelled on the ferry network are projected to increase by 78 per cent despite there being no projected additions to the ferry network. Due to the assumed addition of the Eastern Suburbs Light Rail, and the extension of the light rail network between Dulwich Hill and Lilyfield, passenger kilometres travelled are projected to increase nearly 14 fold.

As a result of increased utilisation, congestion is projected to increase for all public transport modes. In 2030-31 congestion in terms of utilised seated capacity is projected to be highest for the light rail network, which is largely due to the assumed rolling stock having a low seated capacity. Congestion in terms of utilised crush capacity is projected to remain highest for the bus network in 2030-31.

Analysis of key journeys

This section examines the changes in the DEC of origin-destination pairs for roads and public transport between 2010-11 and 2030-31.

Table 35 provides an overview of the ten origin-destination pairs with the highest projected change in DEC for road transport between 2010-11 and 2030-31.

Table 35 **Roads – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Sydney GCCSA**

From	To	∆ DEC ($m)
Botany	Sydney Inner City	101.5
Camden	Campbelltown (NSW)	78.3
Baulkham Hills	Parramatta	66.4
Parramatta	Merrylands - Guildford	64.0
Eastern Suburbs - South	Sydney Inner City	61.8
Eastern Suburbs - North	Sydney Inner City	58.1
Gosford	Wyong	56.5
Bringelly - Green Valley	Liverpool	54.7
Fairfield	Liverpool	53.4
Fairfield	Merrylands - Guildford	53.0

Source: ACIL Allen Consulting, 2014

Increases in DEC can be a result of higher utilisation of links between different suburbs, increased cost of congestion and network extensions between origin-destination pairs. For road travel, the DEC of journeys between Botany and the inner city is projected to increase by the largest amount of all origin-destination pairs in the Sydney GCCSA. This is due to substantial increases in projected passenger car travel and freight movements from the port of Botany. Other origin-destination pairs with notable increases include trips from Camden to Campbelltown and between Baulkham Hills and Parramatta. The change in road DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C1 in Appendix C.

Table 36 shows the ten origin-destination pairs with the highest projected change in public transport DEC between 2010-11 and 2030-31.

Table 36 **Public transport – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Sydney GCCSA**

From	To	∆ DEC ($m)
Eastern Suburbs - South	Sydney Inner City	53.7
Warringah	Sydney Inner City	44.1
Eastern Suburbs - North	Sydney Inner City	38.7
Ryde - Hunters Hill	Sydney Inner City	35.7
North Sydney - Mosman	Sydney Inner City	34.4
Strathfield - Burwood - Ashfield	Sydney Inner City	33.0
Chatswood - Lane Cove	Sydney Inner City	33.0
Canada Bay	Sydney Inner City	26.1
Pittwater	Sydney Inner City	24.9
Ku-ring-gai	Sydney Inner City	23.9

Source: ACIL Allen Consulting, 2014

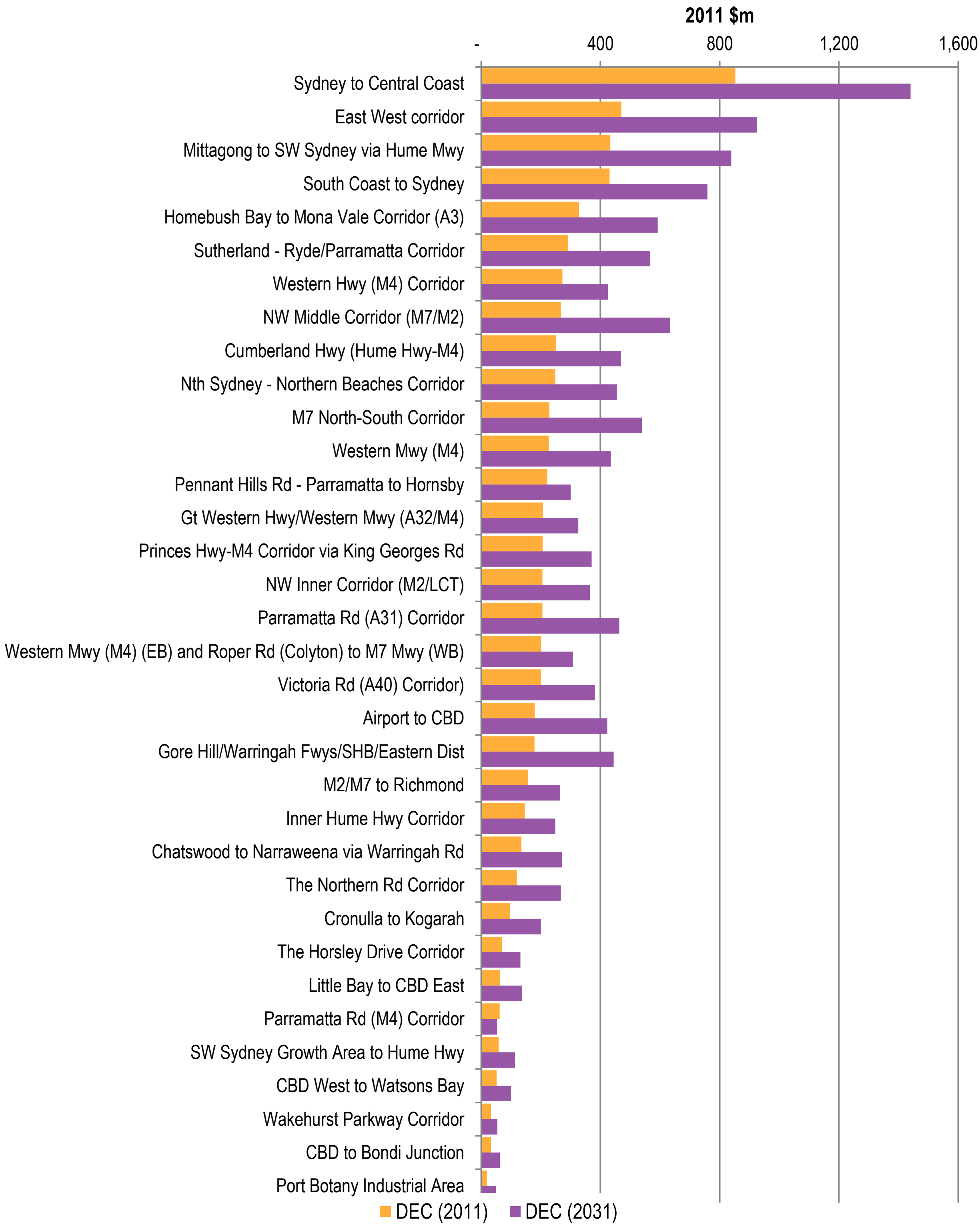
Due to the nature of the present public transport network, and assumed future additions to the network the origin-destination pairs with the highest increase in DEC all have the 'Sydney Inner City' SA3 as a destination. DEC of public transport is projected to increase most strongly for trips between the 'Eastern Suburbs – South' and the inner city. This is partially due to the addition of the Eastern Suburbs Light Rail to the network. Strong increases in the time taken for bus travel from Warringah, the Eastern Suburbs, Ryde and Hunters Hill also contribute to increases in the DEC of public transport between 2010-11 and 2030-31. The change in public transport DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C2 in Appendix C

Analysis of corridors

Figure 26 compares the projected DEC of major transport corridors in the Sydney-Newcastle-Wollongong area in 2030-11 to the DEC of these corridors in 2010-11.

Figure 27 compares the projected delay costs on major transport corridors in 2030-31 to the delay cost on these corridors in 2010-11.

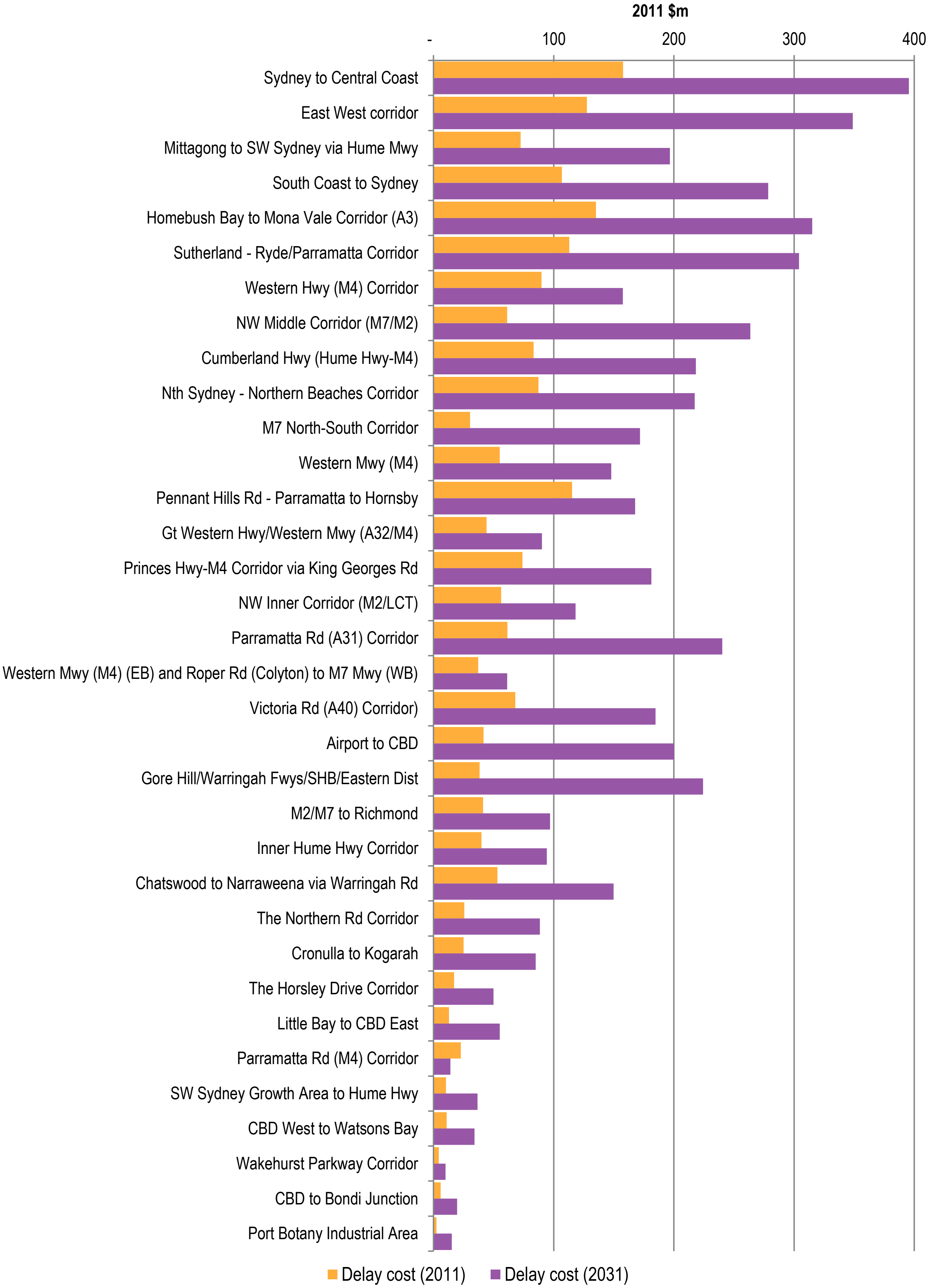
Figure 26 **Transport corridors – DEC 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**



Source: ACIL Allen Consulting, 2014

The DEC of all major transport corridors with the exception of the 'Parramatta Rd (M4)' corridor is projected to increase. Stage 3 of the WestConnex, the construction of a tunnel under Parramatta Rd between Haberfield and St. Peters is projected to take traffic off the 'Parramatta Rd (M4)' corridor and hence decrease the DEC.

Figure 27 **Transport corridors – delay cost 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**

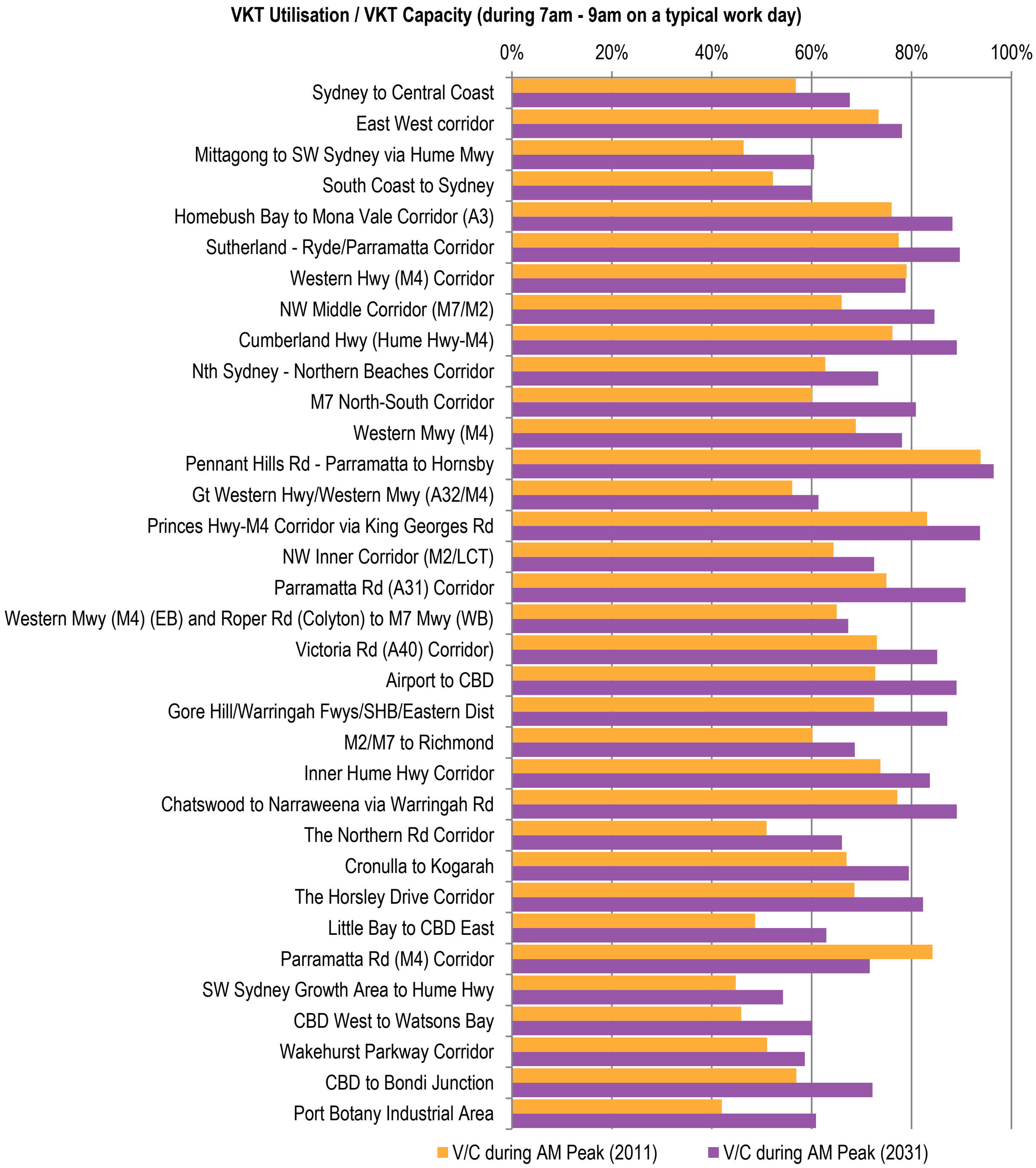


Source: ACIL Allen Consulting, 2014

Under the low investment scenario, delay costs are projected to increase across all major corridors except for the 'Parramatta Rd (M4)' corridor. Total delay costs across all corridors are projected to increase by $4.3 billion. On the 'Port Botany Industrial Area' corridor, delay costs are projected to increase more than 6 fold between 2010-11 and 2030-31. The large increase in delay costs on this corridor is consistent with the finding that trips from the 'Botany' SA3 to the 'Sydney Inner City' SA3 will experience the highest growth in DEC.

Figure 28 provides a comparison of projected congestion on major transport corridors during the morning peak in 2030-31 and 2010-11. The figure shows the ratio of volume travelled to the capacity of the corridors.

Figure 28 **Transport corridors – change in congestion 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**



Source: ACIL Allen Consulting, 2014

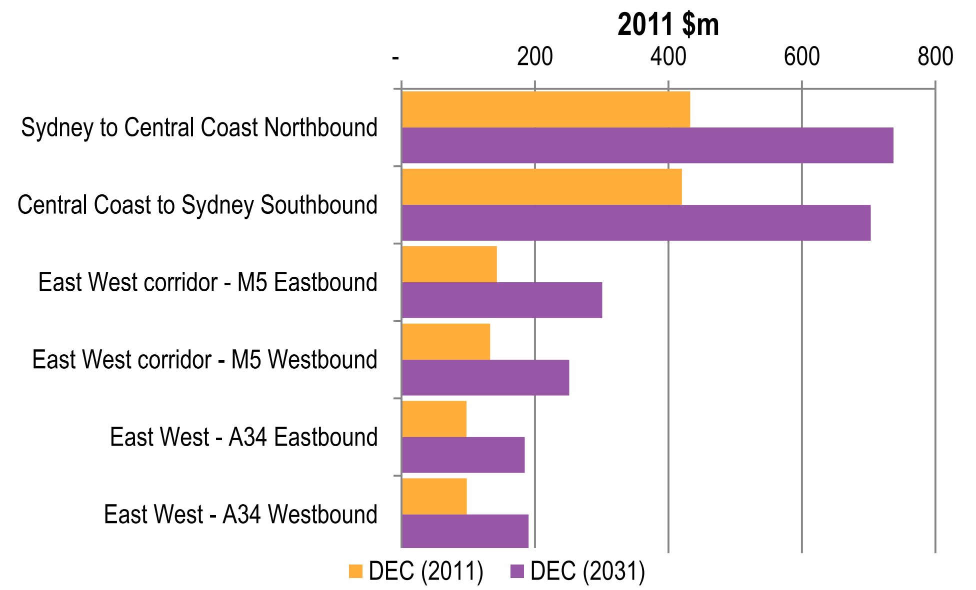
Congestion on all corridors is projected to increase with the exception of the 'Parramatta Rd (M4) Corridor'. Congestion during the morning peak is highest on the 'Pennant Hills Rd - Parramatta to Hornsby' corridor and is projected to reach 96 per cent in 2030-31.

Analysis of key routes

The analysis in this section focusses on key routes within the two major transport corridors i.e. the 'Sydney to Central Coast' and the 'East West Corridor'.

Figure 29 compares the DEC and delay costs of routes within the two corridors with the highest DEC in the Sydney-Newcastle-Wollongong area in 2010-11 and 2030-31.

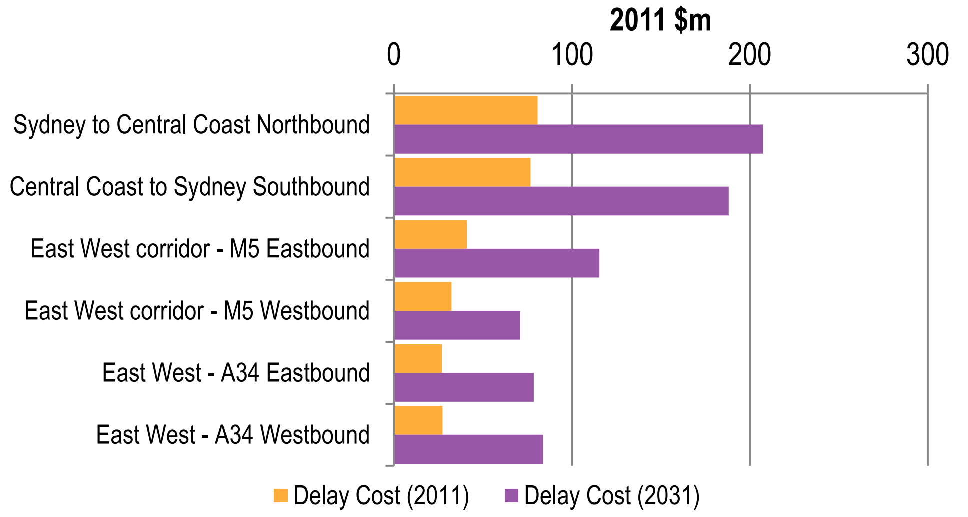
Figure 29 **Key routes– DEC 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**



Source: ACIL Allen Consulting, 2014

Figure 30 shows a comparison of delay cost on routes within the two corridors with the highest DEC in the Sydney-Newcastle-Wollongong area between 2010-11 and 2030-31.

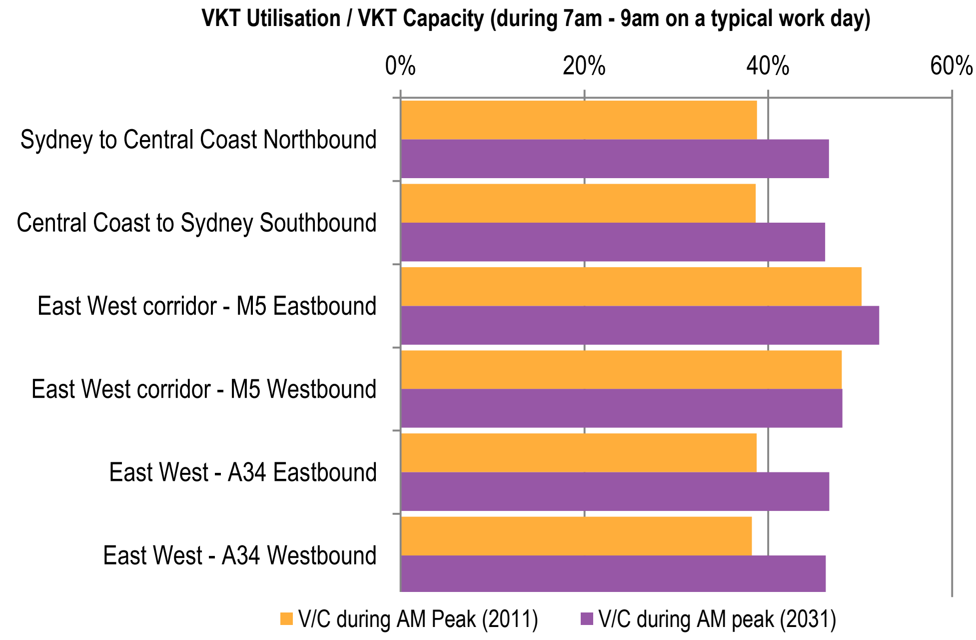
Figure 30 **Key routes– change in delay cost 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**



Source: ACIL Allen Consulting, 2014

Figure 31 compares congestion on key routes in the Sydney-Newcastle-Wollongong area between 2010-11 and 2030-31.

Figure 31 **Key routes– change in congestion 2010-11 and 2030-31 – Sydney-Newcastle-Wollongong**



Source: ACIL Allen Consulting, 2014

4.7.5 Reconciliation with macro-economic data

In this section the projections of DEC from urban transport infrastructure based on transport activity data are reconciled with projections based on national statistics.

The bottom-up projections of DEC are based on transport activity projections from VLC's Zenith model. The top-down projections of DEC from urban transport infrastructure are based on national statistics (using SDs rather than GCCSA as basic geographical units; details of this is provided earlier in this chapter). Household expenditure on personal transport is based on data from the household expenditure survey and scaled to the number of households in each region. Household expenditure is assumed to grow in line with income growth as a proxy for expenditure growth. Income growth projections are obtained from ACIL Allen's Tasman Global modelling for the Baseline Scenario of the broader AIA. DEC from road and rail freight is projected to grow in line with projections of gross value add for rail and road transport, which is also obtained from the Tasman Global model projections.

Table 37 provides a comparison between bottom-up and top-down estimates of DEC for the Sydney-Newcastle-Wollongong region in 2030-31.

Table 37 **Macro-reconciliation –DEC of urban transport infrastructure 2030-31 – Sydney-Newcastle-Wollongong area**

DEC (Based on transport simulation modelling)					DEC (Based on national statistics)				
	Sydney	Hunter	Illawarra	**Total**		Sydney	Hunter	Illawarra	**Total**
Car	31,217	6,030	2,240	**39,487**	Car/PMV	35,227	3,956	1,836	**41,019**
LCV	1,436	233	71	**1,740**	Rail	1,072	79	37	**1,187**
HCV	3,288	1,821	381	**5,489**	Bus/tram/mixed	748	57	27	**832**
Rail	3,220	622	231	**4,073**	Ferry	74	5	2	**82**
Bus	2,094	405	150	**2,649**	Total Passenger	37,121	4,097	1,901	**43,119**
Ferry	45	-	-	**45**	Road	7,166	779	307	**8,251**
Light Rail	152	-	-	**152**	Rail	3,656	443	177	**4,276**
Total Transport	**41,452**	**9,110**	**3,073**	**53,635**	**Total Transport**	**47,943**	**5,319**	**2,385**	**55,646**
Growth factor	**2.0**	**1.8**	**1.6**	**2.0**	**Growth factor**	**2.2**	**1.7**	**1.7**	**2.1**

Source: ACIL Allen Consulting, 2014

5 Melbourne-Geelong

Melbourne is serviced by a range of public transport modes including buses, heavy rail and tram.

The salient feature of Melbourne's public transport system is its Tram network. Melbourne has the world's largest operational tram system with 28 routes and 1,763 stops. In addition to trams Melbourne's suburban heavy rail system provides services along 15 lines covering 218 stations. Regional trains connect Melbourne's inner city to regional centres in Geelong, Ballarat, Bendingo, Seymour and Bairnsdale. The suburban bus network covers 346 routes in addition regional buses and coaches connect Melbourne to regional centres.

The Hume Highway links Melbourne to Sydney and enters the city in the suburb of Thomastown in Melbourne's north. The Calder Freeway enters the city in the east near Tullamarine airport where it merges with the Tullamarine freeway to form the City Link toll road leading into North Melbourne and ultimately to Port Melbourne. In the west the Western Freeway connects Melbourne to Ballarat. The Western Freeway connects Melbourne to Geelong and enters the city in the suburb of Derrimut where it merges with the Western Ring Road. The Princess Highway enters Melbourne in Altona North and runs through Port Melbourne and South Melbourne leaving the city in the east via Dandenong, Berwick and Pakenham. The Peninsula Link provides services to the Mornington Peninsula running from Chelsea Heights a suburb in Melbourne's south to Rosebud on the Mornington Peninsula. The M3 leads from Frankston in Melbourne's South West to Clifton Hill via the eastern suburbs of Mitcham, Doncaster and Box Hill.

Figure 32 provides an overview of the Melbourne region for which the urban transport system has been analysed.

Figure 32 **Map of the Melbourne-Geelong region**

Source: ACIL Allen Consulting, 2014

We note that the analysis excludes the 'Macedon Ranges' SA3 and hence does not cover the full Melbourne GCCSA. Regional areas around Geelong are included in the analysis.

The boundaries of the urban transport analysis were chosen to ensure that the entire conurbation of a city is included in the analysis. This is to ensure that the transport system of the city is captured as accurately as possible.

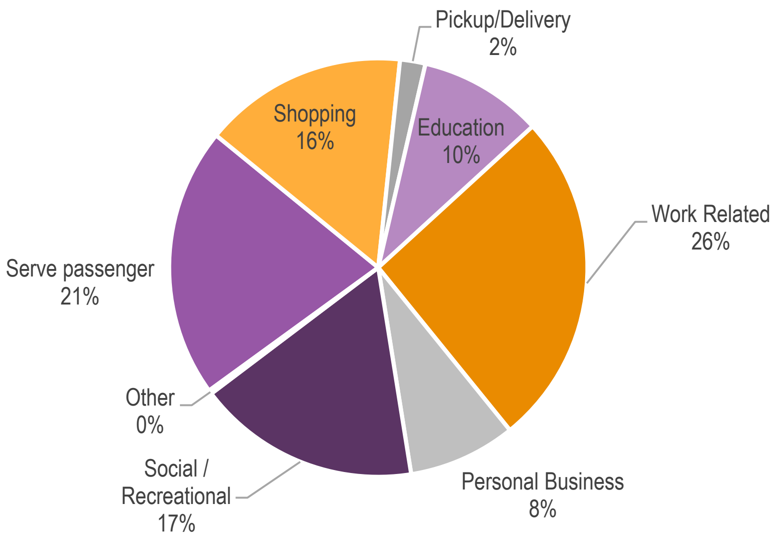
5.1 Key issues and challenges

In 2009-10 residents of Melbourne undertook an average of 12.6 million trips on a typical weekday. In 2007-08 residents of Melbourne travelled a combined 118 million kilometres on a typical day (Department of Transport, 2009).

In addition to transport needs of households, Melbourne's urban transport infrastructure has to cater to a strong manufacturing industry. The Port of Melbourne handles around 36 per cent of Australia's container trade and is the origin or destination of 25 per cent of Australia's interstate road freight. (Victorian Government, 2012).

As Figure 33 shows that work related trips were the single largest contributor to the number of trips taken by residents of metropolitan Melbourne.

Figure 33 **Share of trips by purpose metropolitan Melbourne 2009-10**



Source: (Department of Transport Planning and Local Infrastructure, 2013)

There is a trend of manufacturing businesses moving out of central and inner Melbourne towards areas in the outer north, outer west and outer south west. The move of manufacturing out of central Melbourne is expected to provide room for increased growth in professional employment in this area (Victorian Government, 2012). While employment is expected to increase in the city centre, the majority of population growth is expected to occur in the north, west and south east, and further increase travel demand.

Melbourne's inner city[9] provides jobs to 17 per cent of the population of the Melbourne GCCSA in an area that represents 0.3 per cent of the GCCSA. This concentration of jobs in the inner city is proving to be a challenge for the urban transport infrastructure of Melbourne. Congestion is increasing across Melbourne's road network. Measurements by VicRoads on a number of congestion related metrics are pointing towards increased congestion on Melbourne's roads.

[9] Defined here as the SA3 'Melbourne City'

Over the period 2002-03 to 2012-13 average travel speeds have decreased by an average of 1.9km/h during the morning peak and by 4.4 kilometres per hour during the evening peak. As trams share road space with other forms of vehicular traffic the performance of the tram system is also affected by road congestion and average tram travel speeds have been declining over the 2002-03 to 2012-13 period.

Patronage of Melbourne's train system increased by 94 per cent to 230 million passengers a year over the period from 1998-99 to 2010-11 2010-11. Most of Melbourne's train system was established over the period 1854 to 1934 and is approaching capacity.

The last major addition to the train system was the City Loop completed in the early 1980's. Other smaller additions to the train system were the extension of the metropolitan rail system from St Albans to Sydenham, Broadmeadows to Craigieburn and Epping to South Morang. In 2012 and 2013 additional stations in Melbourne's growth areas in Lynbrook and Cardinia were opened.

The Regional Rail Link project is expected to be completed in early 2015 and will allow the separation of regional and metropolitan train services between West Werribee and Southern Cross station.

Another major planned urban transport infrastructure project included is the Melbourne Metro rail project, a rail project aimed at increasing the capacity of Melbourne's rail network by 30 per cent. The Metro rail project involves the construction of a nine kilometre tunnel between South Yarra and Kensington and the addition of five new stations in inner Melbourne.

Strong projected population growth will result in higher travel demand on the Melbourne-Geelong urban transport infrastructure. To cater for the additional transport demand, a number of additions to the current urban transport network are required.

5.2 Regulation, policy and governance context

Urban transport in the Melbourne-Geelong region is primarily planned and regulated by the Victorian Government, with local councils having a planning and regulation role for the local road networks.

The Victorian Department of Transport, Planning and Local Infrastructure is responsible for long-term planning and development of the Victorian transport network.

Key issues in Victorian urban transport include:

— reforming public transport fare zones

— reforms to the funding of major infrastructure

— implementing standard development contribution levies (in relation to infrastructure) (Victorian Government, 2014).

5.2.1 Planning

Plan Melbourne: Metropolitan Planning Strategy 2014, is the Victorian Government's strategy for addressing Melbourne's infrastructure, housing, employment and environmental challenges. It covers numerous sectors including transport.

Public Transport Victoria is responsible for planning, coordinating, providing, operating and maintaining public transport across Melbourne.

VicRoads plans, develops and manages the Victorian arterial road network. Victorian local councils have planning responsibilities for local roads in their council areas.

5.2.2 Regulation

VicRoads is responsible for the regulation of some elements of the Victorian road system, including licences and registration. Local councils are responsible for the regulation of their local road networks.

Public Transport Victoria (PTV) is responsible for monitoring the performance of the train, tram and bus services.

The Secretary of the Department of Transport, Planning and Local Infrastructure may set public transport fares.[10] PTV has advised that these powers are vested in the Chief Executive Officer of PTV. Fares are set in coordination with the Minister responsible for public transport and with Treasury.

Public transport fares are set in consideration of a number of factors and policies including concessions.

5.2.3 Funding

Urban transport in the Melbourne-Geelong region is funded by a combination of grants/subsidies from all three levels of government together with fares/user charges.

Public transport in the Melbourne-Geelong region is funded by a combination of user charges and public subsidies. In 2010-11, the operating costs for Victorian public transport (excluding capital costs) was $2.22 billion (including both fare revenue and subsidies). Fares funded 30 per cent of the operational costs with government funding the rest (Victorian Auditor General's Office, 2012).

Public Transport Victoria has advised ACIL Allen that over $600 million is collected as ticketing revenue each year. These fares cover around one-third of the cost of providing public transport, with the Victorian Government funding the balance. PTV further advises that public transport fares increase annually, usually in line with CPI.

5.2.4 Service delivery

VicRoads is responsible for delivering arterial roads and freeways (excluding tollways). Local councils are responsible for the construction and maintenance of local roads.

Public Transport Victoria is responsible for providing, operating and maintaining public transport across the Melbourne-Geelong region.

Melbourne's train and tram networks are contracted out as follows:

— to Metro Trains Melbourne for trains

— Yarra Trams for trams

— V/Line for regional public transport.

Both Metro and Yarra Trams are private entities and V/Line is a public entity. There are 32 operators for the metropolitan bus services; approximately 30 per cent of Melbourne's public bus network is contracted out to Transdev Melbourne.

There are a small number of ferry services in Melbourne. These are provided by Westgate Punt and Melbourne Water Taxis.

[10] Under Section 220D of the *Transport (Compliance and Miscellaneous) Act 1983* (Vic).

5.3 Current network capacity, utilisation and congestion

5.3.1 Capacity

The road network of the Melbourne-Geelong region is the largest of the road network analysed as part of this study.

Table 38 provides an overview of the road network capacity in the Melbourne area in terms of VKT per day and in terms of kilometres of road network.

Table 38 **Road network capacity – 2010-11 – Melbourne-Geelong**

Road network	Capacity	Capacity
	VKT per day	kms of road
Road network	600,408,778	21,769

Source: ACIL Allen Consulting, 2014

Table 39 shows the network capacity for the public transport network in the Melbourne-Geelong area.

Table 39 **Public transport network capacity – 2010-11 – Melbourne-Geelong**

Public Transport Networks	Capacity	Capacity
	Passenger seat kms per day	Passenger crush kms per day
Rail Network	47,335,571	99,595,712
Bus Network	3,227,466	12,984,295
Light rail Network	21,597,822	32,396,733

Source: ACIL Allen Consulting, 2014

The rail network has the largest capacity of the public transport modes available in the Melbourne-Geelong region. Unlike other cities in Australia, Melbourne has a substantial tram network which has the second highest capacity of public transport networks in the Melbourne-Geelong region.

5.3.2 Utilisation and congestion

Table 40 provides an overview of utilisation and congestion in the road network of the Melbourne-Geelong area.

Table 40 **Road network utilisation and congestion Melbourne-Geelong**

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
Road network	116,136,869	39%	19%	17%	2,837

Source: ACIL Allen Consulting, 2014

The road network in the Melbourne-Geelong region is highly utilised during the morning peak when travel demand spikes. During an average day congestion is a lot less severe than during the morning peak. The cost of congestion across the Melbourne-Geelong region in 2010-11 was estimated be $2.8 billion.

Table 41 shows the overall utilisation of public transport networks in the Melbourne-Geelong area.

Table 41 **Public transport network utilisation and congestion Melbourne-Geelong**

Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
	passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
Rail network	17,622,360	61%	29%	37%	18%
Bus network	2,312,022	108%	27%	72%	18%
Light rail	4,075,718	25%	17%	19%	13%]

Source: ACIL Allen Consulting, 2014

The bus network of the Melbourne–Geelong region is highly utilised. VLC's modelling indicates that all seats on the bus network are used during the morning peak. The utilisation of the seated capacity of the rail network is also high. We note that the utilisation in terms of the share of the network's crush capacity that is used during the morning is much lower than the share of the seated capacity. This is due to the configuration of the rolling stock in the Melbourne train network which has a lower seated capacity than, for example, the Sydney network.

5.4 Current network Direct Economic Contribution

5.4.1 Aggregate DEC

Total DEC from Urban transport in the Melbourne-Geelong region in 2011 was $20,007 million in 2010-11.

5.4.2 DEC by mode

Table 42 provides an overview of the DEC by transport for the Melbourne-Geelong area.

Table 42 **Urban transport DEC by transport mode – 2010-11 – Melbourne-Geelong**

Mode	DEC
	$m
Car	15,537
LCV	641
HCV	779
Rail	1,744
Bus	985
Ferries	0
Light Rail	322
Total	**20,007**

Source: ACIL Allen Consulting, 2014

In 2010-11, car travel had the highest DEC of all urban transport modes in the Melbourne-Geelong area. In the public transport sector the light rail network had a lower DEC than the bus network despite the larger size of the light rail network. This is because passengers spend more time travelling on buses; an indication that bus services are delayed by road congestion.

5.4.3 Reconciliation with macro-economic data

Table 43 provides a comparison of estimates of DEC of urban transport infrastructure in the Melbourne-Geelong area using a bottom-up and using a top-down approach. The columns to the right of Table 43 show estimates of the DEC of urban transport infrastructure based on household expenditure and national accounts statistics i.e. the top-down estimates. The columns to the left of Table 43 show estimates of DEC from urban transport infrastructure based on modelled transport activity data i.e. the bottom-up estimates.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the value of freight movements.

The macro reconciliation is aiming to provide a broad indication as to whether the results of the bottom-up modelling reconcile with macro-economic data. National account statistics available at the time of writing this report were available on the basis of statistical divisions (SD's). SDs were used as a basic geographical unit for understanding and interpreting the geographical context of statistics published by the ABS before 2011. Generally SDs are broadly consistent with the GCCSA; detailed mapping of the SDs and their consistency with the GCCSAs can be found on the ABS website[11]. To reduce the potential mismatch between the national account statistics provided on a SD basis and the bottom-up modelling results the macro data has been scaled to the population of the relevant bottom-up modelling areas.

Table 43 **Macro-reconciliation – DEC of urban transport infrastructure 2010-11 – Melbourne-Geelong area**

DEC (Based on transport simulation modelling)					DEC (Based on national statistics)				
Mode	**Melbourne**	**Geelong**	**Mornington Peninsula**	**Total**	**Mode**	**Melbourne**	**Geelong**	**Mornington Peninsula**	**Total**
Car	14,162	719	656	15,537	Household private vehicle expenditure	14,243	931	534	15,708
LCV	571	38	33	641	Road transport (freight)	3,869	188	268	4,325
HCV	664	74	40	779	Rail transport (freight)	1,007	25	70	1,101
Rail	1,590	81	74	1,774	Rail (household expenditure)	254	15	9	278
Bus	897	46	42	985	Bus/tram/light rail (household expenditure)	231	12	7	250
Ferry	-	-	-	-	Ferry (household expenditure)	-	-	-	-
Light Rail	322	-	-	322					
Total Transport	**18,206**	**958**	**844**	**20,007**	**Total Transport**	**19,605**	**1,170**	**887**	**21,663**

Source: ACIL Allen Consulting, 2014

The overall estimates of DEC of urban transport infrastructure in the Melbourne-Geelong area are relatively close. Overall the estimated DEC using the top-down approach is higher than the bottom-up approach.

The biggest difference between the top-down and bottom-up estimates of the DEC of urban transport infrastructure lie in the estimates of the DEC of freight services. The bottom-up

[11] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1216.0July%202011?OpenDocument

estimates of the DEC of freight services do not include rail freight. In the bottom-up model the DEC from road freight is based on estimated freight movements on the roads within the study area. In the top-down model the DEC of freight services is calculated based on the gross value added of freight services from national account statistics.

The national account statistics account for freight services at the point where contracts for freight movements are struck. As such contracts tend to be struck in the city, and since the study area covers a largely urban area, the top-down DEC estimates of road freight transport tend to be higher in the top-down model than in the bottom-up model.

The DEC estimates of public transport infrastructure in the top-down model are based on household expenditure survey data in which households report expenditure on public transport fares. The bottom-up model of the DEC from public transport accounts for the fares spent on public transport as well as the value of time spent travelling. As a result the estimates of DEC from public transport tend to be higher in the bottom-up model than in the top-down.

5.5 Demand analysis by origin/destination

5.5.1 Overview of demand analysis

The demand analysis assesses the value (measured as DEC) of journeys from combinations of origins and destinations.

The demand analysis is distinguished from other levels of analysis as it shows the demand for mobility (the value that is placed on trips that transport people or goods from one SA3 to another) as opposed to the value that is being derived from use of a physical network or infrastructure component.

A significant proportion of this demand (19.5 per cent of road journeys and 7.8 per cent of public transport journeys in the Melbourne GCCSA) is within each SA3 (i.e. where the SA3 is both the origin and destination). The focus of this demand analysis however, is on infrastructure connecting separate origins and destinations. Specifically, the DEC of road journeys and public transport for combinations of different SA3 origins and destinations, for the GCCSA area, is shown in the form of 'heat-map' matrices.

5.5.2 Roads

Overview of DEC for all origin-destination pairs

Figure 34 shows the DEC for all origin-destination pairs in 2010-11 in the Melbourne GCCSA. Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys originating in the SA3 'Melbourne City' whereas the first column shows the DEC of trips ending in the SA3 'Melbourne City'. The DEC is colour coded from green to red where green indicates a low DEC and red indicates a high DEC. The right hand side of the figure provides an overview range of the DEC values across the matrix. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure 34 **Roads – origin-destination pairs – DEC 2011 – Melbourne GCCSA**

SA3 Origin / Destinatio	Melbourne City	Port Phillip	Hobsons Bay	Maribyrnong	Essendon	Brunswick - Coburg	Yarra	Stonnington - West	Stonnington - East	Glen Eira	Bayside	Kingston	Dandenong	Monash	Boroondara	Darebin - South	Darebin - North	Moreland - North	Keilor	Brimbank	Banyule	Manningham - West	Manningham - East	Whitehorse - West	Whitehorse - East	Maroondah	Knox	Casey - North	Casey - South	Cardinia	Yarra Ranges	Nillumbik - Kinglake	Whittlesea - Wallan	Tullamarine - Broadm	Sunbury	Melton - Bacchus M	Wyndham
Melbourne City		24.5	25.3	21.4	16.9	18.0	19.6	11.0	6.9	24.5	19.9	14.7	16.9	24.0	37.3	9.7	19.9	14.3	15.1	37.3	24.6	19.2	5.9	14.2	9.7	12.1	18.7	9.2	6.9	4.1	14.0	11.8	30.5	33.3	8.0	21.4	35.0
Port Phillip	25.4		12.5	9.3	5.1	6.2	12.1	12.1	7.1	20.0	15.0	13.1	10.9	15.8	18.4	3.8	5.9	4.1	4.5	12.4	7.0	5.5	1.3	6.5	3.0	4.1	7.7	4.1	3.8	2.4	4.3	2.6	6.2	12.1	1.9	8.6	17.6
Hobsons Bay	27.8	13.4		18.5	6.7	5.0	7.4	5.3	2.2	5.1	4.2	3.4	4.3	5.3	6.7	1.7	4.2	3.4	6.3	24.0	3.2	1.8	0.3	2.7	1.0	1.5	2.5	1.8	0.9	1.5	1.6	1.2	5.4	12.6	2.6	12.3	39.9
Maribyrnong	23.0	9.6	18.1		10.9	7.1	6.7	3.9	1.6	4.0	3.2	2.6	2.6	4.3	6.6	2.8	4.9	5.7	10.5	28.2	4.0	2.5	0.6	2.6	1.3	2.1	2.0	1.4	0.8	0.7	1.9	1.9	6.8	15.4	3.2	12.7	20.9
Essendon	17.8	5.2	6.6	10.8		10.5	5.7	2.2	1.2	2.6	2.0	1.5	1.5	2.4	5.0	3.8	6.4	7.6	10.9	14.1	5.0	2.3	0.5	2.1	0.7	1.7	1.7	0.8	0.6	0.5	1.4	2.0	7.9	16.0	2.8	6.9	8.3
Brunswick - Coburg	19.0	6.3	4.9	7.0	10.5		9.6	3.2	1.3	2.9	2.0	2.0	1.9	3.5	8.1	7.1	12.3	10.9	7.7	10.7	10.0	4.0	0.8	3.6	1.4	2.7	2.7	0.9	0.8	0.6	2.7	3.7	13.3	17.6	2.3	6.0	5.3
Yarra	20.3	12.1	7.0	6.5	5.6	9.4		7.9	3.9	9.4	6.1	4.5	6.5	9.1	22.5	8.1	9.9	4.8	4.0	9.0	12.0	8.2	1.6	7.8	3.8	5.7	5.7	3.4	2.8	1.9	5.9	5.6	13.7	11.9	1.7	5.7	9.2
Stonnington - West	11.6	12.3	5.1	3.8	2.2	3.2	8.1		6.5	13.0	8.3	7.2	6.8	11.6	16.0	2.6	3.2	1.8	1.7	4.7	4.7	3.8	0.8	5.2	2.4	2.5	5.0	3.2	2.5	1.8	3.4	2.1	3.8	6.0	0.8	2.9	6.4
Stonnington - East	7.4	7.3	2.2	1.6	1.2	1.3	4.1	6.6		15.4	6.47	7.6	9.0	16.8	15.7	1.5	2.0	0.9	1.1	2.0	4.4	4.0	0.7	6.2	2.8	2.5	7.2	4.1	3.3	2.5	3.8	2.2	2.3	3.7	0.32	1.3	3.0
Glen Eira	26.0	20.4	4.9	4.0	2.6	2.9	9.7	13.2	15.5		26.7	27.6	24.9	35.3	25.0	2.4	3.7	1.7	2.0	5.0	5.8	5.5	1.5	11.0	4.6	4.3	13.6	7.6	5.5	4.2	5.6	2.5	3.6	7.6	0.7	2.8	6.9
Bayside	21.0	15.2	4.0	3.2	2.0	2.0	6.2	8.3	6.5	26.7		30.5	19.6	18.5	12.0	1.6	1.9	1.2	1.4	3.4	3.0	2.6	0.6	5.3	2.2	2.5	6.7	5.4	5.1	2.4	3.0	0.7	1.5	5.6	0.5	1.9	3.8
Kingston	15.5	13.4	3.3	2.6	1.5	2.0	4.6	7.3	7.6	27.6	30.7		57.7	38.4	13.4	1.2	2.3	1.5	1.1	3.3	3.7	3.6	1.0	10.1	4.2	6.3	16.1	18.3	19.5	8.4	8.0	2.2	2.5	6.4	0.5	1.9	4.9
Dandenong	17.9	11.1	4.3	2.7	1.5	1.9	6.7	6.8	9.2	24.9	19.7	58.0		71.2	17.6	1.3	2.3	1.2	1.4	4.3	4.9	6.7	2.7	15.4	10.0	15.0	45.4	53.5	44.5	24.3	21.9	3.5	4.1	9.5	0.7	2.1	4.6
Monash	25.7	16.2	5.3	4.3	2.4	3.5	9.5	11.8	17.0	35.2	18.4	38.5	70.7		35.6	3.1	4.9	2.0	2.3	6.3	10.2	16.2	5.6	32.8	20.4	22.6	56.8	31.2	22.4	16.3	32.1	8.1	7.9	11.8	1.1	2.9	6.9
Boroondara	39.8	18.8	6.5	6.6	5.1	8.1	23.4	16.2	15.8	24.9	12.0	13.3	17.3	35.2		9.3	13.6	4.0	3.4	8.1	24.2	23.6	4.7	31.5	12.6	14.4	19.7	7.9	6.4	4.2	15.6	10.7	15.5	13.1	1.4	4.2	9.6
Darebin - South	10.4	3.9	1.7	2.8	3.9	7.2	8.5	2.7	1.5	2.4	1.7	1.2	1.3	3.1	9.3		10.5	3.9	3.1	4.4	10.9	3.8	0.8	3.4	1.8	2.3	2.4	0.7	0.5	0.5	2.1	3.3	10.1	8.0	0.9	2.4	2.4
Darebin - North	21.1	6.1	4.1	5.0	6.4	12.6	10.2	3.2	2.0	3.7	1.9	2.3	2.2	4.9	13.6	10.5		11.6	7.4	12.0	28.9	9.3	2.1	6.4	2.7	4.5	4.5	1.2	0.9	0.9	5.4	12.4	41.1	27.9	3.2	7.0	6.4
Moreland - North	14.9	4.3	3.3	5.8	7.7	11.0	4.9	1.8	0.9	1.7	1.2	1.5	1.2	2.0	4.0	3.9	11.6		8.4	11.4	9.1	2.8	0.6	2.1	1.0	1.5	1.5	0.5	0.3	0.3	1.4	4.3	16.7	26.5	2.4	5.2	4.8
Keilor	16.2	4.7	6.2	10.6	11.2	7.9	4.1	1.7	1.1	2.0	1.4	1.1	1.4	2.3	3.4	3.1	7.4	8.3		23.3	6.5	1.9	0.6	2.0	0.6	1.1	1.2	0.6	0.2	0.4	1.3	3.0	11.8	23.8	4.6	11.1	9.7
Brimbank	39.6	12.8	23.7	28.3	14.6	10.9	9.2	4.8	2.0	5.1	3.4	3.3	4.3	6.3	8.1	4.4	12.2	11.5	23.8		9.5	2.6	0.7	3.6	1.1	2.6	2.5	1.3	1.4	0.8	2.0	4.3	17.3	38.1	10.9	49.7	39.7
Banyule	26.5	7.3	3.2	4.1	5.0	10.2	12.5	4.8	4.4	5.8	3.0	3.6	5.0	10.3	24.4	11.0	29.5	9.1	6.5	9.6		18.8	3.9	12.6	6.3	9.3	7.4	1.9	1.5	1.6	8.8	32.3	47.3	24.1	2.0	5.1	4.6
Manningham - West	21.1	5.7	1.8	2.6	2.4	4.1	8.7	3.7	4.0	5.5	2.6	3.6	6.7	16.3	23.6	3.9	9.6	2.8	1.9	2.7	18.7		7.5	20.5	10.6	13.0	11.4	3.0	2.0	1.4	11.1	12.6	10.9	7.8	0.5	1.0	2.2
Manningham - East	6.5	1.4	0.3	0.6	0.5	0.8	1.7	0.8	0.7	1.5	0.6	1.0	2.7	5.6	4.8	0.8	2.1	0.6	0.6	0.7	4.0	7.6		6.1	4.7	10.0	5.9	1.2	0.6	0.6	7.4	3.7	2.5	2.1	0.1	0.2	0.3
Whitehorse - West	15.0	6.7	2.7	2.6	2.1	3.6	8.0	5.3	6.3	11.0	5.2	10.0	15.4	32.8	31.6	3.4	6.5	2.0	2.0	3.6	12.4	20.4	6.1		16.9	17.6	21.8	6.9	5.5	4.0	20.5	10.4	9.5	8.2	0.8	2.2	3.9
Whitehorse - East	10.4	3.1	1.0	1.4	0.7	1.4	4.0	2.4	2.8	4.6	2.2	4.2	10.1	20.4	12.6	1.8	2.6	1.0	0.6	1.1	6.2	10.5	4.7	17.0		17.9	19.7	4.9	3.8	2.9	16.7	5.3	4.2	3.9	0.3	0.8	1.3
Maroondah	13.2	4.4	1.5	2.2	1.8	2.8	6.0	2.6	2.6	4.3	2.5	6.3	15.0	23.0	14.6	2.3	4.7	1.5	1.1	2.6	9.4	13.4	10.1	17.9	18.1		46.3	8.5	5.6	5.9	64.9	11.4	6.9	7.7	0.3	1.0	1.3
Knox	20.0	7.9	2.5	2.1	1.7	2.8	6.0	5.1	7.3	13.7	6.7	16.2	45.4	57.6	19.9	2.4	4.6	1.5	1.2	2.5	7.5	11.6	5.9	22.2	19.9	46.4		26.7	16.2	15.6	65.4	7.2	5.7	8.7	0.3	0.9	3.0
Casey - North	10.0	4.2	1.8	1.4	0.8	0.9	3.6	3.2	4.3	7.6	5.4	18.3	53.6	32.0	8.2	0.7	1.2	0.5	0.7	1.3	2.0	3.0	1.2	7.2	5.0	8.6	27.3		51.2	37.7	18.2	1.3	1.4	4.8	0.1	0.6	1.6
Casey - South	7.4	3.8	0.9	0.8	0.6	0.8	3.0	2.5	3.3	5.6	5.2	19.9	44.5	22.9	6.8	0.5	0.9	0.3	0.2	1.4	1.5	2.0	0.7	5.7	3.9	5.7	16.6	51.9		23.4	8.2	1.0	1.0	5.1	0.1	0.3	1.2
Cardinia	4.3	2.5	1.5	0.7	0.6	0.7	2.1	1.8	2.7	4.1	2.4	8.3	24.1	16.7	4.4	0.5	0.9	0.3	0.4	0.8	1.7	1.4	0.6	4.2	3.0	5.9	15.9	37.7	23.2		17.3	0.5	0.7	3.9	0.0	0.1	0.7
Yarra Ranges	14.8	4.5	1.6	1.9	1.4	2.8	6.2	3.5	3.8	5.7	2.9	8.1	22.1	32.7	15.9	2.2	5.5	1.4	1.3	1.9	8.8	11.3	7.4	20.8	16.9	65.5	65.7	18.1	8.2	17.1		13.2	7.4	10.9	0.3	0.9	1.5
Nillumbik - Kinglake	12.6	2.7	1.2	1.9	2.0	3.7	5.9	2.1	2.2	2.6	0.7	2.3	3.5	8.3	11.0	3.3	12.6	4.4	3.1	4.4	32.3	12.9	3.7	10.5	5.4	11.4	7.2	1.3	1.0	0.5	13.1		31.7	15.1	0.8	1.5	2.1
Whittlesea - Wallan	31.9	6.3	5.4	6.9	8.0	13.5	13.9	3.8	2.4	3.7	1.50	2.4	4.1	7.9	15.6	10.2	41.5	16.8	12.0	17.6	46.6	10.8	2.5	9.6	4.2	6.8	5.6	1.4	1.0	0.6	7.3	31.4		66.4	5.49	7.6	8.0
Tullamarine - Broadme	33.9	11.9	12.2	15.2	16.0	17.3	11.8	5.8	3.5	7.1	5.3	6.0	8.9	11.2	12.4	7.9	27.5	26.0	23.7	37.7	23.4	7.5	1.9	7.8	3.8	7.3	8.2	4.5	4.8	3.6	10.5	14.7	65.0		14.0	19.7	20.4
Sunbury	8.3	2.0	2.5	3.1	2.8	2.2	1.6	0.8	0.3	0.7	0.5	0.5	0.7	1.1	1.4	0.9	3.1	2.4	4.4	10.8	2.0	0.5	0.1	0.8	0.3	0.3	0.3	0.1	0.1	0.0	0.3	0.7	5.4	14.1		9.5	4.1
Melton - Bacchus Mars	22.6	9.0	12.2	12.8	7.1	6.2	5.8	2.9	1.3	2.7	2.0	1.9	2.0	3.0	4.3	2.4	7.1	5.3	11.4	50.1	5.2	1.1	0.2	2.2	0.8	1.0	0.9	0.6	0.3	0.1	0.9	1.4	7.7	20.1	9.7		26.7
Wyndham	37.6	18.4	41.3	21.3	8.5	5.3	9.5	6.7	3.1	7.1	3.9	4.9	4.6	7.0	9.9	2.4	6.5	4.8	9.8	40.1	4.6	2.1	0.3	3.9	1.3	1.3	2.9	1.6	1.1	0.7	1.5	2.0	8.1	20.9	4.2	26.7	

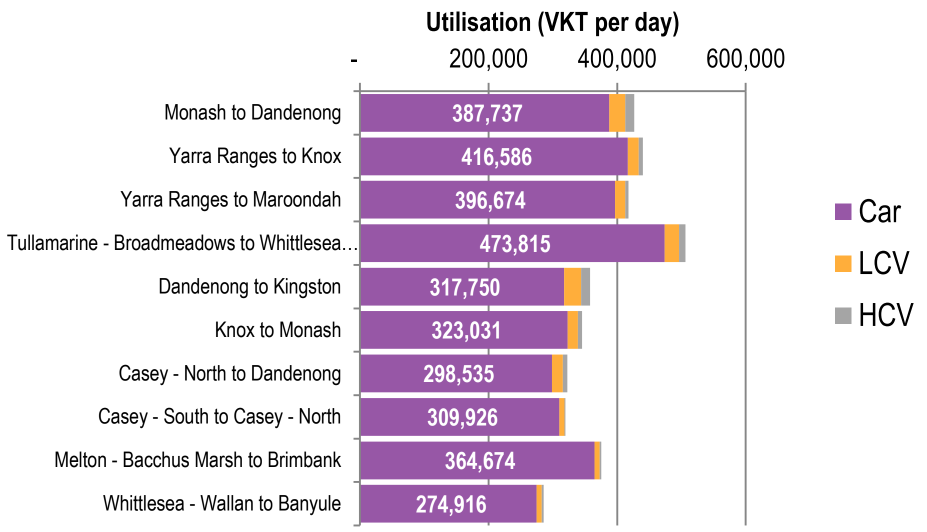
Source: ACIL Allen Consulting, 2014

Hot spots include trips between the 'Monash' SA3 and the 'Dandenong' SA3. In general trips that start or end in the inner city i.e. the 'Melbourne City' SA3 have a high DEC.

Utilisation for top 10 origin-destination trips

Figure 35 provides an overview of the ten origin-destination pairs with the greatest utilisation of the road network in the Melbourne GCCSA area in 2010-11.

Figure 35 **Roads – top ten origin-destination pairs – utilisation 2010-11 – Melbourne GCCSA**



Source: ACIL Allen Consulting, 2014

Trips between the 'Tullamarine – Broadmeadows' and 'Whittlesea – Wallan' SA3 had the highest utilisation of car travel of all origin-destination pairs in the Melbourne GCCSA region.

DEC for top 10 origin-destination trips

Table 44 provides an overview of the ten origin-destination pairs with the greatest DEC in the Melbourne GCCSA in 2011.

Table 44 **Roads – top ten origin-destination pairs – DEC 2011 – Melbourne GCCSA**

From	To	DEC
		$m
Monash	Dandenong	62.6
Yarra Ranges	Knox	61.1
Tullamarine - Broadmeadows	Whittlesea - Wallan	61.5
Yarra Ranges	Maroondah	59.2
Dandenong	Kingston	49.7
Knox	Monash	52.9
Casey - North	Dandenong	48.4
Casey - South	Casey - North	50.1
Melton - Bacchus Marsh	Brimbank	48.5
Whittlesea - Wallan	Banyule	44.3

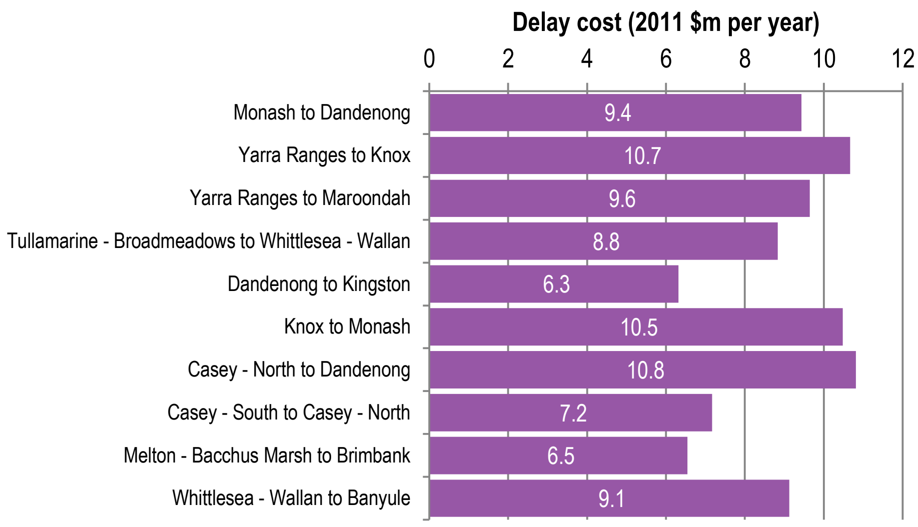
Source: ACIL Allen Consulting, 2014

The trip between 'Monash' and 'Dandenong' has the highest DEC due to its high utilisation by cars (which have a greater value of time).

Delay costs for top 10 origin-destination trips

Figure 36 shows the ten origin-destination pairs with the greatest delay cost in Melbourne GCCSA in 2011.

Figure 36 **Roads – top ten origin-destination pairs – delay cost 2011 – Melbourne GCCSA**



Source: ACIL Allen Consulting, 2014

The cost of delays between the ‘Casey-North’ and ‘Yarra Ranges to Knox’ have the highest associated delay costs despite lower travel demands in terms of VKT for these areas.

DEC by cluster

Trips to the inner city areas make up a large proportion of the DEC of road travel in the Melbourne region. To provide high level insights into car travel patterns for trips to the inner city, regions within the Melbourne-Geelong area were grouped into clusters. SA3s within the Melbourne-Geelong area were grouped into clusters of areas with similar demographics and travel demand characteristics based on the SA4 regions they fall into. Table 45 provides the clusters that were defined in the Melbourne-Geelong area.

Table 45 **Definition of clusters – Melbourne-Geelong**

Cluster	Regions
Inner	Melbourne City Port Phillip Essendon Brunswick - Coburg Yarra Stonington - West Darebin - South
Geelong	Geelong Surf Coast - Bellarine Peninsula Barwon - West
Inner East	Boroondara Manningham - West Whitehorse - West
Inner South	Stonington - East Glen Eira Bayside Kingston
Mornington Peninsula	Mornington Peninsula Frankston
North East	Darebin - North Banyule Nillumbik - Kinglake Whittlesea - Wallan Tullamarine - Broadmeadows
North West	Moreland - North Keilor Sunbury
Outer East	Manningham - East Whitehorse - East Maroondah Knox Yarra Ranges
South East	Monash Casey - North Casey - South Cardinia
West	Hobsons Bay Maribyrnong Brimbank Melton - Bacchus Marsh

Source: ACIL Allen Consulting, 2014

Table 46 provides an overview of the delay costs incurred by car transport in 2010-11 in the Melbourne-Geelong area for trips from the defined clusters to the inner city.

Table 46 **Car delay cost and DEC – 2010-11 – Melbourne-Geelong**

Cluster	Car delay cost	Car DEC	Car delay cost
	($m)	($m)	% of DEC
Inner	26.23	95.01	28%
West	50.73	140.33	36%
Inner South	18.54	65.99	28%
Inner East	25.73	73.15	35%
North East	41.54	117.35	35%
North West	10.57	29.35	36%
Outer East	23.65	60.54	39%
South East	21.68	58.97	37%
Geelong	2.43	11.59	21%
Mornington Peninsula	3.97	12.47	32%

Source: ACIL Allen Consulting, 2014

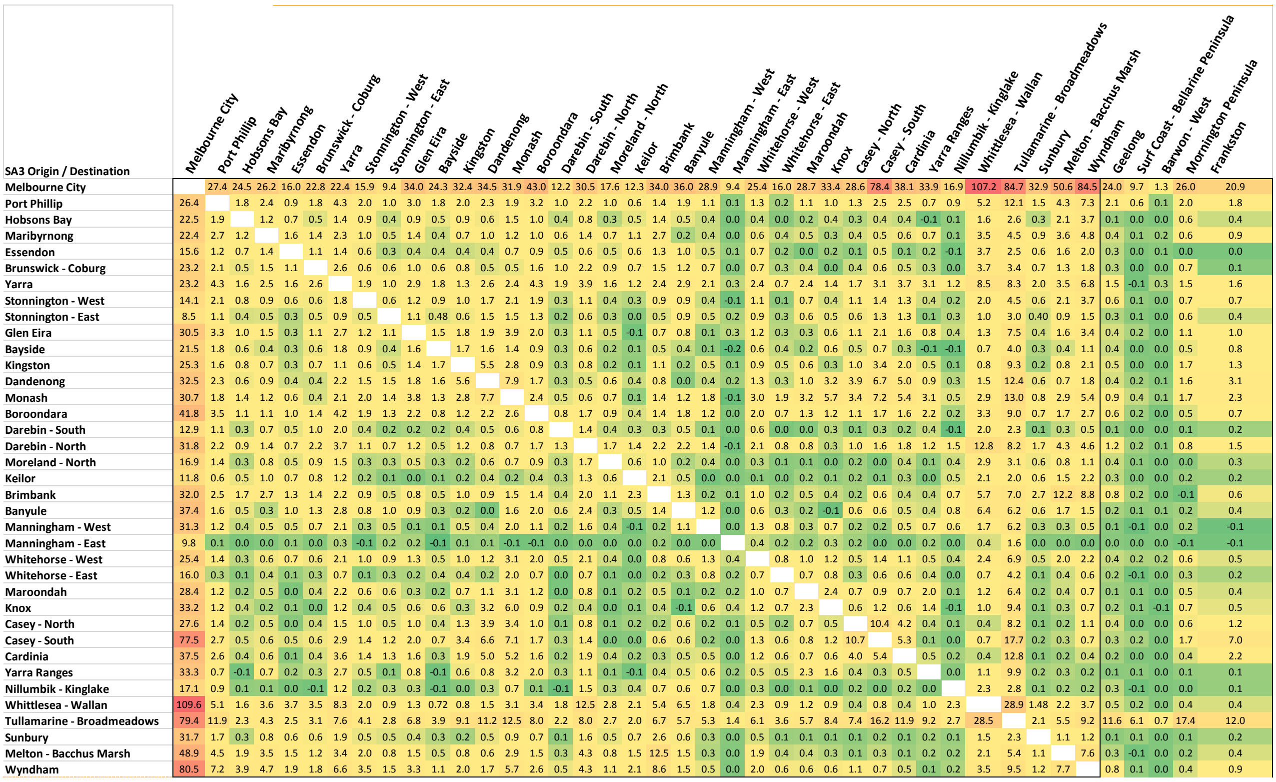
Trips from the 'West' cluster to the inner city have the highest associated delay cost of clusters within the Melbourne-Geelong region. Delay costs as a share of DEC are highest for trips from the 'Outer East' cluster to the inner city. For trips to the inner city, delay costs as a share of DEC are lowest for trips originating in 'Geelong'.

5.5.3 Public transport

Overview of DEC for all origin-destination pairs

Figure 37 provides an overview of the DEC of public transport for all SA3 origin-destination pairs in the Melbourne GCCSA.

Figure 37 **Public transport – all origin-destination pairs – DEC 2011 – Melbourne GCCSA**



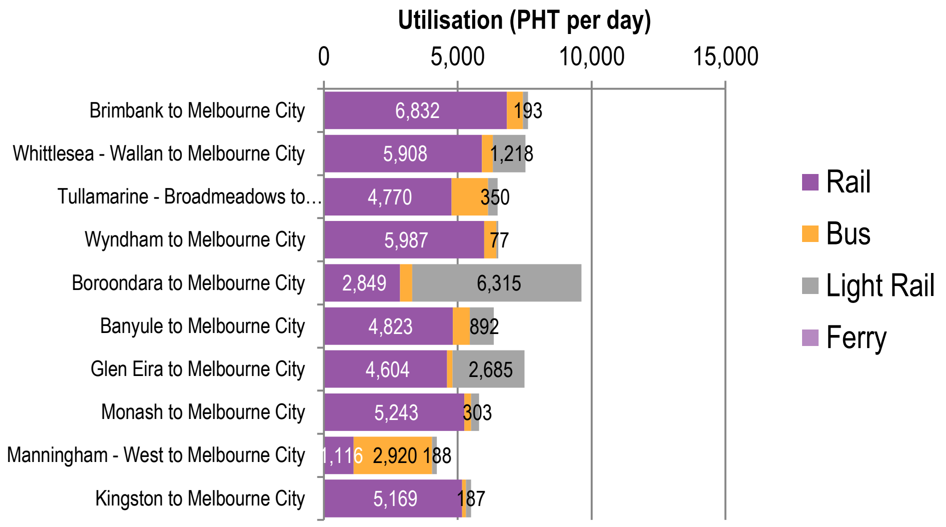
Source: ACIL Allen Consulting, 2014

For public transport the matrix of DEC between origin-destination pairs is clearly dominated by trips with the inner city of Melbourne as origin-destination. This is testament to the structure of the public transport network which is centred on the inner city but also reflects the high travel demands from commuters entering the inner city by public transport on weekdays.

Utilisation for top 10 origin-destination trips

Figure 38 provides an overview of the PHT on public transport for the top ten origin-destination pairs in the Melbourne GCCSA area in 2010-11.

Figure 38 **Public transport – top ten origin-destination pairs – utilisation 2011 – Melbourne GCCSA**



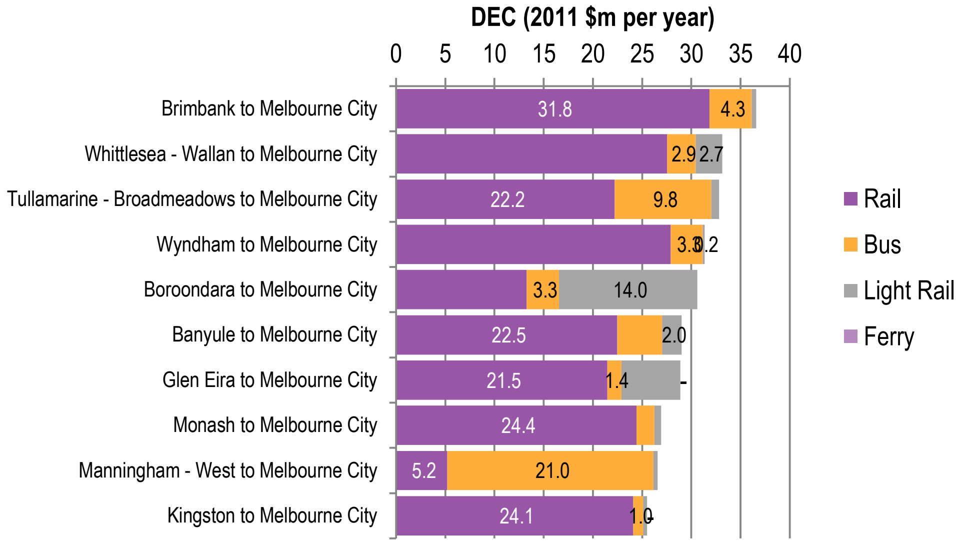
Source: ACIL Allen Consulting, 2014

For public transport all of the top ten origin-destination pairs in the Melbourne GCCSA have the inner city as a destination. For most origin-destination pairs, utilisation is greatest for trips on the rail network excepting trips originating in Boroondara to Melbourne city. For trips from Boroondara utilisation is greatest for trips on the tram network, which is testament to the well-built tram network in the area. The bus network had a high utilisation for trips from Brimbank to the inner city.

DEC for top 10 origin-destination trips

Figure 39 shows the ten origin-destination pairs which had the highest DEC in the Melbourne GCCSA area in 2011.

Figure 39 **Public transport – top ten origin-destination pairs – DEC 2011 – Melbourne GCCSA**



Source: ACIL Allen Consulting, 2014

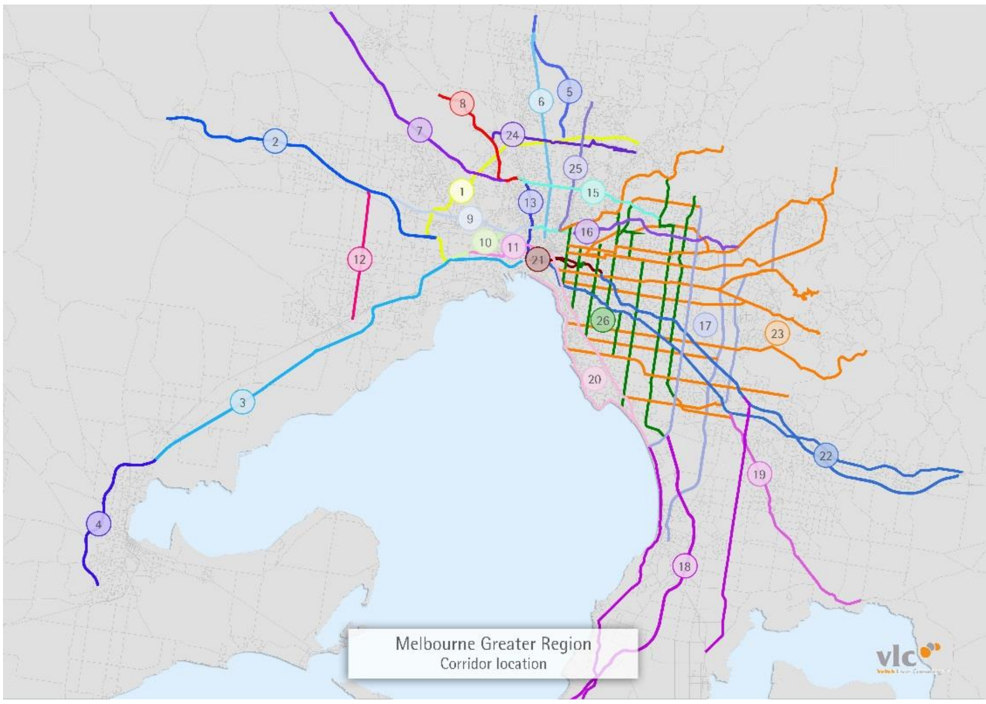
For public transport, trips from Brimbank to the inner city had the highest DEC in 2010-11.

5.6 Corridor analysis

The analysis of key transport corridors in the Melbourne region provides more detailed insights than the analysis of origin-destination pairs. Corridors are defined to reflect some of the most commonly travelled journeys in the Melbourne-Geelong area. Corridors can include multiple routes travelling in parallel, reflecting different choices for motorists to travel between certain destinations. The analysis of corridors is limited to the urban road network and does not include public transport.

Figure 40 provides an overview of the 27 major transport corridors that are assessed in the Melbourne-Geelong area.

Figure 40 **Melbourne-Geelong urban transport corridors**



Source: VLC, 2014

Table 47 **Melbourne-Geelong corridors**

Corridor	Description	Corridor	Description
1	Western/Metropolitan Ring Road	15	City Link-Eastern Fwy connection north of CBD
2	Western Freeway Corridor	16	Eastern Fwy Corridor to Ringwood
3	West Gate/Princes Freeway Corridor	17	Eastlink/Frankston Fwy Corridor
4	Geelong Bypass	18	Mornington Peninsula Corridor (M P Fwy and Peninsula Link)
5	Hume Freeway Corridor	19	South Gippsland Highway Corridor
6	Sydney Rd Corridor	20	Inner Beach Suburbs Corridor (Nepean Highway)
7	Calder Freeway Corridor	20	Inner Beach Suburbs Corridor (Beach Rd and Esplanade)
8	Tullamarine Freeway (Airport) Corridor	21	City Link Southern Link
9	Ballarat Rd Corridor	22	Monash/Princes Fwy Corridor (Monash/Princes Fwy)
10	Geelong Rd Corridor	23	East-West Arterials - Eastern Suburbs (Maroondah Hwy)
11	Docklands Hwy Corridor	24	East-West Arterials - Northern Suburbs (Mahoneys Rd)
12	Werribee-Melton Rd Corridor	25	North-South Arterial - Northern Suburbs (St Georges Rd/High St)
13	City Link Western Link	26	North-South Arterials - Eastern Suburbs (Punt Rd/Hoddle Street)

Source: ACIL Allen Consulting, 2014

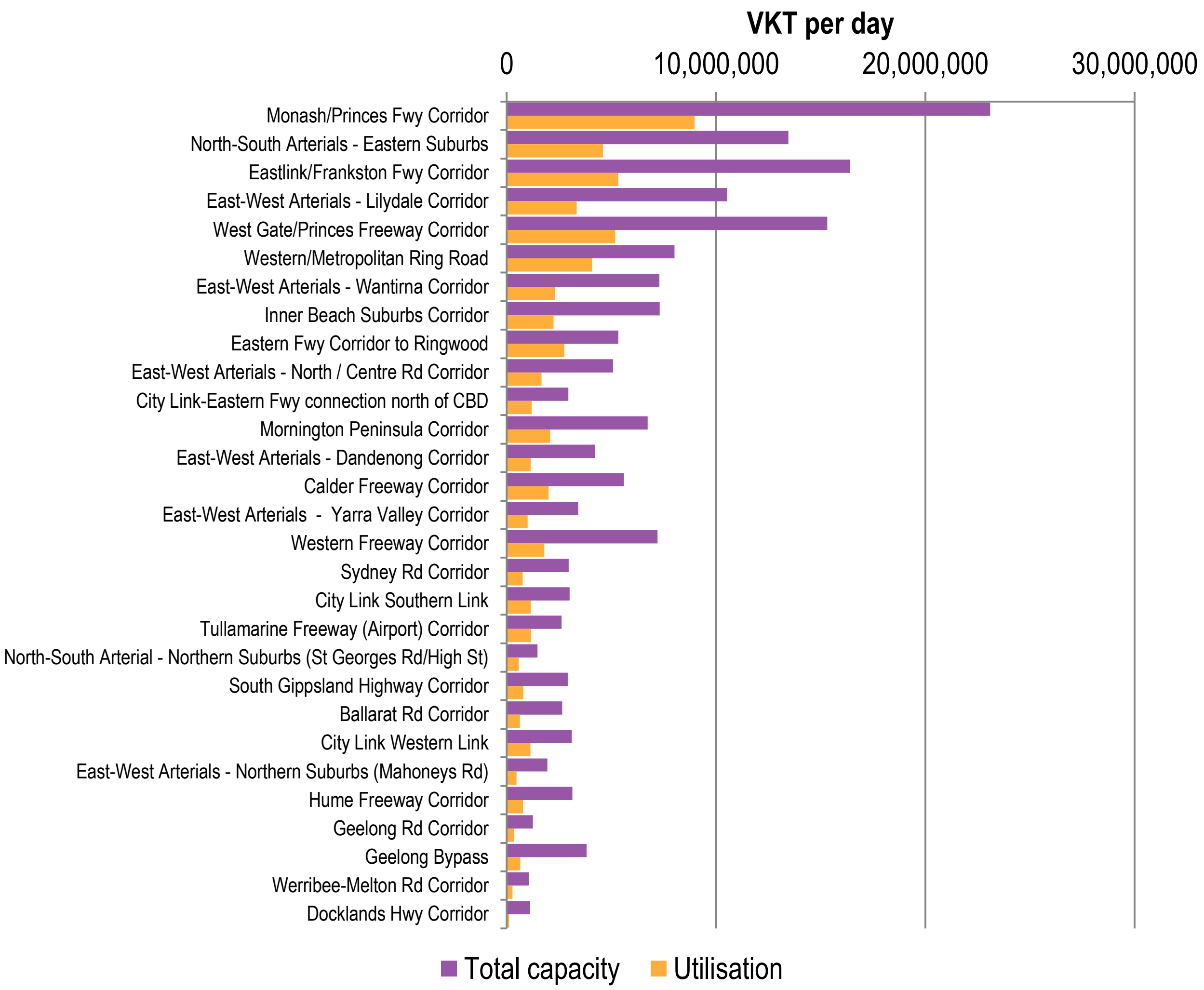
5.6.1 DEC of corridors

Corridor capacity and utilisation

The capacity of the selected corridors depends on the length of the corridor, the speed limits and the number of parallel routes that the corridor is made up of.

Figure 41 shows the capacity and utilisation of road corridors in the Melbourne-Geelong area in 2010-11. The graph shows the capacity of the road corridors in VKT per day (purple bars), the utilisation on a typical day (yellow bars) and the utilisation during the morning peak (percentage figures).

Figure 41 **Transport corridors – Capacity and utilisation 2011 – Melbourne-Geelong**



Source: ACIL Allen Consulting, 2014

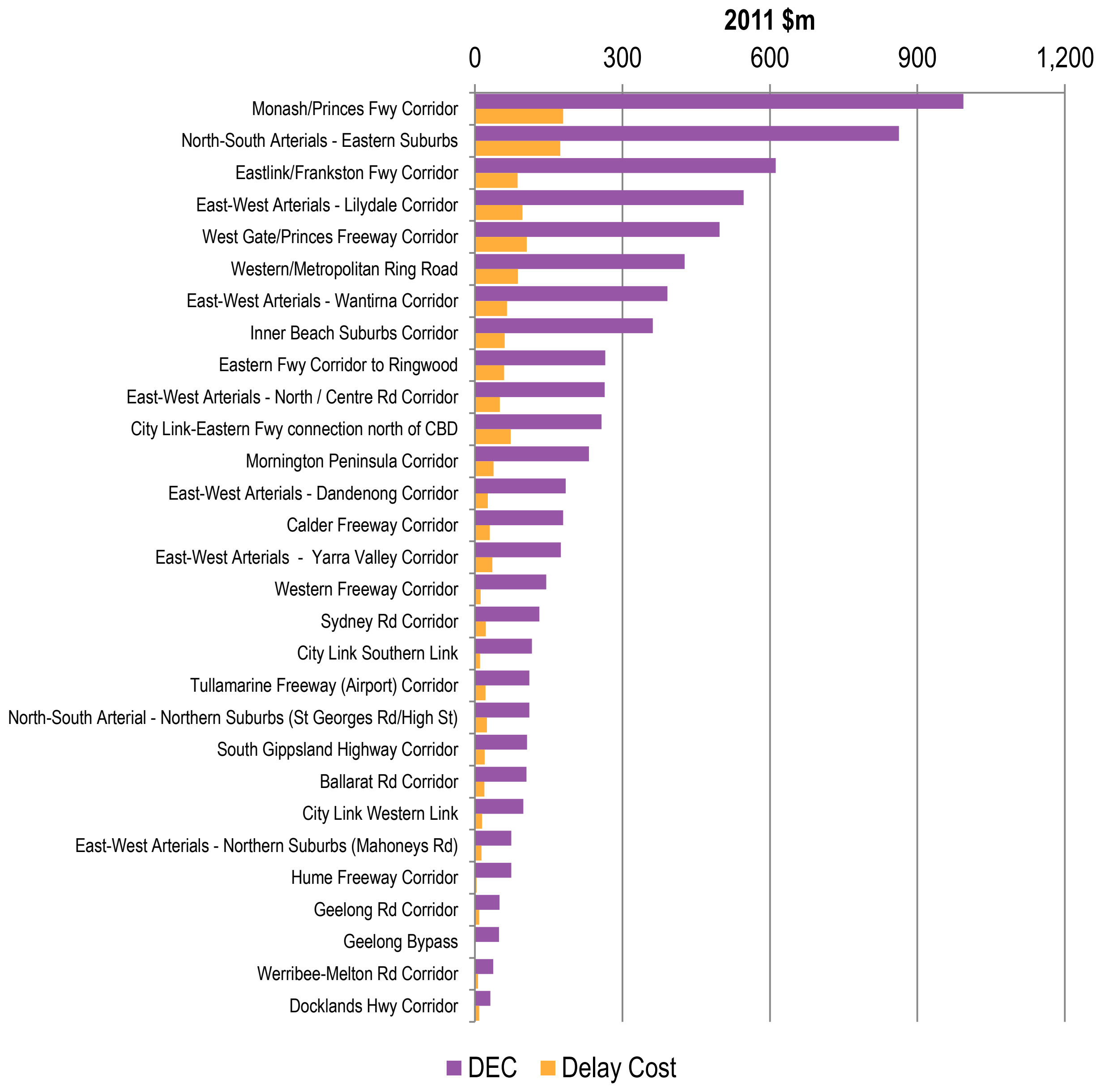
The corridor with the highest capacity is the Monash/Princes Freeway, which consists of a number of arterial roads that connect Melbourne-Geelong's eastern suburbs to the inner city.

Congestion during the morning peak is most intense on smaller corridors such as the 'Western/Metropolitan Ring Road', the 'City Link-Eastern Fwy connection north of CBD' and the 'Eastern Fwy Corridor to Ringwood'.

Corridor DEC and delay costs

Figure 42 shows the DEC and utilisation of major transport corridors in the Melbourne-Geelong area.

Figure 42 **Transport corridors – DEC and delay cost 2010-11 – Melbourne-Geelong**



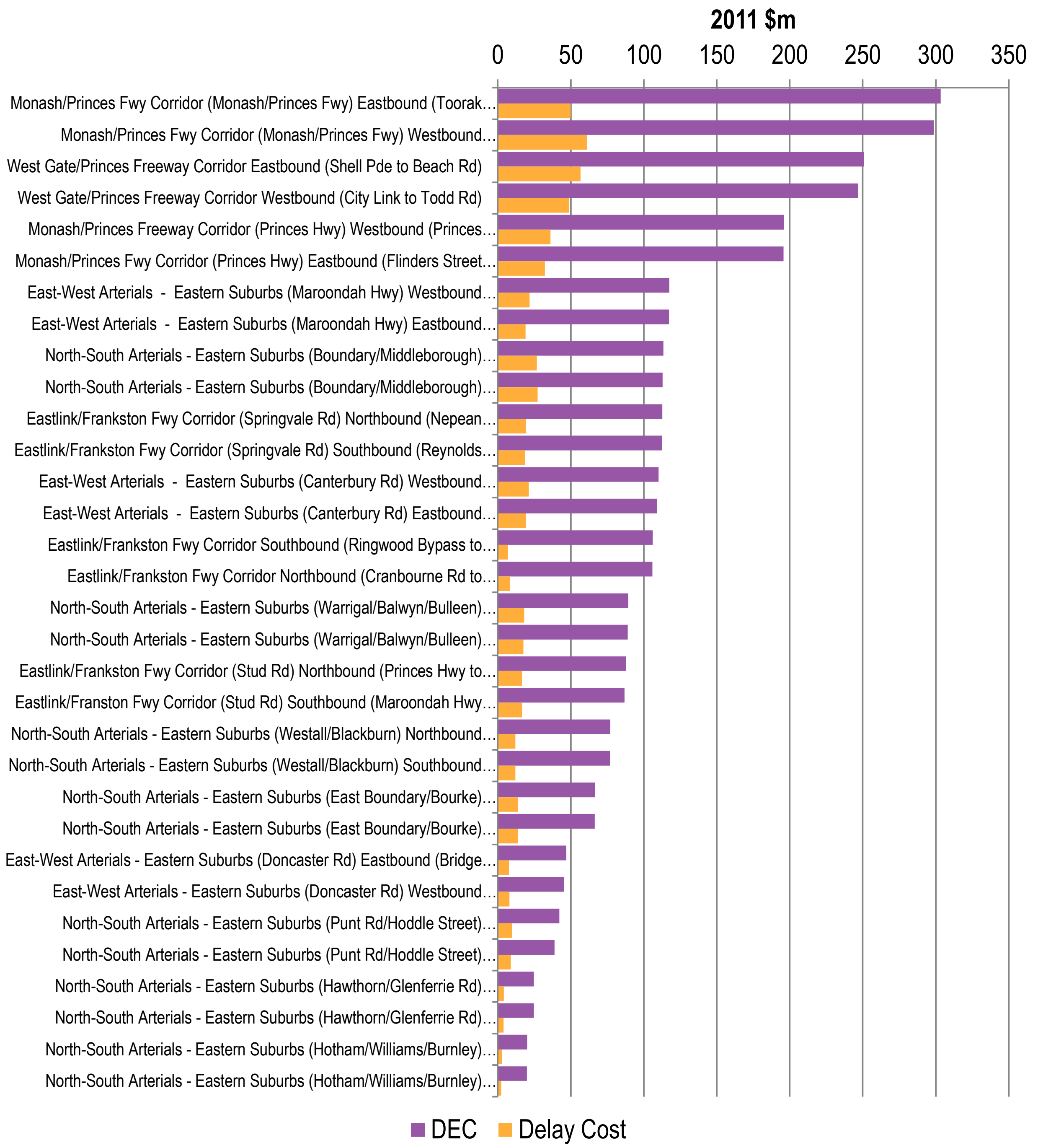
Source: ACIL Allen Consulting, 2014

The DEC of the Monash/Princes Freeway Corridor was estimated to be more than $1 billion in 2010-11. Delay costs on the corridors selected in the Melbourne-Geelong region amounted to a total of $1.7 billion in 2010-11.

5.6.2 Analysis of routes within major corridors

Figure 43 shows the DEC and delay costs of routes within the five corridors with the highest DEC in the Melbourne-Geelong area.

Figure 43 **Transport corridors – DEC and delay cost of routes within major corridors – Melbourne-Geelong**



Note: Shown are routes within the five corridors with the highest DEC.
Source: ACIL Allen Consulting, 2014

The DEC and delay costs are relatively evenly split between north and south bound (or east and west bound) routes within the major corridors.

5.7 Projections for 2031

5.7.1 Demand drivers for urban transport

Key drivers for growth in travel demand are economic growth and growth in travel demand.

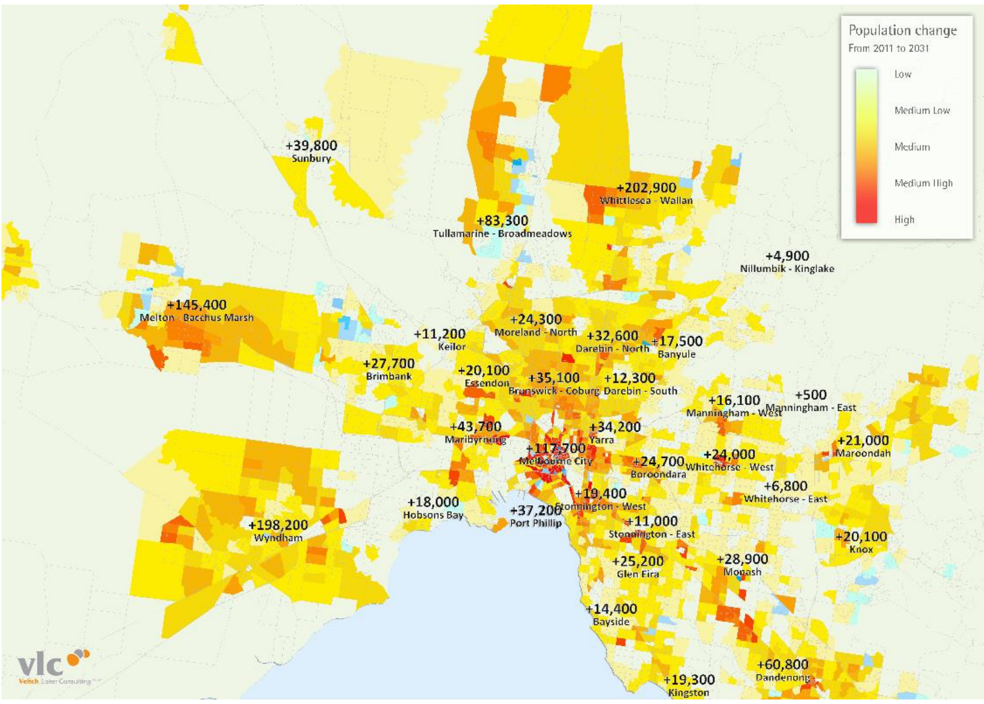
Projected population growth

Changes in demographics at the local level can lead to increased demand along key links that go beyond the levels of the overall growth of larger regions.

Figure 44 shows projected changes in population for the Melbourne-Geelong area by transport zone. Population growth is based on ABS Series B projections.

The map shown below is colour coded to indicate the amount of projected growth for each transport zone with green indicating low growth and red indicating high growth. The figures shown on the map indicate the projected growth of a selection of SA3s between 2010-11 and 2030-31.

Figure 44 **Projected population growth 2010-11 to 2030-31 – Melbourne-Geelong**



Source: (VLC, 2014)

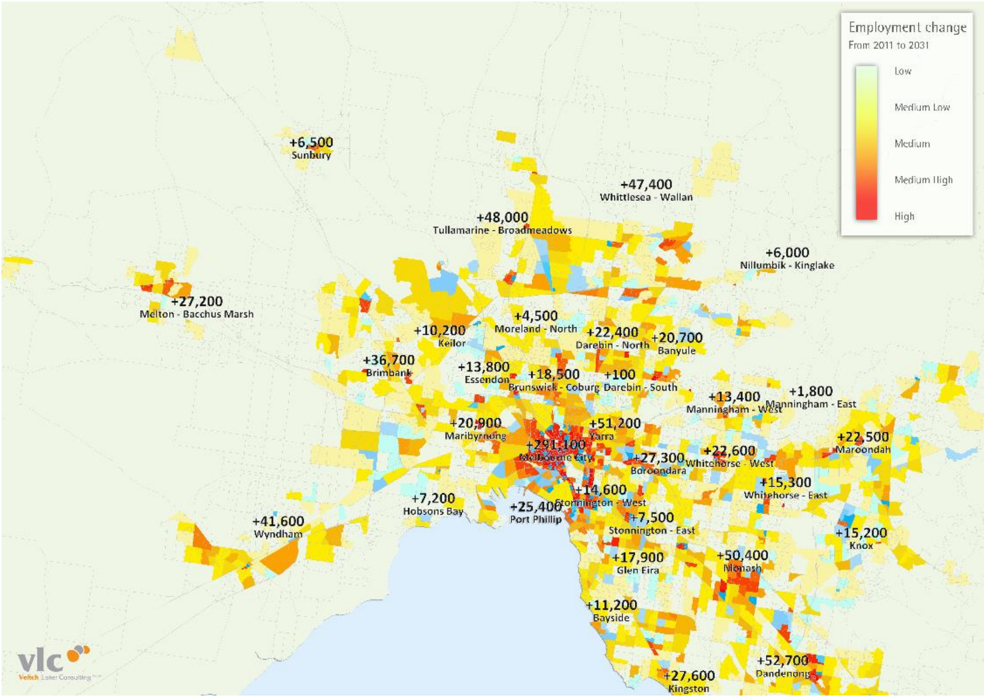
The largest growth can be seen in the SA3s of Melbourne City as expected, however there is also significant expected growth in the areas of South-Casey, Cardinia, Sunbury, Whittlesea – Wallan, Tullamarine – Broadmeadows, Melton – Bacchus Marsh and Wyndham in the outer suburbs of Melbourne. Between 2010-11 and 2030-31 these areas are forecast to double, or more than double in terms of population.

There are forecast to be 5.6 million people living in the Melbourne GCCSA by 2030-31 (growth of 43 per cent), with around 350 thousand in Geelong and Mornington Peninsula (growth of 34 and 22 per cent respectively).

Projected employment growth

Figure 45 shows projected employment growth in the Melbourne-Geelong area.

Figure 45 **Projected employment growth 2010-11 to 2030-31 – Melbourne**



Source: (VLC, 2014)

Employment growth follows a similar overall pattern to population growth but is much more concentrated on the inner city of Melbourne. Other areas that are projected to show high growth in employment include Essendon, Yarra, Brunswick – Coburg, Darebin North, Brimbank, Casey- South, Cardinia and Whittlesea.

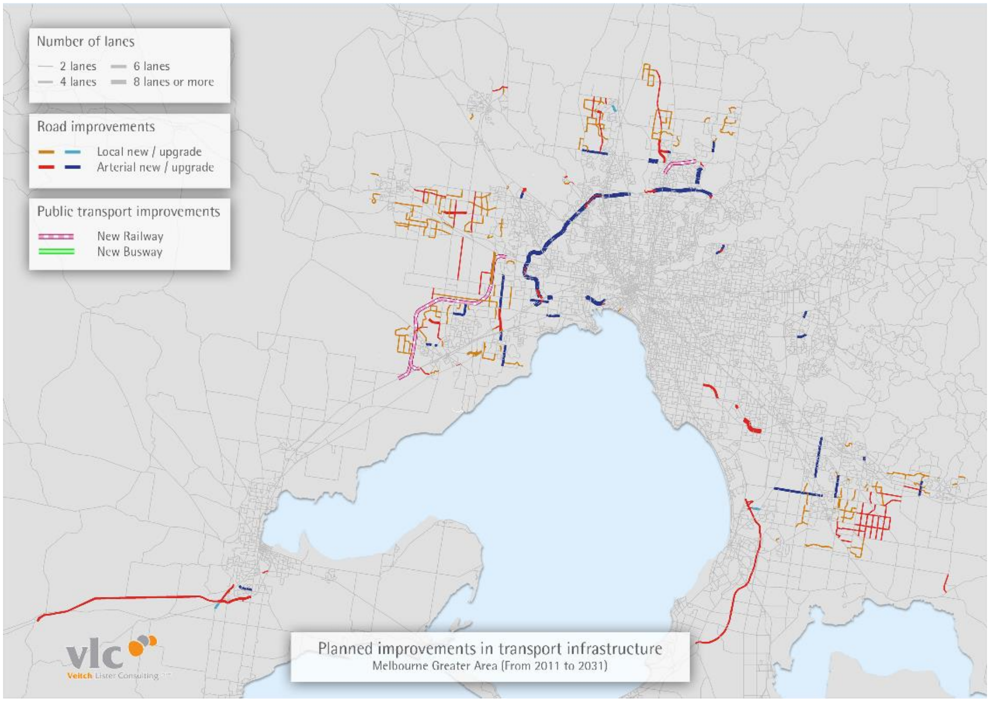
Overall employment in the Melbourne GCCSA and Mornington Peninsula area is expected to grow by 60 per cent as compared to only 28 per cent for the Geelong region.

5.7.2 Planned expansion of urban transport infrastructure

Figure 46 gives an overview of assumed changes in rail and road infrastructure between 2010-11 and 2030-31.

As with other regions analysed within this report, assumed additions to urban transport infrastructure for this study have been limited to a low investment scenario. This means that only projects where funding has already been committed, or where significant political capital has been invested, are included in the projections.

Figure 46 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 – Melbourne-Geelong**



Source: (VLC, 2014)

Table 48 provides an overview of the key additions to the transport system in the Melbourne-Geelong region that are assumed to go ahead between 2010-11 and 2030-31.

Table 48 **Major additions to transport infrastructure between 2010-11 and 2030-31 assumed in transport modelling**

Item	Description
1	Cranbourne-Pakenham Rail Corridor project
2	M80 Ring Rd upgrade (widening)
3	Western Hwy duplication – Ballarat to Stawell
4	Metro Level Crossing Blitz - Blackburn Rd | Burke Rd | North Rd
5	Metropolitan grade separations - Mitcham Rd & Rooks Rd | Springvale Rd
6	Princes Hwy duplication project – Winchelsea to Colac
7	Main Road Level Crossing Removal
8	Western Hwy realignment – Anthonys Cutting (Melton to Bacchus Marsh)
9	Goulburn Valley Nagambie Bypass
10	Princes Hwy East – Traralgon to Sale duplication
11	Princes Hwy West Stage 1 - Waurn Ponds to Winchelsea
12	Dingley Bypass - Warrigal Rd to Westall Rd
13	Geelong Ring Rd Stage 4C – Geelong Ring Rd to Surf Coast Hwy
14	Calder Hwy interchange at Ravenswood
15	Koo Wee Rup Bypass
16	Breakwater Road – upgrade
17	Geelong Ring Rd Stage 4B – Anglesea Rd to Princes Hwy West
18	Peninsula Link
19	Port-Rail shuttle (metropolitan intermodal system)
20	Clyde Rd duplication – High St to Kangan Dr
21	Narre Warren Cranbourne Rd duplication - Pound Rd to Thompson Rd
22	South Gippsland Hwy upgrade – Sale to Longford
23	Bass Hwy duplication Stage 7 – Woolmer Rd to Phillip Island Rd

Source: (VLC, 2014)

5.7.3 DEC in 2031

Table 49 shows the DEC of different transport modes within the urban transport sector of the Melbourne-Geelong area.

Table 49 **Urban transport DEC by transport mode – 2030-31 – Melbourne-Geelong**

Mode	DEC	DEC
	(2011) $m	(2031) $m
Car	15,537	30,605
LCV	641	792
HCV	779	1,418
Rail	1,744	4,891
Bus	985	1,964
Ferries	0	0
Light Rail	322	1,126
Total	**20,007**	**40,796**

Source: ACIL Allen Consulting, 2014

The total DEC of urban transport in the Melbourne-Geelong region is set to grow by 104 per cent between 2010-11 and 2030-31, with the largest growth in absolute terms coming from car transport.

However, the highest proportional growth is expected to come from the various modes of public transport: light rail, rail and buses. Light rail and rail are both expected to more than double their economic contribution, while the lowest growth is seen for LCV.

5.7.4 Capacity, utilisation and congestion in 2031

Table 50 provides an overview of the road network capacity in 2030-31 compared to the capacity in 2010-11.

Table 50 **Road network capacity – 2010-11 and 2030-31 – Melbourne-Geelong**

Road network	Capacity	Capacity
	VKT per day	kms of road
2011	600,408,778	21,769
2031	636,098,134	22,725

Source: ACIL Allen Consulting, 2014

While the capacity of the network is assumed to only grow at a modest rate the utilisation of the network is projected to increase significantly.

Table 51 compares road network utilisation in the Melbourne-Geelong area in 2030-31 with 2010-11.

Table 51 **Road network utilisation and congestion – 2010-11 and 2030-31 – Melbourne-Geelong**

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
2011	116,136,869	39%	19%	17%	2,837
2031	163,880,115	50%	26%	28%	9,007

Source: ACIL Allen Consulting, 2014

Between 2010-11 and 2030-31 the cost of congestion on the road network in the Melbourne-Geelong region is projected to increase to $9 billion dollars per annum.

Table 52 provides a comparison of the projected capacity of public transport in the Melbourne-Geelong area in 2030-31 to the capacity in 2010-11.

Table 52 **Public transport network capacity – 2010-11 and 2030-31 – Melbourne-Geelong**

Year	Public Transport Networks	Capacity	Capacity
		Passenger seat kms per day	Passenger crush kms per day
2011	Rail Network	47,335,571	99,595,712
2011	Bus Network	3,227,466	12,984,295
2011	Light rail Network	21,597,822	32,396,733
2031	Rail Network	70,739,099	138,317,751
2031	Bus Network	4,033,120	16,307,703
2031	Light rail Network	35,654,678	53,482,018

Source: ACIL Allen Consulting, 2014

A number of planned expansions in the public transport network of the Melbourne-Geelong region are assumed to go ahead between 2010-11 and 2030-31. The seating capacity of the light rail network is assumed to grow by 65 per cent, the seating capacity of the heavy rail network is assumed to grow by 49 per cent and the seating capacity of Melbourne-Geelong's bus system is projected to increase by 25 per cent.

Table 53 compares the utilisation of different public transport modes in 2010-11 and 2030-31.

Table 53 **Public transport network utilisation – 2010-11 and 2030-31 – Melbourne-Geelong**

Year	Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
		Passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
2011	Rail Network	17,622,360	61%	29%	37%	18%
2011	Bus Network	2,312,022	108%	27%	72%	18%
2011	Light rail Network	4,075,718	25%	17%	19%	13%
2031	Rail Network	40,956,587	100%	51%	58%	30%
2031	Bus Network	3,794,382	148%	37%	94%	23%
2031	Light rail Network	8,360,219	34%	23%	23%	16%

Source: ACIL Allen Consulting, 2014

Despite the relatively large additions to the public transport system assumed in the Melbourne-Geelong region, the congestion (in terms of volume over capacity) is projected to increase markedly across all public transport modes. Population growth will also lead to a 93 per cent increase in the total utilisation of public transport networks in the Melbourne-Geelong region between 2010-11 and 2030-31.

Analysis of key journeys

This section examines the changes in the DEC of origin-destination pairs for public transport and road transport in the Melbourne-Geelong region between 2010-11 and 2030-31.

Table 54 provides an overview of the ten origin-destination pairs with the highest projected change in DEC between 2010-11 and 2030-31.

Table 54 **Roads – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Melbourne-Geelong**

From	To	∆ DEC ($m)
Tullamarine - Broadmeadows	Whittlesea - Wallan	335.4
Wyndham	Melton - Bacchus Marsh	123.1
Melton – Bacchus Marsh	Brimbank	118.2
Casey - South	Casey - North	98.2
Whittlesea - Wallan	Darebin - North	96.6
Cardinia	Casey - South	92.7
Wyndham	Brimbank	90.3
Frankston	Casey - South	82.4
Surf Coast - Bellarine Peninsula	Geelong	82.3
Casey - South	Dandenong	81.5

Source: ACIL Allen Consulting, 2014

The DEC for trips between the growth centres of 'Tullamarine – Broadmeadows' and 'Whittlesea – Wallan' is projected to increase by the largest amount of all origin-destination pairs in the Melbourne-Geelong region. The change in road DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C3 in Appendix C.

Table 55 shows the ten origin-destination pairs with the highest projected change in public transport DEC in Melbourne-Geelong between 2010-11 and 2030-31.

Table 55 **Public transport – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Melbourne-Geelong**

From	To	∆ DEC ($m)
Whittlesea - Wallan	Melbourne City	109.6
Wyndham	Melbourne City	80.5
Tullamarine - Broadmeadows	Melbourne City	79.4
Casey - South	Melbourne City	77.5
Melton - Bacchus Marsh	Melbourne City	48.9
Boroondara	Melbourne City	41.8
Cardinia	Melbourne City	37.5
Banyule	Melbourne City	37.4
Yarra Ranges	Melbourne City	33.3
Knox	Melbourne City	33.2

Source: ACIL Allen Consulting, 2014

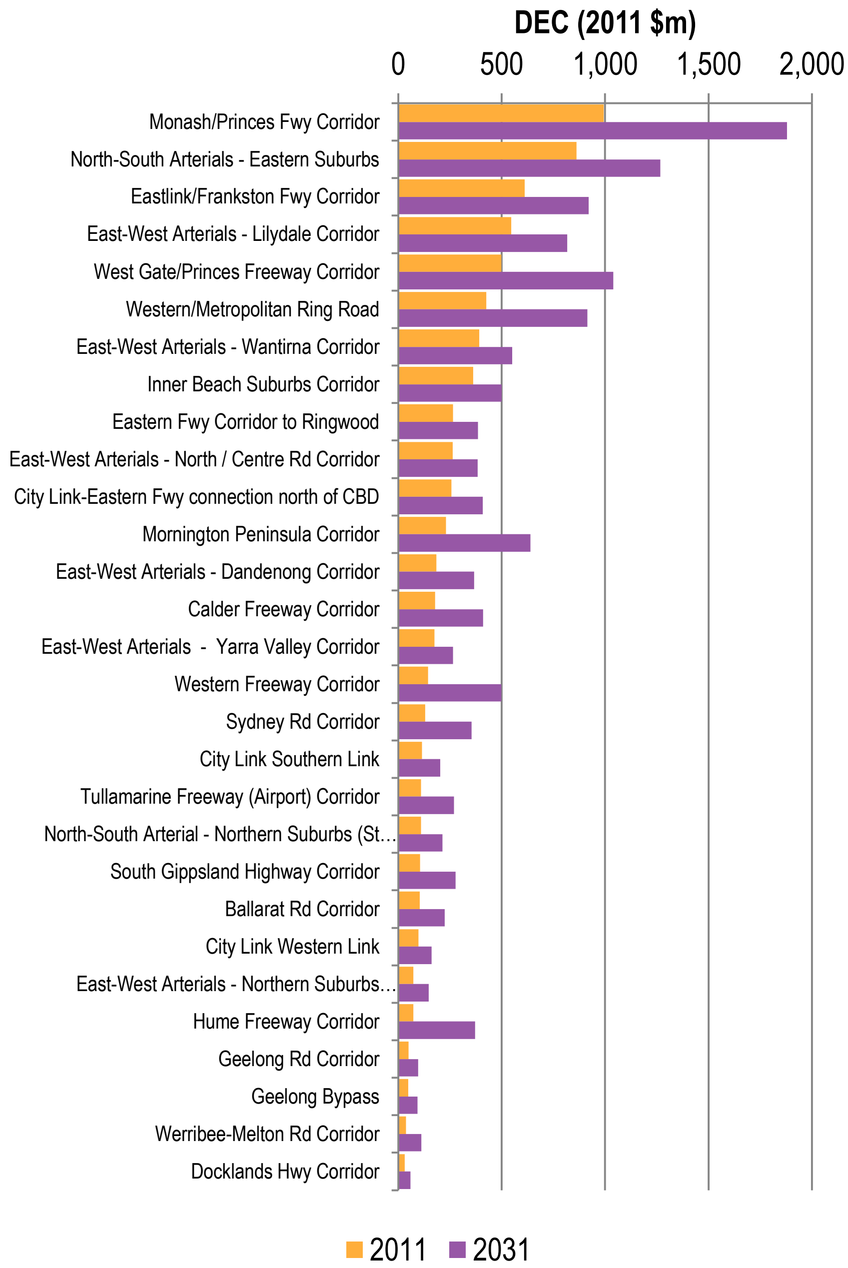
Driven by large projected population growth, trips from the 'Whittlesea-Wallan' SA3 to the inner city are projected to experience the highest growth in DEC between 2010-11 and 2030-31. The change in public transport DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C4 in Appendix C.

Analysis of corridors

This section examines the changes in the DEC of key road corridors in the Melbourne-Geelong area between 2010-11 and 2030-31.

Figure 47 compares the projected DEC of major transport corridors in the Melbourne-Geelong area in 2030-11 to the DEC of these corridors in 2010-11.

Figure 47 **Transport corridors – DEC 2010-11 and 2030-31 – Melbourne-Geelong**

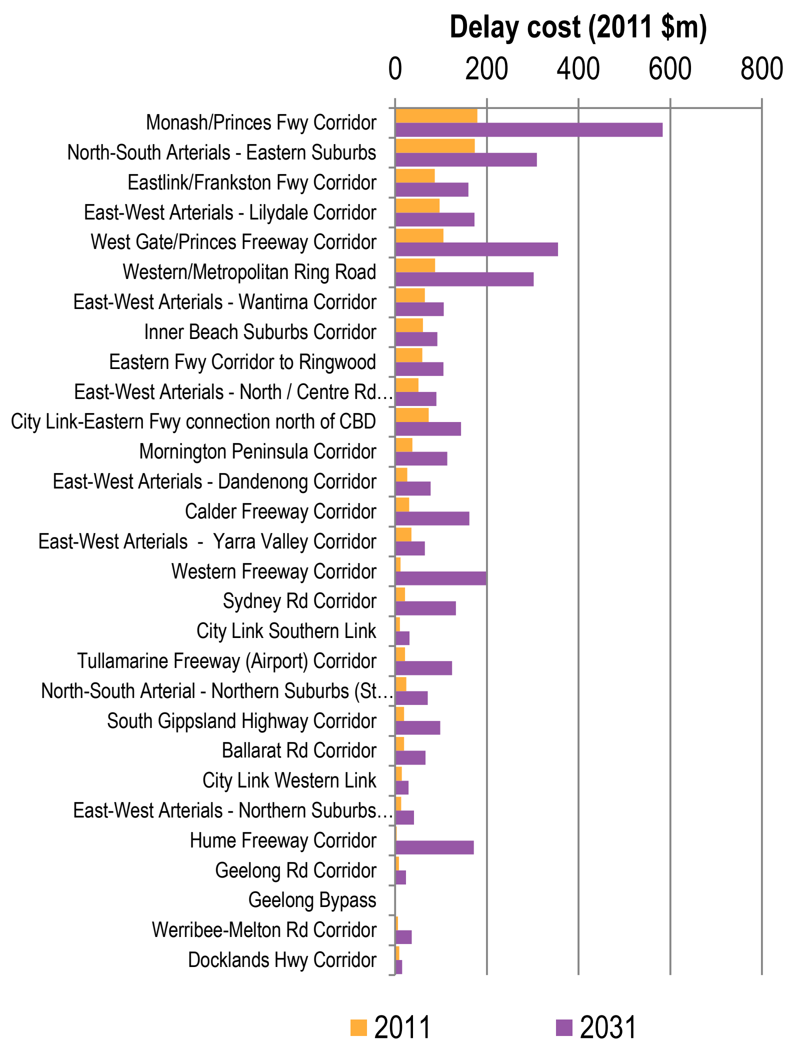


Source: ACIL Allen Consulting, 2014

The DEC of trips along the major corridors in the Melbourne-Geelong region is projected to increase by $4.2 billion between 2010-11 and 2030-31. Of all corridors in the Melbourne region, the DEC of the 'Monash/Princes Fwy Corridor' is projected to increase by the greatest amount.

Figure 48 compares the projected delay costs on major transport corridors in 2030-31 to the delay cost on these corridors in 2010-11.

Figure 48 **Transport corridors – delay cost 2010-11 and 2030-31 – Melbourne-Geelong**

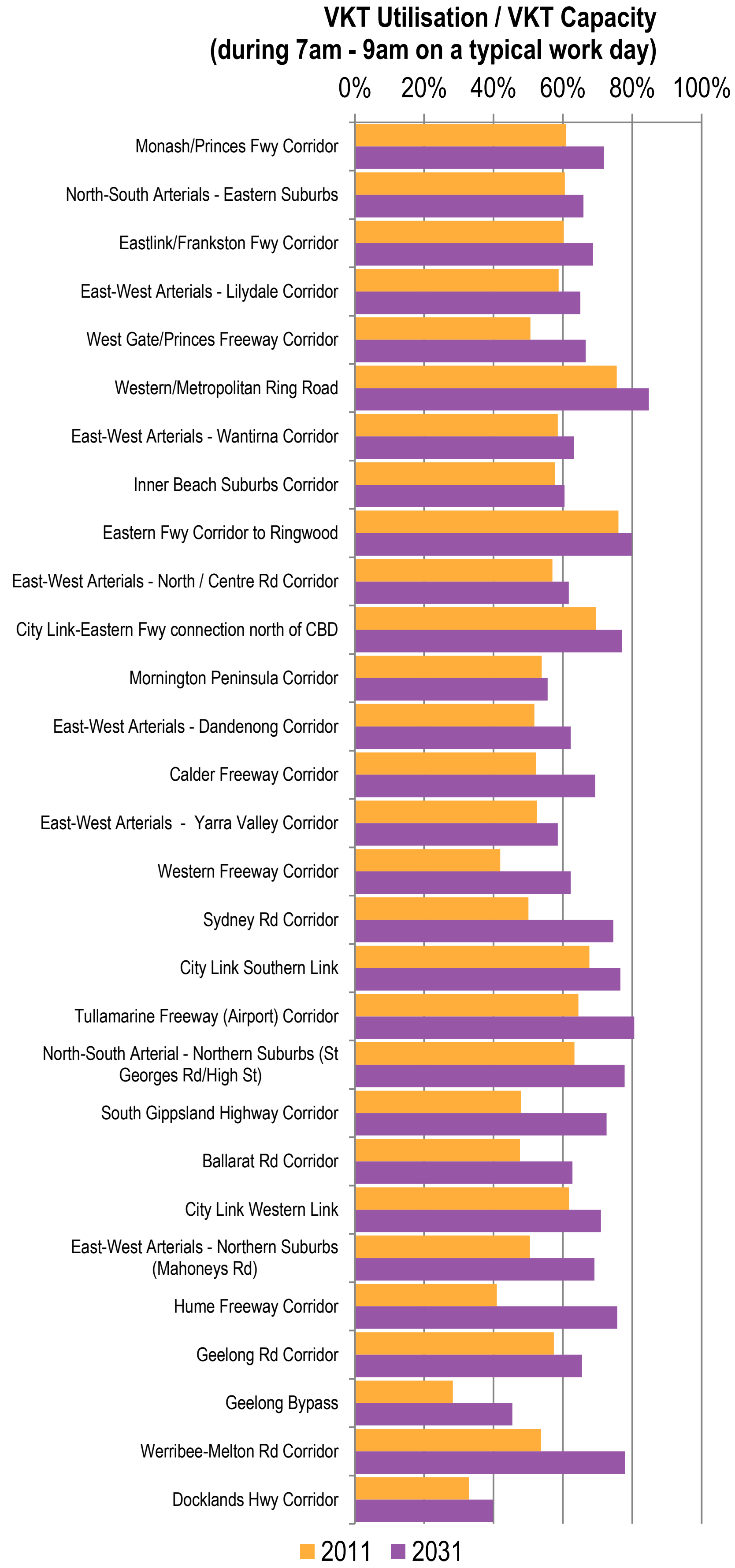


Source: ACIL Allen Consulting, 2014

Delay costs on the major corridors in the Melbourne-Geelong region are projected to increase by $1.3 billion between 2010-11 and 2030-31. Delay costs on all major corridors except the 'Docklands Hwy Corridor' are projected to increase.

Figure 49 provides a comparison of projected congestion on major transport corridors during the morning peak in 2030-31 to congestion on these corridors in 2010-11. The figure shows the ratio of VKT to the VKT capacity of the corridors.

Figure 49 **Transport corridors – change in congestion 2010-11 and 2030-31 – Melbourne-Geelong**



Source: ACIL Allen Consulting, 2014

The utilisation of most major transport corridors is projected to increase between 2010-11 and 2030-31. By 2030-31 utilisation in terms of volume over capacity is projected to reach more than 80 per cent on the Western/Metropolitan Ring Road.

5.7.5 Reconciliation with macro-economic data

Table 56 provides a comparison between the estimates of DEC based on transport activity modelling i.e. a bottom-up analysis and DEC estimates based on analysis of national statistics i.e. a top-down analysis.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014) using SDs as basic geographical units rather than GCCSAs (details of this is provided in the earlier section of this chapter). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements. The bottom-up projections of the DEC of urban transport infrastructure are based on transport activity projections from VLC's Zenith model. The top-down, projections of DEC are based on national statistics. Household expenditure on personal transport is based on data from the household expenditure survey and scaled to the number of households in each region. Household expenditure is assumed to grow in line with income growth as a proxy for expenditure growth. Income growth projections are obtained from ACIL Allen's Tasman Global modelling for the Baseline Scenario of the broader AIA. DEC from road and rail freight is projected to grow in line with projections of gross value add for rail and road transport which is also obtained from the Tasman Global model projections.

Table 56 **Macro-reconciliation – DEC of urban transport infrastructure 2030-31 – Melbourne-Geelong area**

DEC (Based on transport simulation modelling)					DEC (Based on national statistics)				
Mode	**Melbourne**	**Geelong**	**Mornington Peninsula**	**Total**	**Mode**	**Melbourne**	**Geelong**	**Mornington Peninsula**	**Total**
Car/PMV	28,151	1,361	1,093	30,605	Household private vehicle expenditure	39,116	1,751	1,451	42,319
LCV	713	40	39	792	Road transport (freight)	7,039	272	487	7,798
HCV	1,181	124	113	1,418	Rail transport (freight)	1,491	29	103	1,623
Rail	4,499	218	175	4,891	Rail (household expenditure)	672	27	23	722
Bus	1,806	87	70	1,964	Bus/tram/light rail (household expenditure)	612	22	18	651
Ferry	0	0	0	0	Ferry (household expenditure)		0	0	1
Light Rail	1,126	0	0	1,126					
Total Transport	37,477	1,830	1,489	40,796	**Transport**	**48,930**	**2,101**	**2,083**	**53,114**
Growth factor (2011-31)	2.06	1.91	1.77	2.04	**Growth factor (2011-31)**	**2.50**	**1.80**	**2.35**	**2.45**

Source: ACIL Allen Consulting, 2014

6 Brisbane and South East Queensland

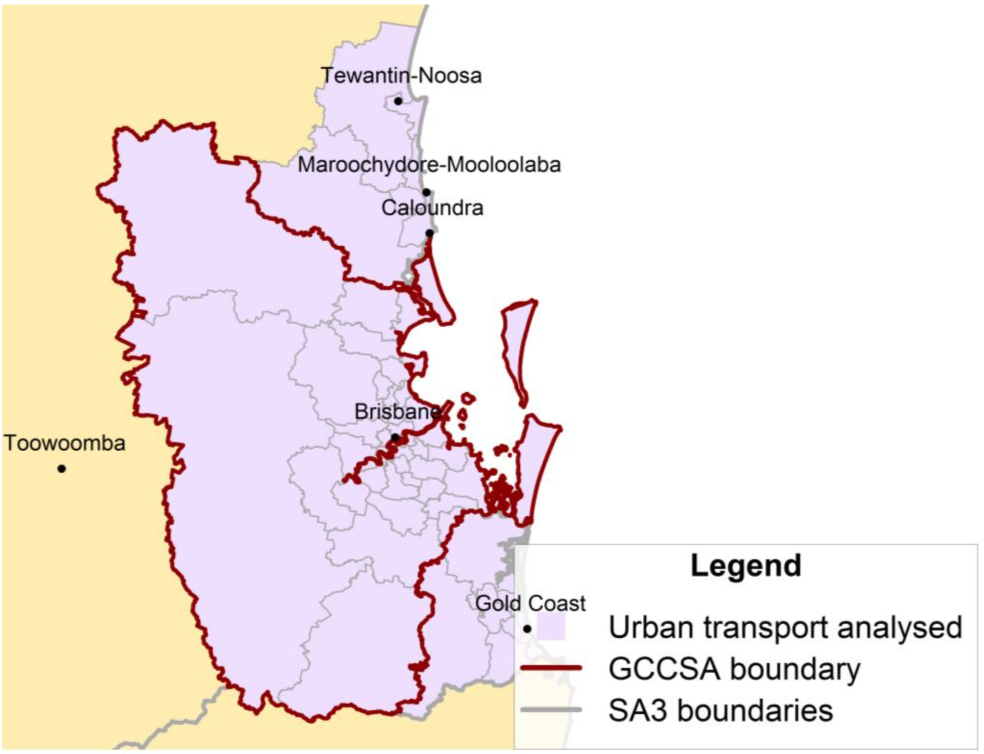
Brisbane and the rest of South East Queensland is connected through roads, heavy rail, buses and ferries.

Brisbane's city rail network has eleven lines including services to the Sunshine Coast and the Gold Coast. The city rail network has trains running from Brisbane Central station to Gympie on the Sunshine Coast line, Varsity Lakes on the Gold Coast and the regional centre of Ipswich in Brisbane's east. Transdev Brisbane Ferries operates a fleet of 28 ferries including large City Cat ferries and smaller City Hoppers. Ferry services operate on the Brisbane River servicing the inner city between St Lucia and Hamilton. Brisbane's bus network includes a system of grade-separated, bus only corridors.

The Pacific Highway enters Brisbane in Springwood in the south east and leads all the way to the centre of the city. In the north the Bruce Highway connects the centre of Brisbane to the Sunshine Coast. The Warrego Highway connects Brisbane to the regional centre of Toowoomba in the east. The Gateway Motorway skirts the inner city from the west and connects to the Hume Highway at Bracken Ridge in the North and merges into the Logan Motorway in the south.

Figure 50 provides an overview of the Brisbane and South East Queensland (SEQ) region for which the urban transport system has been analysed.

Figure 50 **Brisbane- South-East-Queensland**



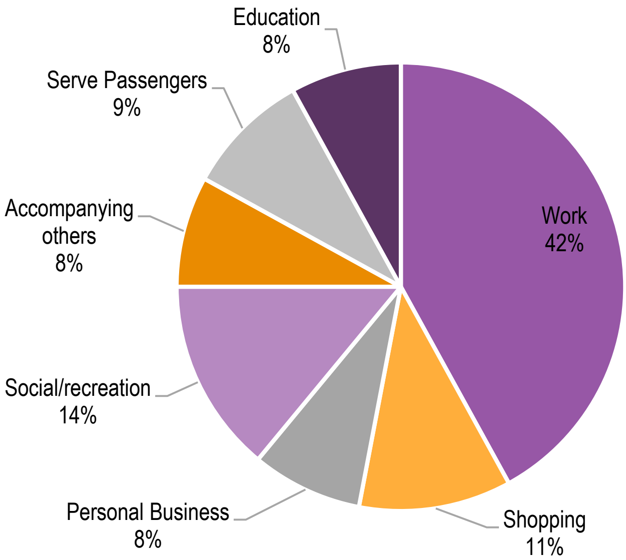
Source: ACIL Allen Consulting, 2014

We note that the area covered by the urban transport analysis covers some non-urban areas. The boundaries of the urban transport analysis were chosen to ensure that the entire conurbation of a city is included in the analysis. This is to ensure that the transport system of the city is captured as accurately as possible.

6.1 Key issues and challenges

In 2009 residents of South East Queensland (SEQ) undertook a combined 9 million trips on an average weekday. Between 1992 and 2009 the population of SEQ grew by 59 per cent. Over the same period the length of trips undertaken grew, resulting in growth of 85 per cent in the distance travelled on an average weekday. In total Brisbane residents travelled 85.8 million km on an average weekday. (Department of Transport and Main Roads, 2012). Figure 51 provides an overview of the proportion of kilometres travelled in SEQ by trip purpose.

Figure 51 **Share of Distance travelled by trip purpose in Brisbane - 2009**

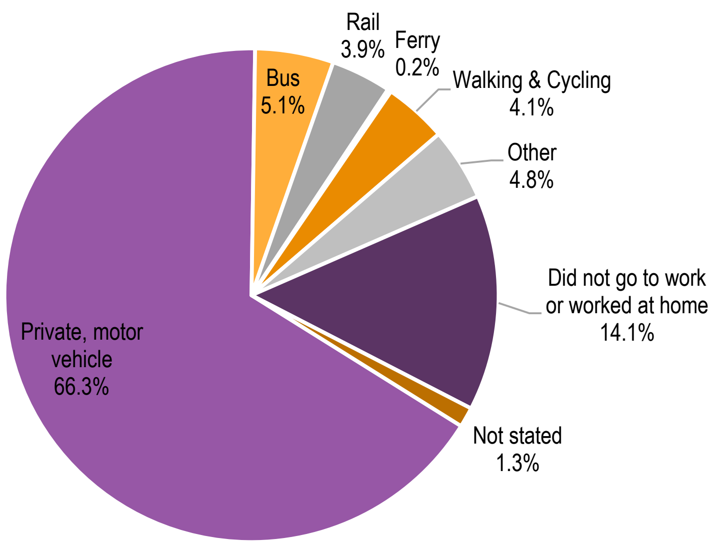


Source: (Department of Transport and Main Roads, 2012)

Work related trips are especially challenging from a transport planning perspective as they are both spatially and temporally highly correlated. Work related trips accounted for 42 per cent of km travelled in SEQ. Brisbane's CBD was the largest single generator of transport demand with 10 per cent of all trips originating or ending in Brisbane's CBD.

Figure 52 provides an overview of the method by which people in the Brisbane GCCSA are getting to work.

Figure 52 **Method of travel to work Brisbane GCCSA - 2011**



Note: Transport methods have been grouped e.g. 'private motor vehicle' include trucks and motorbikes, 'other' includes multimodal public and private transport, does not include: Unemployed persons looking for either part-time or full-time work, Persons not in the labour force, Persons with Labour Force Status (LFSP) not stated, Persons aged under 15 years

Source: (ABS, 2011)

While the majority of commuters in the Brisbane GCCSA use private motor vehicles to commute, workers in Brisbane's CBD are more reliant on public transport. In the morning peak 76 per cent of workers in the Brisbane CBD commute using public transport (Department of Transport and Main Roads, 2012).

As mentioned above 10 per cent of all trips taken in SEQ originate or end in the Brisbane CBD. Growth in employment in inner Brisbane is projected to further increase the travel task for the Brisbane CBD.

Population in SEQ is projected to grow strongly with major growth areas in the Brisbane City LGA, the Gold Coast, Ipswich, Sunshine Coast, Moreton Bay and Logan (Department of Transport and Main Roads, 2014). As a result of strong population growth, The Brisbane City Centre Master Plan projects growth in public transport of 80 per cent in the inner city by 2031 (Brisbane City Council, 2014).

Currently the Brisbane CBD is served by a single railway line and incidents on this line can cause major delays. While there are three railway bridges crossing the crossing Brisbane River Merivale Bridge is the only rail bridge serving inner Brisbane. Merivale Bridge is close to operating at capacity and alternative river crossings will be needed to sustain projected growth in rail travel.

The South East Busway is a bus-only corridor running from the inner city to Eight Mile plains 15km south east of the Brisbane CBD. The inner sections of the South East Busway are operating at capacity and there is limited surface capacity to increase bus travel.

Inner city rail stations such as Roma street station and Central station are overcrowded. The capacity of Fortitude Valley and Bowen hills rail station is limited by single platforms and contributes to problems in operating the rail system.

As part of the Brisbane inner city rail solution the Queensland Government has announced a proposed 5km bus and train tunnel crossing the CBD from north to south from Spring Hill to Dutton Park. In September 2014 detailed design works and the environmental impact statement for the project were published.

Brisbane has historically lacked an efficient road system bypassing the inner city. This has forced motorists to travel through the inner city. Brisbane City's TransApex project is aimed at providing a bypass for traffic that would otherwise travel through the inner City. The TransApex project consists of five mostly underground road projects to alleviate road congestion in the inner city.

6.2 Regulation, policy and governance context

Urban transport in Brisbane-South-East-Queensland is planned and regulated by state and local governments. Among the local councils, the Brisbane City Council has a larger role relative to most other Australian local councils - it plans and delivers bus and ferry services in addition to some major road infrastructure.

Key issues in Brisbane-South-East-Queensland urban transport include market testing and contracting of public transport.

6.2.1 Planning

The South East Queensland Regional Plan 2009-2031 is the pre-eminent planning instrument for Brisbane-South-East-Queensland, an area comprising 11 local councils. This plan is currently being reviewed. Two additional documents that will inform policy and planning are the recently-released Queensland Plan (launched July 2014) and the Queensland Government's response (released September 2014) to the Queensland Plan.

The Department of Transport and Main Roads (DTMR) is responsible for developing transport policy, planning strategic transport investment, and managing and delivering an integrated transport network.

The Transport Coordination Plan 2008-2018 guides the planning and operations of the Department of Transport and Main Roads, and the current investment program is laid out in the Queensland Transport and Roads Investment Program 2014-15 to 2017-18.

Translink, a division of DTMR, coordinates planning by working with state government departments and local councils to deliver public transport services and infrastructure in their areas. Translink is also responsible for short-term planning of passenger transport (Queensland Commission of Audit, 2013).

Local councils plan local road networks in their local areas. The Brisbane City Council also plans for bus services and ferry services in conjunction with Translink.

6.2.2 Regulation

The Department of Transport and Main Roads is responsible for regulating the transport system and local councils are responsible for regulating local road networks in their areas. Translink is responsible for the regulation of passenger transport.

Translink sets rail passenger fares and DMR estimates that passenger fares cover approximately 30 per cent of the cost of providing passenger rail services.

In addition, there are “no publicly stated principles on which fares are set” and there is no process for independent review of the operating costs of passenger rail (Queensland Commission of Audit, 2013).

6.2.3 Funding

Urban transport in Queensland is funded from a combination of grants/subsidies from all levels of government and user charges.

Translink is funded by a combination of fares and government subsidies. Passenger revenues account for approximately 24 per cent of Translink's costs of contracting passenger services across Queensland (Queensland Commission of Audit, 2013).

6.2.4 Service delivery

The Department of Transport and Main Roads is responsible for delivering and maintaining regional roads and train lines. Local councils are responsible for delivering and maintaining local roads in their area.

Translink is responsible for delivering bus, train, ferry and trams across South East Queensland. Translink does this by purchasing public transport services from providers including Queensland Rail, the Brisbane City Council (for bus and ferry services in Brisbane) and bus service providers more widely.

The Brisbane City Council contracts out the operation and maintenance of its ferry services (CityCat, CityFerry and CityHopper) to Transdev, a private firm. The council also operates an on-demand bike hire service in Brisbane.

6.3 Current network capacity, utilisation and congestion

6.3.1 Capacity

Table 57 provides an overview of the road network capacity in the Brisbane-South-East-Queensland area.

Table 57 **Road network capacity – 2010-11 – Brisbane-South-East-Queensland**

Road network	Capacity	Capacity
	VKT per day	kms of road
Road network	457,374,113	22,764

Source: ACIL Allen Consulting, 2014

Table 58 shows the network capacity for the public transport network in the Brisbane-South-East-Queensland area.

Table 58 **Public transport network capacity – 2010-11 – Brisbane-South-East-Queensland**

Public Transport Networks	Capacity	Capacity
	Passenger seat kms per day	Passenger crush kms per day
Rail network	16,494,696	33,676,233
Bus network	12,753,276	18,421,399
Ferry network	487,447	584,990
Light rail network	-	-

Source: ACIL Allen Consulting, 2014

Brisbane-South-East-Queensland's city rail network connects the inner city of Brisbane to the Gold Coast and Sunshine Coast spanning a north to south distance of more than 100km. Trains provide the highest capacity public transport in the Brisbane-South-East-Queensland region. Brisbane's ferries operate only within a small area and provide only a low capacity of public transport services in comparison to the bus and rail network. The table above shows the capacity of public transport networks in 2010-11 and does not include the Gold Coast Light rail which commenced operation in July 2014.

6.3.2 Utilisation and congestion

Table 59 provides an overview of utilisation and congestion in the road network of the Brisbane-South-East-Queensland area.

Table 59 **Road network utilisation and congestion Brisbane-South-East-Queensland**

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
Road Network	83,745,007	36%	18%	17%	1,914

Source: ACIL Allen Consulting, 2014

Aggregate delay costs on the road network in the Brisbane-South-East-Queensland region were over $3.8 billion in 2010-11. Across the network delays added around 17 per cent to the average travel time.

Table 60 shows the overall utilisation public transport networks in the Brisbane-South-East-Queensland area.

Table 60 **Public transport network utilisation and congestion Brisbane-South-East-Queensland**

Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
	passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
Rail network	4,320,496	46%	22%	26%	13%
Bus network	3,214,913	34%	24%	25%	17%
Ferry network	75,928	19%	16%	16%	13%

Source: ACIL Allen Consulting, 2014

The train network in the Brisbane-South-East-Queensland region is highly utilised. Across the train network the utilisation of seated capacity during the morning peak is higher than on the bus network.

6.4 Current network Direct Economic Contribution

The DEC represents the contribution of the urban transport infrastructure to the gross domestic product (GDP).

6.4.1 Aggregate DEC

Total DEC from Urban transport in the Brisbane-South-East-Queensland region in 2011 was $13,075 million in 2010-11.

6.4.2 DEC by mode

Table 61 provides an overview of the DEC by transport for the Brisbane-South-East-Queensland area.

Table 61 **Urban transport DEC by transport mode – 2010-11 – Brisbane-South-East-Queensland**

Mode	DEC
	$m
Car	11,429
LCV	528
HCV	516
Rail	190
Bus	398
Ferries	14
Light Rail	-
Total	**13,075**

Source: ACIL Allen Consulting, 2014

In 2010-11 car travel had the highest DEC of all urban transport modes in the Brisbane-South-East-Queensland area. In the public transport sector buses had a higher DEC than trains despite the higher utilisation in terms of VKT on the train network. This is because passengers spend more time travelling on buses an indication that bus services are delayed by road congestion.

6.4.3 Reconciliation with macro-economic data

Table 62 provides a comparison of estimates of DEC of urban transport infrastructure in the Brisbane-South-East-Queensland area using a bottom-up and using a top-down approach. The columns to the right of Table 62 show estimates of the DEC of urban transport infrastructure based on household expenditure and national accounts statistics i.e. the top-down estimates. The columns to the left of Table 62 show estimates of DEC from urban transport infrastructure based on modelled transport activity data i.e. the bottom-up estimates.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements.

The macro reconciliation is aiming to provide a broad indication as to whether the results of the bottom-up modelling reconcile with macro-economic data. National account statistics available at the time of writing this report were available on the basis of statistical divisions (SD's). SDs were used as a basic geographical unit for understanding and interpreting the geographical context of statistics published by the ABS before 2011. Generally SDs are broadly consistent with the GCCSA; detailed mapping of the SDs and their consistency with the GCCSAs can be found on the ABS website[12]. To reduce the potential mismatch between the national account statistics provided on a SD basis and the bottom-up modelling results the macro data has been scaled to the population of the relevant bottom-up modelling areas.

[12] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1216.0July%202011?OpenDocument

Table 62 **Macro-reconciliation – DEC of urban transport infrastructure 2010-11 – Brisbane-South-East-Queensland area**

DEC (Based on transport simulation modelling)					DEC (Based on national statistics)				
	Brisbane	Gold Coast	Sunshine Coast	Total		Brisbane	Gold Coast	Sunshine Coast	Total
Car/private vehicle	8,977	1,333	1,119	**11,429**	Household private vehicle expenditure	7,541	1,833	1,148	**10,522**
LCV	432	51	45	**528**	Road transport (freight)	2,398	409	232	**3,039**
HCV	431	42	42	**516**	Rail transport (freight)	1,508	18	15	**1,541**
Rail	149	22	19	**190**	Rail (household expenditure)	64	9	6	**79**
Bus	312	46	39	**398**	Bus/tram/light rail (household expenditure)	144	23	14	**181**
Brisbane Ferries	14	0	0	**14**	Ferry (household expenditure)	10	3	2	**15**
Total	**10,316**	**1,495**	**1,264**	**13,075**	**Total**	**11,664**	**2,296**	**1,417**	**15,377**

Source: ACIL Allen Consulting, 2014

The overall estimates of DEC of urban transport infrastructure in the Brisbane-South-East-Queensland area are relatively close. Overall the estimated DEC using the top-down approach is 17 per cent higher than the bottom-up approach.

The biggest difference between the top-down and bottom-up estimates of the DEC of urban transport infrastructure lies in the estimates of the DEC of freight services. The bottom-up estimates of the DEC of freight services do not include rail freight. In the bottom-up model the DEC from road freight is based on estimated freight movements on the roads within the study area. In the top-down model the DEC of freight services is calculated based on the gross value added of freight services from national account statistics. The national account statistics account for freight services at the point where contracts for freight movements are struck. As such contracts tend to be struck in the city and since the study area covers a largely urban area the top-down DEC estimates of road freight transport tend to be higher in the top-down model than in the bottom-up model.

The DEC estimates of public transport infrastructure in the top-down model are based on household expenditure survey data in which households report expenditure on public transport fares. The bottom-up model of the DEC from public transport accounts for the fares spend on public transport as well as the value of time spent travelling. As a result the estimates of DEC from public transport tend to be higher in the bottom-up model than in the top-down.

6.5 Demand analysis by origin/destination

6.5.1 Overview of demand analysis

The demand analysis assesses the value (measured as DEC) of journeys from combinations of origins and destinations.

The demand analysis is distinguished from other levels of analysis as it shows the demand for mobility (the value that is placed on trips that transport people or goods from one SA3 to another) as opposed to the value that is being derived from use of a physical network or infrastructure component.

A significant proportion of this demand (20.2% of road journeys and 11.2% of public transport journeys in Brisbane) is within each SA3 (i.e. where the SA3 is both the origin and destination). The focus of this demand analysis however, is on infrastructure connecting separate origins and destinations. Specifically, the DEC of road journeys and public transport for combinations of different SA3 origins and destinations, for the GCCSA area, is shown in the form of 'heat-map' matrices.

6.5.2 Roads

Overview of DEC for all origin-destination pairs

Figure 53 shows the DEC for all origin-destination pairs in 2010-11 in the Brisbane GCCSA. Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys originating in the SA3 'Brisbane Inner' whereas the first column shows the DEC of trips ending in the SA3 'Brisbane Inner'. The DEC is colour coded from green to red where green indicates a low DEC and red indicates a high DEC. The right hand side of the figure provides an overview range of the DEC values across the matrix. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure 53 **Roads – origin-destination pairs – DEC 2011 – Brisbane GCCSA**

SA3 Origin / Destination	Brisbane Inner	Brisbane Inner - East	Brisbane Inner - North	Brisbane Inner - West	Bald Hills - Everton Park	Chermside	Nundah	Sandgate	Wynnum - Manly	Capalaba	Holland Park - Yeronga	Carindale	Mt Gravatt	Cleveland - Stradbroke	Nathan	Sunnybank	Rocklea - Acacia Ridge	Sherwood - Indooroopilly	Centenary	Kenmore - Brookfield - Moggill
Brisbane Inner		12.7	28.3	17.3	6.0	16.4	24.0	5.8	16.6	12.1	23.4	12.5	15.1	9.8	10.8	5.7	13.4	14.0	5.5	11.8
Brisbane Inner - East	13.3		7.1	4.0	0.9	2.8	4.2	1.0	11.0	4.7	10.5	9.5	5.6	2.9	3.3	1.4	3.7	3.1	0.9	1.6
Brisbane Inner - North	28.2	6.9		18.5	8.9	29.4	31.4	9.5	10.3	5.8	12.1	6.2	7.0	4.8	5.0	2.7	7.2	10.7	4.1	7.8
Brisbane Inner - West	17.5	3.9	17.8		4.1	9.2	9.5	3.0	4.7	3.3	8.7	3.9	5.4	2.6	3.7	2.0	4.8	13.3	4.4	8.9
Bald Hills - Everton Park	6.1	0.9	9.1	4.2		15.7	8.2	7.9	1.5	0.8	2.0	0.8	1.2	0.6	0.8	0.3	1.0	2.2	0.7	1.1
Chermside	16.6	2.8	29.8	9.4	15.3		28.4	17.8	6.3	3.0	5.3	2.6	3.2	2.5	2.3	1.1	3.6	4.9	1.9	3.6
Nundah	23.9	4.3	31.9	9.7	8.1	28.3		16.1	14.5	6.3	7.8	4.5	5.5	6.6	3.7	2.3	7.4	6.7	2.8	4.7
Sandgate	5.8	1.1	9.7	3.0	7.8	18.1	16.4		2.7	1.3	2.1	1.2	1.3	1.0	0.8	0.4	1.1	1.8	0.6	0.9
Wynnum - Manly	16.5	11.1	10.1	4.6	1.5	6.2	14.1	2.6		24.1	11.56	17.4	13.7	12.6	6.0	3.2	10.6	3.7	1.2	1.7
Capalaba	12.3	4.7	5.8	3.3	0.8	3.0	6.2	1.3	24.2		8.5	11.0	13.2	32.2	4.6	2.8	5.6	3.2	1.0	1.2
Holland Park - Yeronga	24.0	10.5	12.3	8.7	2.0	5.3	7.7	2.1	11.5	8.5		14.3	18.5	6.4	13.5	5.4	12.9	9.7	3.6	5.3
Carindale	12.7	9.5	6.2	4.0	0.8	2.5	4.3	1.2	17.4	11.1	14.4		15.6	6.4	5.2	2.8	4.7	3.4	1.1	1.9
Mt Gravatt	15.5	5.7	7.2	5.4	1.2	3.2	5.2	1.3	13.8	13.1	18.8	15.6		10.7	15.8	13.7	16.9	5.5	3.0	3.0
Cleveland - Stradbroke	9.8	2.8	4.7	2.6	0.6	2.4	6.5	0.9	12.6	32.2	6.5	6.3	10.7		4.3	2.3	5.9	2.9	0.9	0.8
Nathan	10.9	3.3	5.0	3.7	0.8	2.3	3.7	0.8	6.0	4.6	13.6	5.2	15.8	4.3		7.1	17.0	6.5	3.2	3.2
Sunnybank	5.7	1.4	2.8	2.0	0.3	1.1	2.2	0.4	3.2	2.8	5.5	2.7	13.9	2.4	7.2		14.6	2.7	1.5	1.1
Rocklea - Acacia Ridge	13.4	3.7	7.2	4.8	1.0	3.6	7.2	1.1	10.6	5.7	13.0	4.6	17.0	5.9	17.1	14.7		8.7	5.4	4.3
Sherwood - Indooroopilly	13.9	3.0	10.2	13.2	2.1	4.7	6.5	1.8	3.7	3.2	9.6	3.4	5.5	2.8	6.4	2.7	8.6		9.0	17.0
Centenary	5.7	0.9	4.0	4.6	0.6	1.9	2.7	0.6	1.2	1.0	3.5	1.1	3.0	0.9	3.2	1.5	5.4	9.7		6.6
Kenmore - Brookfield - Moggill	11.7	1.5	7.6	9.0	1.1	3.5	4.6	0.9	1.7	1.1	5.3	1.8	3.0	0.8	3.3	1.1	4.3	17.6	6.6	
The Gap - Enoggera	14.3	2.0	17.3	13.0	6.7	13.7	8.9	3.6	2.7	1.5	4.9	2.1	2.9	1.1	2.0	1.0	2.6	5.9	2.0	4.2
Springwood - Kingston	10.2	2.8	4.9	3.4	0.7	2.2	4.7	1.0	9.3	8.5	8.1	5.5	22.8	9.7	7.7	12.4	19.1	3.5	1.7	1.6
Loganlea - Carbrook	7.6	1.7	3.4	2.4	0.5	1.5	3.4	0.6	5.3	5.2	5.0	3.1	10.3	10.3	4.0	4.3	8.9	2.1	0.9	0.8
Beenleigh	3.6	0.8	1.6	1.1	0.2	0.8	2.0	0.3	2.5	2.2	2.3	1.4	4.3	4.4	1.9	1.8	3.8	1.1	0.4	0.3
Browns Plains	7.4	1.6	3.5	2.4	0.5	1.6	3.6	0.6	5.0	3.5	5.4	2.8	9.4	3.7	6.7	7.3	24.9	3.6	2.3	1.7
Jimboomba	5.8	0.8	2.4	1.7	0.2	1.1	2.2	0.3	2.3	1.7	3.3	1.7	5.1	1.5	3.7	2.6	8.9	2.9	1.5	0.8
Beaudesert	1.6	0.3	0.7	0.4	0.1	0.3	1.1	0.1	0.8	0.5	0.9	0.5	1.2	0.6	1.0	0.6	2.3	0.7	0.3	0.2
Ipswich Inner	8.0	1.7	5.5	5.0	0.8	2.6	5.6	0.7	3.2	1.6	6.0	1.9	4.7	1.5	5.2	1.9	10.3	7.8	5.5	7.3
Springfield - Redbank	8.1	1.6	5.0	4.9	0.7	2.4	3.9	0.6	3.2	1.6	6.6	1.8	5.1	1.4	6.0	2.2	12.5	8.9	7.7	4.5
Forest Lake - Oxley	10.2	2.7	6.2	6.1	1.1	2.9	4.7	0.9	5.7	3.0	9.7	2.9	8.7	2.8	10.0	5.7	25.0	14.9	14.6	7.6
Ipswich Hinterland	7.6	1.2	4.7	3.6	0.6	2.4	4.5	0.5	2.2	1.4	4.7	1.6	4.1	1.0	4.2	1.4	7.4	6.0	3.4	2.6
Ormeau - Oxenford	6.3	1.4	3.5	2.1	0.4	1.6	5.2	0.6	5.8	3.8	4.1	2.5	6.7	6.8	3.2	2.4	6.8	2.0	0.7	0.6
Strathpine	4.7	0.9	6.8	2.9	7.7	11.7	8.7	10.4	3.4	1.0	1.9	0.9	1.1	0.9	0.9	0.3	2.0	1.9	0.6	1.1
North Lakes	4.9	0.8	6.1	2.4	4.5	9.4	8.1	8.2	1.9	0.9	1.6	0.9	1.0	0.7	0.7	0.3	0.9	1.7	0.4	0.7
Hills District	15.5	1.9	17.8	9.3	12.1	24.9	14.7	9.5	3.3	1.5	5.1	2.1	3.1	1.1	2.2	0.8	2.8	5.8	1.6	2.4
Redcliffe	3.9	0.8	5.5	1.8	3.1	7.5	9.5	9.8	2.7	1.1	1.4	1.0	1.1	0.8	0.7	0.3	1.2	1.2	0.3	0.6
Narangba - Burpengary	4.0	0.7	5.6	2.2	2.9	7.8	8.0	5.5	2.5	0.9	1.6	0.9	1.1	0.7	0.7	0.3	1.3	1.9	0.4	0.5
Caboolture	2.7	0.6	3.9	1.5	2.1	5.2	6.3	3.8	2.0	0.7	1.1	0.7	0.8	0.6	0.6	0.2	1.0	1.2	0.4	0.5
Bribie - Beachmere	1.6	0.3	2.1	0.8	0.8	2.5	3.4	1.5	0.8	0.4	0.6	0.3	0.4	0.2	0.3	0.1	0.4	0.7	0.2	0.1

SA3 Origin / Destination	The Gap - Enoggera	Springwood - Kingston	Loganlea - Carbrook	Beenleigh	Browns Plains	Jimboomba	Beaudesert	Ipswich Inner	Springfield - Redbank	Forest Lake - Oxley	Ipswich Hinterland	Ormeau - Oxenford	Strathpine	North Lakes	Hills District	Redcliffe	Narangba - Burpengary	Caboolture	Bribie - Beachmere
Brisbane Inner	14.1	9.9	7.8	3.6	7.5	5.9	1.6	8.1	8.0	10.3	7.8	6.4	4.7	4.8	15.2	3.9	4.0	2.8	1.8
Brisbane Inner - East	2.0	2.7	1.7	0.8	1.6	0.8	0.3	1.7	1.6	2.7	1.2	1.4	0.9	0.8	1.9	0.8	0.8	0.6	0.3
Brisbane Inner - North	17.1	4.8	3.4	1.7	3.5	2.5	0.7	5.7	5.1	6.3	4.8	3.5	6.7	6.1	17.6	5.4	5.6	3.9	2.1
Brisbane Inner - West	12.6	3.4	2.4	1.1	2.5	1.7	0.4	5.0	4.8	6.0	3.7	2.1	2.9	2.4	9.1	1.8	2.2	1.5	0.8
Bald Hills - Everton Park	6.7	0.7	0.5	0.2	0.5	0.2	0.1	0.8	0.8	1.1	0.6	0.4	7.6	4.5	12.0	3.0	2.9	2.1	0.8
Chermside	13.7	2.1	1.5	0.8	1.6	1.1	0.3	2.7	2.4	2.9	2.4	1.6	11.3	9.4	24.7	7.3	7.9	5.2	2.6
Nundah	8.9	4.7	3.5	2.0	3.7	2.3	1.1	5.8	4.0	4.9	4.6	5.2	8.4	8.2	14.6	9.6	8.1	6.4	3.5
Sandgate	3.6	0.9	0.6	0.3	0.6	0.3	0.1	0.7	0.6	0.9	0.5	0.6	10.1	8.0	9.4	9.7	5.4	3.7	1.5
Wynnum - Manly	2.6	9.0	5.3	2.4	5.0	2.4	0.8	3.3	3.2	5.8	2.2	5.7	3.3	1.9	3.3	2.7	2.5	2.0	0.8
Capalaba	1.5	8.3	5.2	2.2	3.5	1.7	0.5	1.7	1.6	3.0	1.4	3.8	1.0	0.9	1.5	1.1	0.9	0.8	0.4
Holland Park - Yeronga	4.9	7.9	5.1	2.4	5.4	3.3	0.9	6.2	6.6	9.7	4.8	4.2	1.9	1.7	5.2	1.4	1.6	1.1	0.6
Carindale	2.1	5.4	3.1	1.4	2.8	1.7	0.5	1.9	1.9	2.9	1.7	2.5	0.8	0.9	2.1	1.0	0.9	0.7	0.3
Mt Gravatt	3.0	21.8	10.1	4.3	9.2	5.1	1.2	4.8	5.1	8.6	4.2	6.6	1.1	1.0	3.1	1.1	1.1	0.8	0.4
Cleveland - Stradbroke	1.1	9.7	10.4	4.4	3.7	1.5	0.6	1.6	1.5	2.8	1.0	6.8	0.9	0.7	1.1	0.8	0.7	0.6	0.2
Nathan	2.0	7.5	4.0	1.9	6.7	3.7	1.0	5.3	5.9	9.9	4.3	3.2	0.9	0.7	2.2	0.7	0.8	0.6	0.3
Sunnybank	1.0	12.3	4.3	1.7	7.3	2.6	0.6	2.0	2.3	5.7	1.4	2.4	0.3	0.3	0.8	0.3	0.3	0.2	0.1
Rocklea - Acacia Ridge	2.6	18.9	8.9	3.8	25.0	9.0	2.4	10.4	12.4	24.9	7.5	6.8	1.9	0.9	2.8	1.2	1.3	1.0	0.4
Sherwood - Indooroopilly	5.8	3.5	2.1	1.1	3.6	2.9	0.7	7.7	8.4	14.3	6.0	2.0	1.8	1.7	5.7	1.2	1.8	1.2	0.7
Centenary	1.9	1.6	0.9	0.4	2.4	1.5	0.3	5.7	7.6	15.0	3.5	0.7	0.6	0.4	1.6	0.3	0.4	0.4	0.2
Kenmore - Brookfield - Moggill	4.1	1.6	0.8	0.3	1.7	0.8	0.2	7.4	4.5	7.7	2.6	0.6	1.1	0.7	2.4	0.5	0.5	0.5	0.1
The Gap - Enoggera		1.9	1.2	0.6	1.1	0.8	0.2	2.4	2.2	3.1	1.8	1.0	4.6	2.7	18.2	2.0	2.4	1.7	0.8
Springwood - Kingston	1.9		29.3	9.9	24.5	8.6	1.9	3.9	4.4	6.9	3.6	12.4	0.8	0.8	1.9	0.9	0.8	0.7	0.4
Loganlea - Carbrook	1.2	29.4		16.7	16.3	7.2	1.6	2.5	2.7	3.6	2.0	14.9	0.6	0.4	1.0	0.5	0.5	0.4	0.2
Beenleigh	0.6	9.9	16.8		6.8	4.7	1.3	1.2	1.2	1.7	0.9	16.8	0.2	0.2	0.4	0.2	0.2	0.2	0.1
Browns Plains	1.1	24.5	16.6	6.9		15.9	2.8	5.3	7.9	10.8	3.7	7.1	0.5	0.4	1.0	0.5	0.4	0.4	0.2
Jimboomba	0.8	8.6	7.2	4.7	15.9		4.8	4.2	6.2	5.3	1.8	6.4	0.3	0.2	0.4	0.3	0.1	0.2	0.1
Beaudesert	0.2	1.9	1.6	1.3	2.8	4.8		1.0	1.1	1.3	2.9	3.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0
Ipswich Inner	2.3	3.8	2.5	1.1	5.4	4.3	1.0		30.4	15.9	50.5	2.2	1.1	0.4	1.9	0.5	0.6	0.5	0.1
Springfield - Redbank	2.2	4.3	2.7	1.2	8.0	6.3	1.1	30.4		23.6	11.0	2.0	0.9	0.4	1.8	0.4	0.4	0.3	0.2
Forest Lake - Oxley	3.1	6.7	3.5	1.6	10.9	5.3	1.3	16.1	23.1		9.9	2.8	1.3	0.7	2.9	0.6	0.8	0.6	0.3
Ipswich Hinterland	1.8	3.5	2.0	0.9	3.7	1.8	2.9	50.5	10.9	9.8		2.1	1.0	0.5	1.3	0.5	0.5	0.9	0.2
Ormeau - Oxenford	1.0	12.4	14.8	16.6	6.9	6.4	3.0	2.2	2.0	2.8	2.2		0.6	0.4	0.9	0.6	0.5	0.5	0.2
Strathpine	4.6	0.9	0.6	0.2	0.5	0.3	0.1	1.1	0.9	1.3	1.0	0.6		15.7	23.8	7.2	10.1	5.7	2.3
North Lakes	2.7	0.7	0.4	0.2	0.4	0.2	0.0	0.4	0.4	0.7	0.5	0.4	15.7		9.1	13.6	16.5	9.1	2.8
Hills District	18.4	1.9	1.0	0.5	1.0	0.4	0.1	1.9	1.8	2.9	1.3	0.9	23.8	9.2		6.0	7.2	6.1	1.4
Redcliffe	2.0	0.9	0.5	0.2	0.5	0.3	0.1	0.5	0.4	0.6	0.5	0.6	7.2	13.6	6.0		14.4	7.3	2.6
Narangba - Burpengary	2.4	0.8	0.4	0.2	0.4	0.1	0.1	0.6	0.4	0.8	0.5	0.5	10.1	16.6	7.1	14.3		27.0	4.8
Caboolture	1.7	0.7	0.4	0.2	0.4	0.2	0.1	0.5	0.3	0.6	0.9	0.5	5.8	9.3	6.1	7.2	27.3		15.8
Bribie - Beachmere	0.8	0.3	0.2	0.1	0.2	0.1	0.0	0.1	0.2	0.3	0.2	0.2	2.2	2.8	1.4	2.5	4.7	15.9	

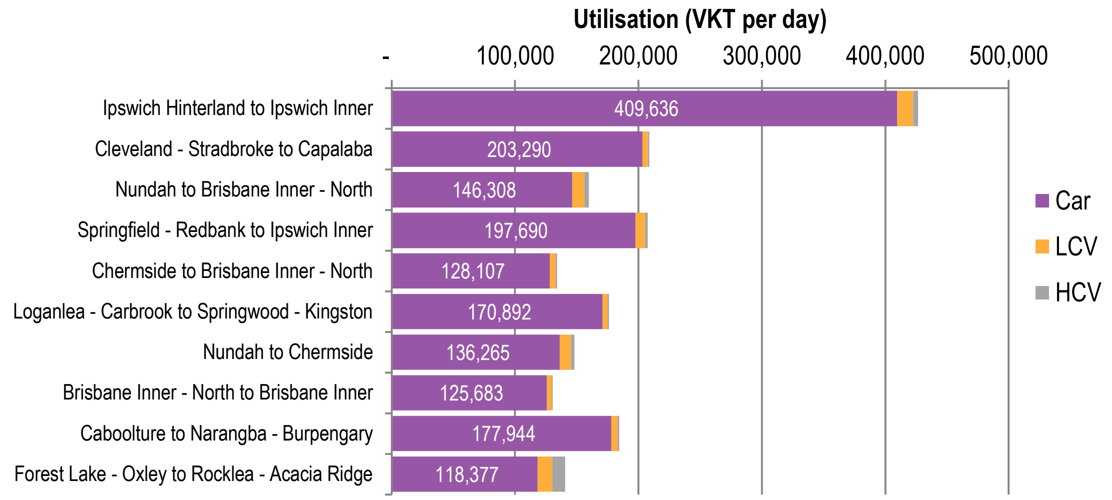
Source: ACIL Allen Consulting, 2014

Hot spots included trips to and from the central SA3s of 'Brisbane Inner' and 'Brisbane Inner North'. Trips to and from Airport contribute to a high DEC for trips to and from the 'Nundah' SA3 and the warehouse areas of the 'Chermside' SA3.

Utilisation for top 10 origin-destination trips

Figure 54 provides an overview of the ten origin-destination pairs with the greatest utilisation of the road network in the Brisbane GCCSA area in 2010-11.

Figure 54 **Roads – top ten origin-destination pairs – utilisation 2010-11 – Brisbane GCCSA**



Source: ACIL Allen Consulting, 2014

Journeys from the 'Ipswich Hinterland' to the 'Ipswich Inner' SA3 had the highest utilisation of the road network of origin-destination pairs in the Brisbane GCCSA. The high amount of VKT between the 'Ipswich Hinterland' and the 'Ipswich Inner' SA3 are largely due to the size of the 'Ipswich Hinterland' SA3 but also reflect the high reliance on car travel in this more regional area of the Brisbane GCCSA. Despite being comparatively small SA3s, journeys between the 'Brisbane Inner-North' SA3 and the 'Brisbane Inner' SA3 feature in the list of top ten origin-destination pairs in the Brisbane GCCSA. This indicates a high concentration of road travel activity in this area of the inner city.

DEC for top 10 origin-destination trips

Table 63 provides an overview of the ten origin-destination pairs with the greatest DEC in the Brisbane GCCSA area in 2011.

Table 63 **Roads – top ten origin-destination pairs – DEC 2011 – Brisbane GCCSA**

From	To	DEC
		$m
Ipswich Hinterland	Ipswich Inner	50.5
Cleveland - Stradbroke	Capalaba	32.2
Nundah	Brisbane Inner - North	31.9
Springfield - Redbank	Ipswich Inner	30.4
Chermside	Brisbane Inner - North	29.8
Loganlea - Carbrook	Springwood - Kingston	29.4
Nundah	Chermside	28.3
Brisbane Inner - North	Brisbane Inner	28.2
Caboolture	Narangba - Burpengary	27.3
Forest Lake - Oxley	Rocklea - Acacia Ridge	25.0

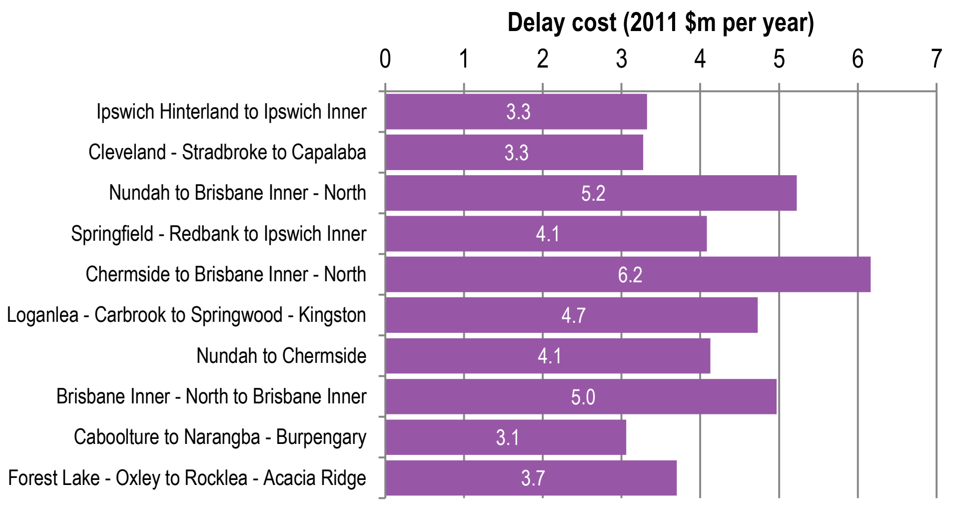
Source: ACIL Allen Consulting, 2014

The DEC of road travel is highest for journeys between the 'Ipswich Hinterland' and the 'Ipswich Inner' SA3. In total, road travel between the top ten origin-destination pairs in the Brisbane GCCSA has a DEC of $313 million.

Delay costs for top 10 origin-destination trips

Figure 14 shows the ten origin-destination pairs with the greatest delay cost in Brisbane GCCSA in 2011.

Figure 55 **Roads – top ten origin-destination pairs – delay cost 2011 – Brisbane GCCSA**



Source: ACIL Allen Consulting, 2014

For the top ten origin-destination pairs, delay costs are highest for trips between 'Chermside' and 'Brisbane Inner - North'. Airport trips contribute to a high delay cost for trips from the 'Nundah' SA3 to the 'Brisbane Inner - North' SA3.

DEC by cluster

Trips to the inner city areas make up a large proportion of the DEC of road travel in the Brisbane-South-East-Queensland region. To provide high level insights into car travel patterns for trips to the inner city regions within the Brisbane-South-East-Queensland area were grouped into clusters. SA3s within the Brisbane-South-East-Queensland area were grouped into clusters of areas with similar demographics and travel demand characteristics. Table 64 provides the clusters that were defined in the Brisbane-South-East-Queensland area.

Table 64 **Definition of clusters – Brisbane-South-East-Queensland**

Cluster	Regions
Inner City	Brisbane Inner
Inner East	Brisbane Inner - East
Inner North	Brisbane Inner - North
Inner West	Brisbane Inner - West
North	Bald Hills - Everton Park, Chermside, Nundah, Sandgate
East	Wynnum – Manly, Capalaba, Mt Gravatt, Cleveland - Stradbroke
South	Holland Park – Yeronga, Nathan, Sunnybank, Rocklea - Acacia Ridge
West	Sherwood – Indooroopilly, Kenmore - Brookfield – Moggill, The Gap – Enoggera,
South West	Centenary, Ipswich Inner, Springfield – Redbank, Forest Lake – Oxley, Ipswich Hinterland
Logan	Springwood – Kingston, Loganlea – Carbrook, Beenleigh, Browns Plains
Beaudesert	Jimboomba, Beaudesert
Far North	Strathpine, North Lakes, Hills District, Redcliffe, Narangba – Burpengary, Caboolture, Bribie - Beachmere
Gold Coast	Ormeau – Oxenford, Gold Coast – North, Southport, Surfers Paradise, Broadbeach – Burleigh, Coolangatta, Nerang, Mudgeeraba – Tallebudgera, Gold Coast Hinterland
Sunshine Coast	Caloundra, Buderim, Maroochy, Noosa, Nambour – Pomona, Caboolture Hinterland, Sunshine Coast Hinterland

Source: ACIL Allen Consulting, 2014

Table 65 provides an overview of the delay costs incurred by car transport in 2010-11 in the Brisbane-South-East-Queensland area for trips from the defined clusters to the inner city.

Table 65 **Car delay cost and DEC – 2010-11 – Brisbane-South-East-Queensland**

Cluster	Car delay cost	Car DEC	Car delay cost
	($m)	($m)	% of DEC
Inner City	2.27	22.56	10%
Inner East	3.29	12.76	26%
Inner North	4.97	26.77	19%
Inner West	4.10	16.91	24%
North	12.22	49.41	25%
East	15.93	62.21	26%
South	9.59	49.84	19%
West	11.15	38.76	29%
South West	10.21	36.86	28%
Logan	7.40	27.30	27%
Beaudesert	2.03	7.09	29%
Far North	9.28	35.19	26%
Gold Coast	2.88	15.67	18%
Sunshine Coast	0.94	7.27	13%

Source: ACIL Allen Consulting, 2014

The total cost of congestion for trips from clusters to the Inner City in 2010-11 was around $96 million or 23.6 per cent of the total DEC of car travel to the inner city. Congestion measured as a percentage of DEC was highest for trips from the 'West' cluster to the inner city.

6.5.3 Public transport

Overview of DEC for all origin-destination pairs

Figure 56 provides an overview of the DEC of public transport for all SA3 origin-destination pairs in the Brisbane GCCSA.

Figure 56 **Public transport – all origin-destination pairs – DEC 2011 – Brisbane GCCSA**

SA3 Origin / Destination	Brisbane Inner	Brisbane Inner - East	Brisbane Inner - North	Brisbane Inner - West	Bald Hills - Everton Park	Chermside	Nundah	Sandgate	Wynnum - Manly	Capalaba	Holland Park - Yeronga	Carindale	Mt Gravatt	Cleveland - Stradbroke	Nathan	Sunnybank	Rocklea - Acacia Ridge	Sherwood - Indooroopilly	Centenary	Kenmore - Brookfield - Moggill	The Gap - Enoggera	Springwood - Kingston	Loganlea - Carbrook	Beenleigh	Browns Plains	Jimboomba	Beaudesert	Ipswich Inner	Springfield - Redbank	Forest Lake - Oxley	Ipswich Hinterland	Ormeau - Oxenford	Strathpine	North Lakes	Hills District	Redcliffe	Narangba - Burpengary	Caboolture	Bribie - Beachmere
Brisbane Inner		6.4	9.3	5.8	3.4	6.8	3.8	4.0	6.5	4.6	8.5	8.0	8.9	6.9	5.2	5.0	7.2	5.7	4.1	8.1	6.0	4.0	3.0	1.4	4.3	0.7	0.1	3.6	2.9	5.5	1.6	2.4	2.1	2.4	6.3	2.0	2.8	1.6	0.8
Brisbane Inner - East	6.4		0.4	0.2	0.0	0.0	0.1	0.0	0.2	0.1	0.3	0.3	0.2	0.3	0.1	0.0	0.1	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brisbane Inner - North	8.9	0.3		0.9	0.4	1.4	0.6	0.6	0.4	0.2	0.7	0.3	0.4	1.1	0.3	0.2	0.3	0.9	0.2	0.3	0.6	0.2	0.2	0.1	0.1	0.0	0.0	0.2	0.2	0.4	0.1	0.1	0.3	0.3	0.6	0.2	0.3	0.2	0.1
Brisbane Inner - West	6.0	0.2	0.9		0.2	0.5	0.3	0.2	0.1	0.1	0.4	0.2	0.3	0.5	0.2	0.2	0.1	1.1	0.4	0.7	0.5	0.1	0.1	0.0	0.1	0.0	0.0	0.2	0.2	0.3	0.0	0.1	0.1	0.1	0.2	0.0	0.1	0.1	0.0
Bald Hills - Everton Park	3.8	0.0	0.5	0.2		0.4	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.5	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0
Chermside	7.0	0.1	1.5	0.5	0.4		0.4	0.5	0.1	0.0	0.2	0.1	0.2	0.5	0.1	0.0	0.1	0.6	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.4	0.1	0.1	0.0	0.0
Nundah	3.8	0.1	0.6	0.3	0.1	0.4		0.3	0.1	0.1	0.2	0.1	0.2	0.9	0.1	0.1	0.1	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Sandgate	4.2	0.0	0.7	0.2	0.2	0.6	0.3		0.1	0.0	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.2	0.1	0.1	0.0
Wynnum - Manly	6.2	0.2	0.4	0.1	0.0	0.1	0.1	0.0		0.2	0.23	0.3	0.3	0.7	0.2	0.1	0.1	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capalaba	4.5	0.1	0.2	0.1	0.0	0.0	0.1	0.0	0.2		0.2	0.2	0.3	1.7	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holland Park - Yeronga	8.8	0.3	0.6	0.4	0.1	0.2	0.2	0.1	0.3	0.2		0.7	0.9	0.9	0.5	0.3	0.4	0.5	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Carindale	8.1	0.3	0.4	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.7		0.6	1.0	0.3	0.1	0.1	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mt Gravatt	9.2	0.2	0.4	0.4	0.1	0.2	0.2	0.1	0.4	0.3	0.9	0.6		1.4	0.7	0.6	0.7	0.5	0.1	0.1	0.1	0.6	0.2	0.1	0.4	0.0	0.0	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Cleveland - Stradbroke	7.1	0.2	1.1	0.6	0.2	0.6	1.0	0.2	0.7	1.8	1.1	0.9	1.4		0.6	0.2	0.5	1.3	0.1	0.2	0.3	0.5	0.6	0.2	0.3	0.0	0.0	0.4	0.2	0.3	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.0
Nathan	5.3	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.2	0.8	0.7		0.3	0.4	0.3	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Sunnybank	5.1	0.0	0.2	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.3	0.1	0.7	0.2	0.3		0.4	0.5	0.0	0.0	0.1	0.2	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rocklea - Acacia Ridge	7.5	0.1	0.3	0.2	0.0	0.1	0.1	0.0	0.1	0.0	0.4	0.1	0.7	0.5	0.5	0.4		0.6	0.1	0.0	0.0	0.2	0.1	0.0	0.3	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sherwood - Indooroopilly	5.7	0.4	0.9	1.0	0.4	0.6	0.4	0.3	0.4	0.5	0.5	0.4	0.6	1.4	0.3	0.5	0.7		0.9	1.5	0.5	0.4	0.3	0.1	0.5	0.1	0.0	0.7	0.7	1.2	0.3	0.3	0.4	0.4	0.7	0.3	0.5	0.3	0.1
Centenary	4.1	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	1.0		0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kenmore - Brookfield - Moggill	8.3	0.0	0.4	0.9	0.0	0.1	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.2	0.1	0.0	0.1	1.6	0.1		0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
The Gap - Enoggera	6.3	0.1	0.7	0.6	0.1	0.3	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.3	0.1	0.0	0.0	0.6	0.0	0.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Springwood - Kingston	4.4	0.0	0.2	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.6	0.6	0.3	0.2	0.2	0.4	0.0	0.0	0.1		0.5	0.1	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loganlea - Carbrook	3.4	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.4	0.6	0.2	0.1	0.1	0.3	0.0	0.0	0.0	0.6		0.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beenleigh	1.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Browns Plains	4.5	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.3	0.2	0.2	0.4	0.5	0.0	0.0	0.0	0.5	0.5	0.0		0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jimboomba	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beaudesert	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ipswich Inner	3.6	0.0	0.3	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.1	0.0	0.0	0.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Springfield - Redbank	3.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3		0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest Lake - Oxley	5.8	0.0	0.3	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.4	0.1	0.3	0.5	0.3	0.1	0.3	1.2	0.3	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ipswich Hinterland	1.8	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ormeau - Oxenford	2.5	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Strathpine	2.1	0.0	0.2	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.2	0.2	0.1	0.1	0.1	0.0
North Lakes	2.4	0.0	0.2	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		0.0	0.3	0.1	0.1	0.0
Hills District	6.4	0.0	0.6	0.3	0.2	0.4	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	0.8	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1		0.1	0.0	0.0	0.0
Redcliffe	2.0	0.0	0.2	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0		0.3	0.1	0.0
Narangba - Burpengary	2.7	0.0	0.3	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2		0.3	0.0
Caboolture	1.7	0.0	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.3		0.3
Bribie - Beachmere	0.9	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	

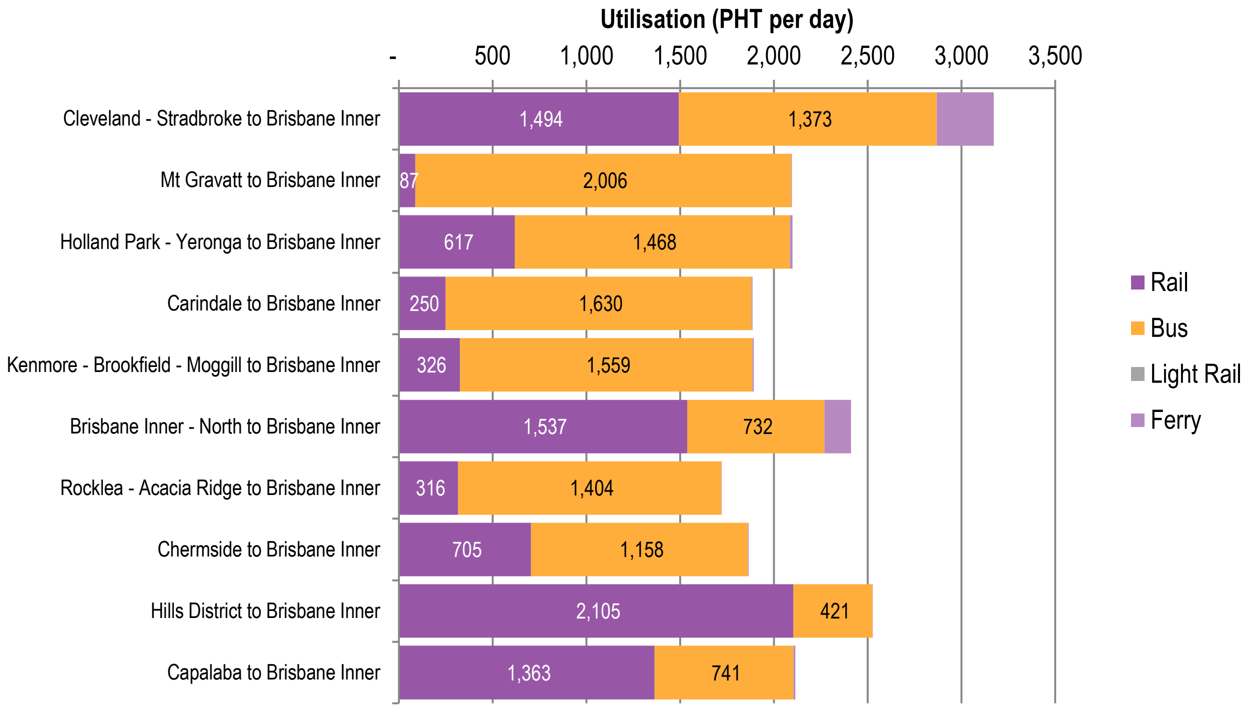
Source: ACIL Allen Consulting, 2014

Trips to and from the ‘Brisbane Inner’ SA3 dominate the matrix of DEC by origin-destination pair shown above. Other hot spots include trips to and from the ‘Cleveland - Stradbroke’ SA3 and the ‘Brisbane Inner North’ SA3.

Utilisation for top 10 origin-destination trips

Figure 57 provides an overview of the PHT on public transport for the top ten origin-destination pairs in Brisbane GCCSA in 2010-11.

Figure 57 **Public transport – top ten origin-destination pairs – utilisation 2011 – Brisbane GCCSA**



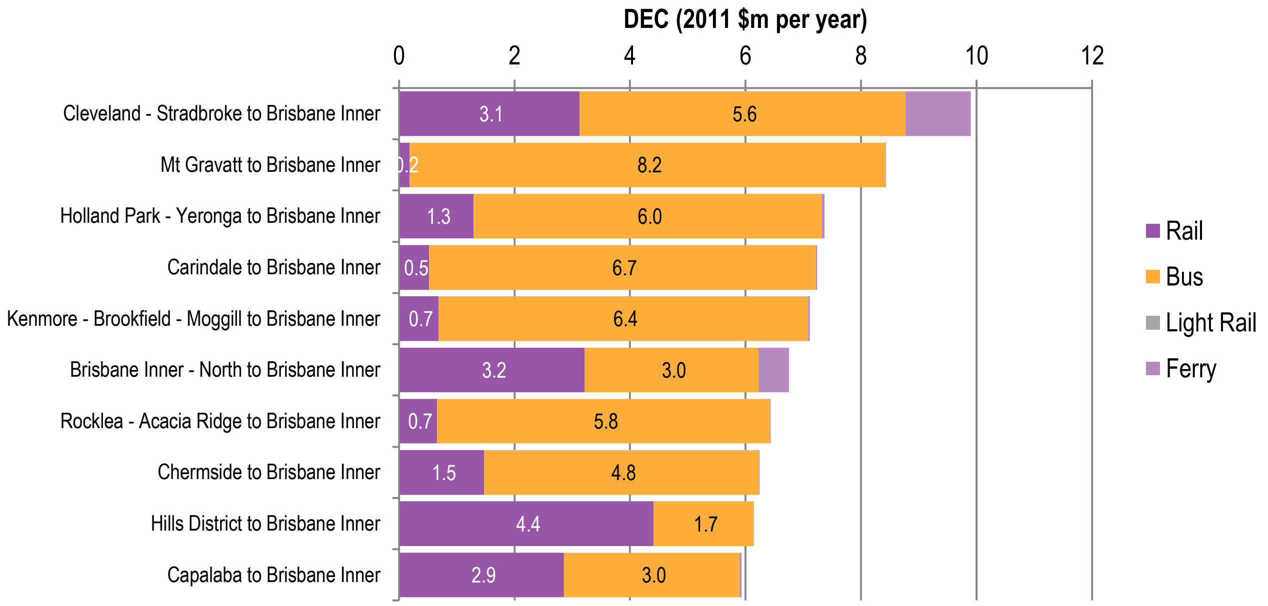
Source: ACIL Allen Consulting, 2014

The ten origin-destination pairs with the highest DEC from public transport in the Brisbane GCCSA all had the 'Brisbane Inner' SA3 as destination. PHT were highest for trips between 'Cleveland – Stradbroke' SA3 and the inner city. We note that there were a significant number of PHT from ferry trips between the 'Cleveland – Stradbroke' SA3 to the inner city although there are no direct ferry services operating between the two SA3s. The PHT on ferries between the 'Cleveland – Stradbroke' SA3 and the inner city account for trips where people drive to a ferry terminal and then use ferries for the one leg of the journey.

DEC for top 10 origin-destination trips

Figure 58 shows the ten origin-destination pairs which in 2011 had the highest DEC in the Brisbane GCCSA.

Figure 58 **Public transport – top ten origin-destination pairs – DEC 2011 – Brisbane GCCSA**



Source: ACIL Allen Consulting, 2014

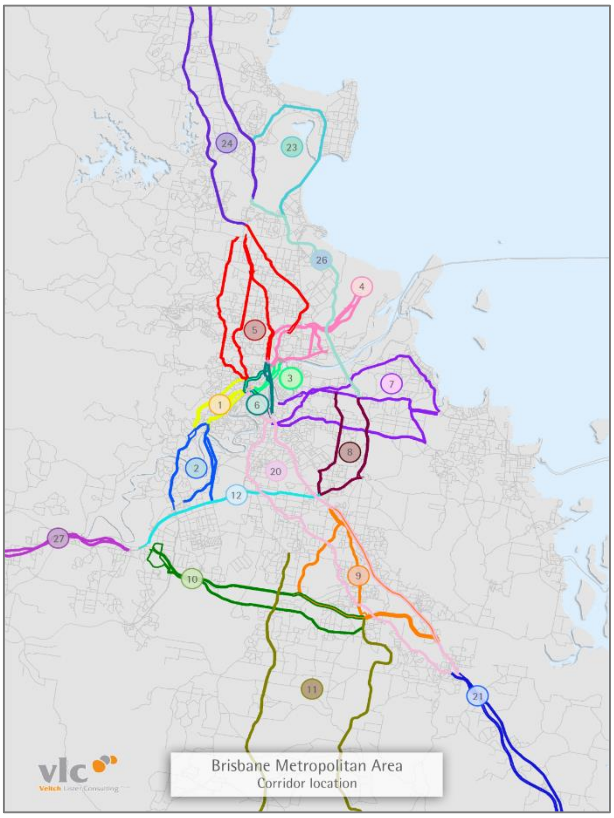
The majority of the DEC of urban transport infrastructure for the top ten origin-destination pairs in the Brisbane GCCSA is derived from bus transport. Overall trips from the 'Cleveland – Stradbroke' SA3 to the inner city had the highest DEC of all public transport trips in the Brisbane GCCSA. DEC from trips from Mt Gravatt south east of the city centre is dominated by the DEC from bus transport while the DEC of trips from the Hills District to the inner city mainly stems from rail travel.

6.6 Corridor analysis

The analysis of key transport corridors in the Brisbane-South-East-Queensland region provides more detailed insights than the analysis of origin-destination pairs. Corridors are defined to reflect some of the most commonly travelled journeys in the Brisbane-South-East-Queensland area. Corridors can include multiple routes travelling in parallel reflecting different choices for motorists to travel between certain destinations. The analysis of corridors is limited to the urban road network and does not include public transport.

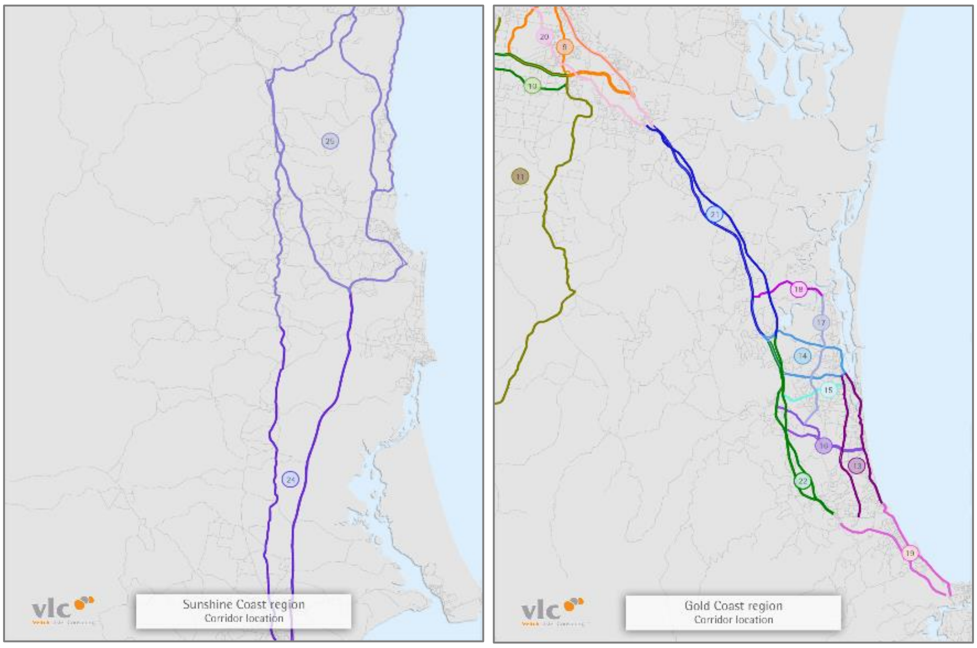
Figure 58 provides an overview of the 27 major transport corridors that are assessed in the Brisbane-South-East-Queensland area.

Figure 59 **Brisbane GCCSA urban transport corridors**



Source: VLC, 2014

Figure 60 **Sunshine and Gold Coast urban transport corridors**



Source: VLC, 2014

Table 66 **Brisbane-South-East-Queensland corridors**

Corridor	Description	Corridor	Description
1	Indooroopilly - City	20	Pacific Mwy | City - Beenleigh
2	Ipswich Mwy - Indooroopilly	21	Pacific Mwy | Beenleigh-Helensvale
3	Inner City | East - West	22	Pacific Mwy | Helensvale - Varsity Lakes
4	City - Airport	23	Redcliff
5	City - Brisbane North	24	North Brisbane - Sunshine Coast
6	Inner City | North - South	25	Sunshine Coast
7	Redland | East - West	26	Gateway Mwy North
8	Mt Gravatt - Gateway Mwy Bridge	27	Ipswich - Wacol
9	Logan River - Gateway Mwy	18	Paradise Point - Pacific Mwy
10	Logan Mwy | East - West	19	Burleigh Heads - Coolangatta
11	Beaudesert - Logan Mwy	20	Pacific Mwy | City – Beenleigh
12	Ipswich Mwy	21	Pacific Mwy | Beenleigh-Helensvale
13	Southport - Burleigh Heads	22	Pacific Mwy | Helensvale - Varsity Lakes
14	Helensvale - Southport	23	Redcliff
15	Nerang - Southport	24	North Brisbane - Sunshine Coast
16	Nerang - Broadbeach	25	Sunshine Coast
17	Paradise Point - Carrara	26	Gateway Mwy North
18	Paradise Point - Pacific Mwy	27	Ipswich - Wacol
19	Burleigh Heads - Coolangatta		

Source: ACIL Allen Consulting, 2014

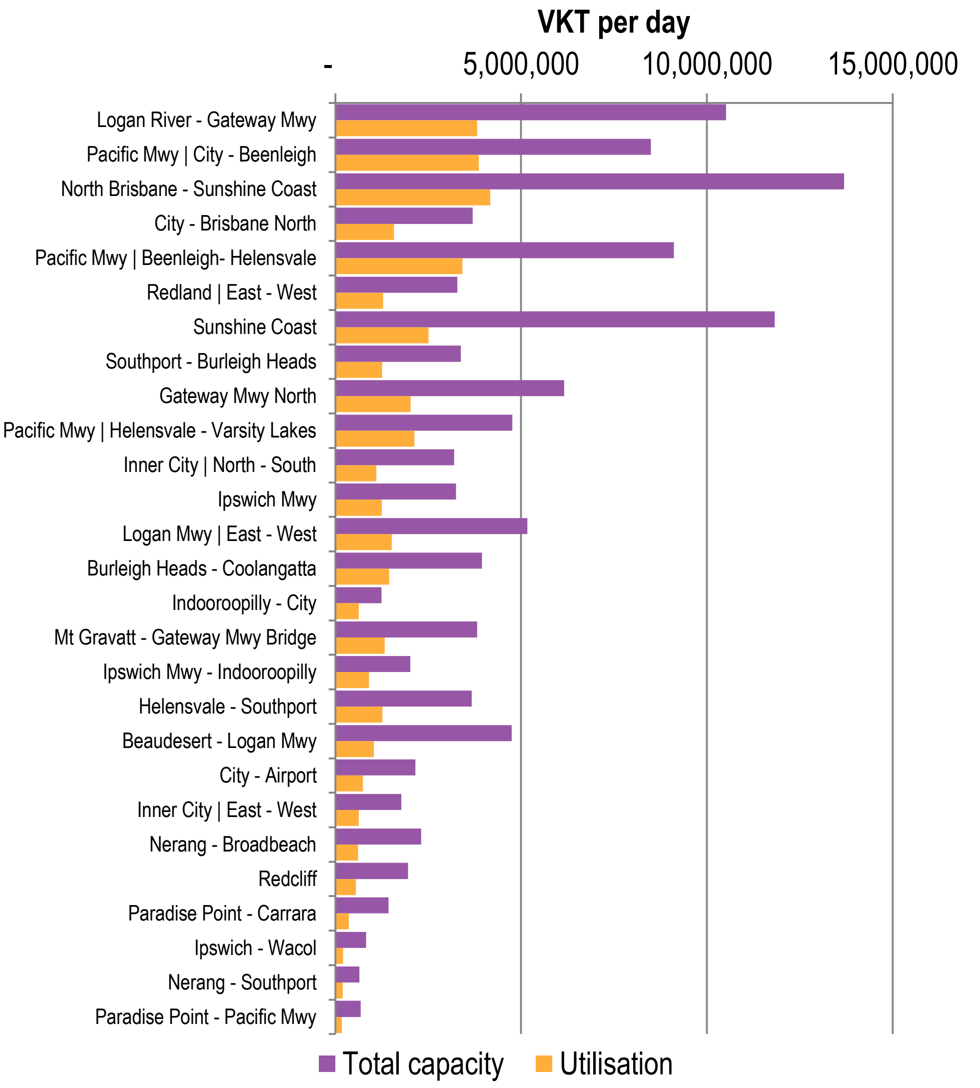
6.6.1 DEC of corridors

Corridor capacity and utilisation

The capacity of the selected corridors depends on the length of the corridor, the speed limits and the number of parallel routes that the corridor is made up by.

Figure 61 shows the capacity and utilisation of road corridors in the Brisbane-South-East-Queensland area in 2010-11. The graph shows the capacity of the road corridors in VKT per day with purple bars, the utilisation on a typical day is indicated with a yellow bar and the utilisation during the morning peak is shown through percentage figures.

Figure 61 **Transport corridors – Capacity and utilisation 2011 – Brisbane-South-East-Queensland**



Source: ACIL Allen Consulting, 2014

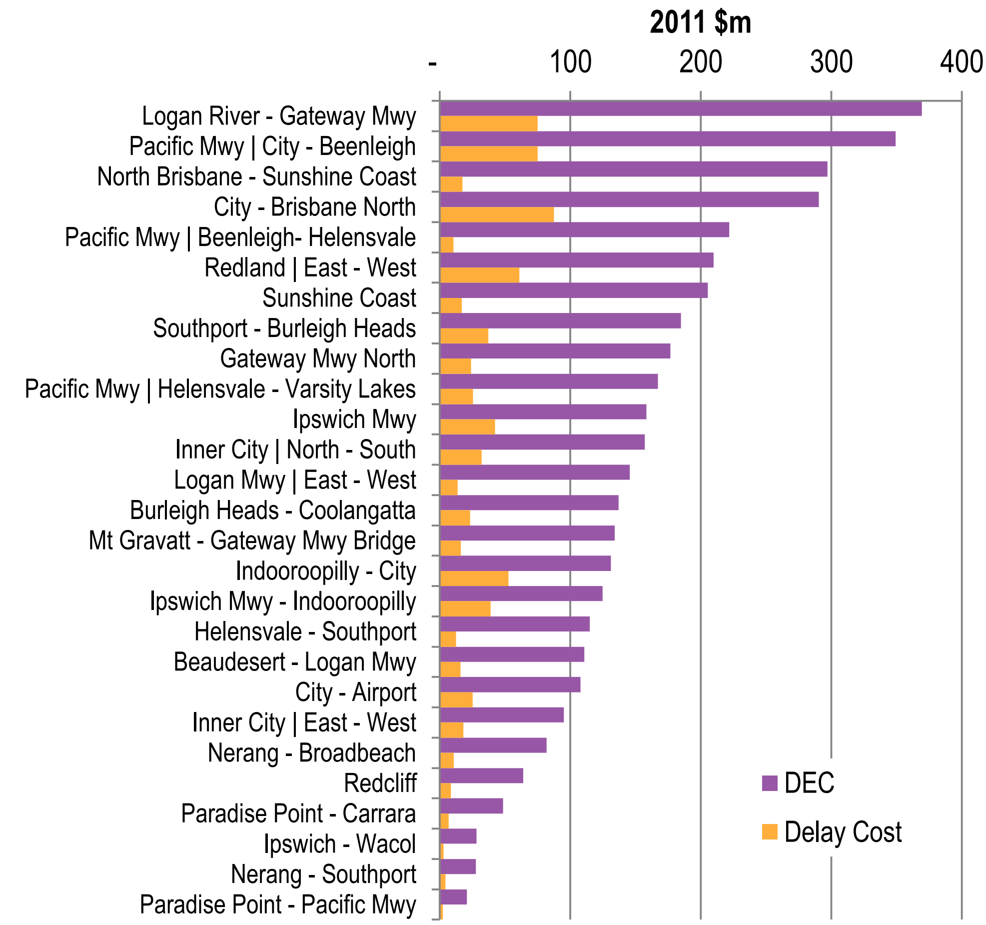
Of the selected corridors the 'North Brisbane – Sunshine Coast' corridor has the highest capacity. While the 'Sunshine Coast' corridor comprises more kilometres of road network its capacity is smaller than that of the 'North Brisbane – Sunshine Coast' corridor due to lower speed limits and fewer parallel lanes.

Utilisation across the selected corridors is high with utilisation during the morning peak above 80 per cent for the 'Indooroopilly – City' corridor.

Corridor DEC and delay costs

Figure 62 shows the DEC and utilisation of major transport corridors in the Brisbane-South-East-Queensland area.

Figure 62 **Transport corridors – DEC and delay cost 2010-11 – Brisbane-South-East-Queensland**



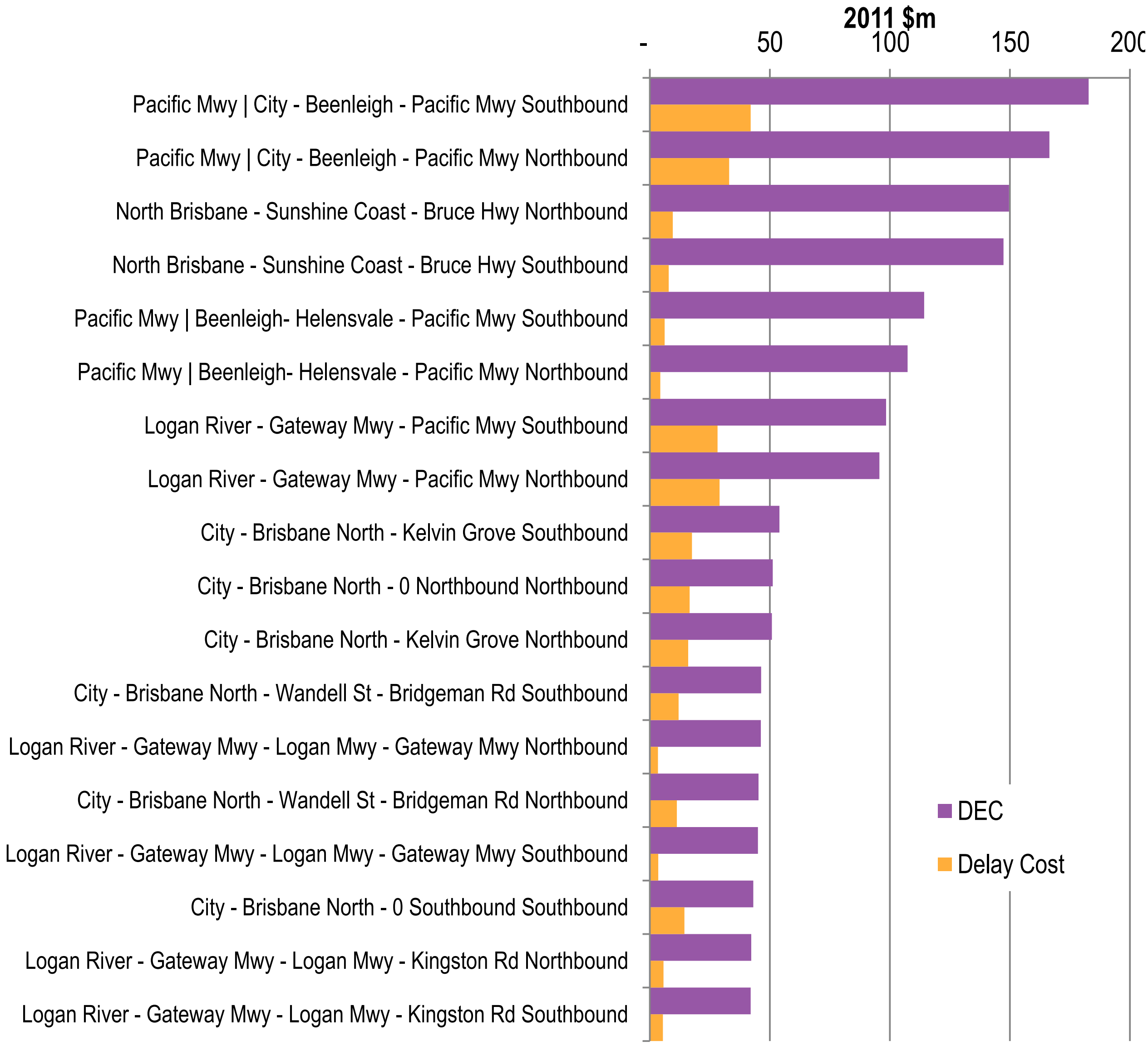
Source: ACIL Allen Consulting, 2014

Of the selected corridors the DEC in 2010-11 was highest for the 'Logan River – Gateway Mwy' with a DEC of $491 million and congestion cost of $99 million. Congestion cost were highest on the 'City - Brisbane North' corridor, reaching over $118 million in 2010-11.

6.6.2 Analysis of routes within major corridors

Figure 63 shows the DEC and delay costs of routes within the five corridors with the highest DEC in the Brisbane-South-East-Queensland area.

Figure 63 **Transport corridors – DEC and delay cost of routes within major corridors – Brisbane-South-East-Queensland**



Note: Shown are routes within the five corridors with the highest DEC.
Source: ACIL Allen Consulting, 2014

The DEC of the south bound corridor of the Pacific Motorway in 2010-11 reached levels of close to $250 million.

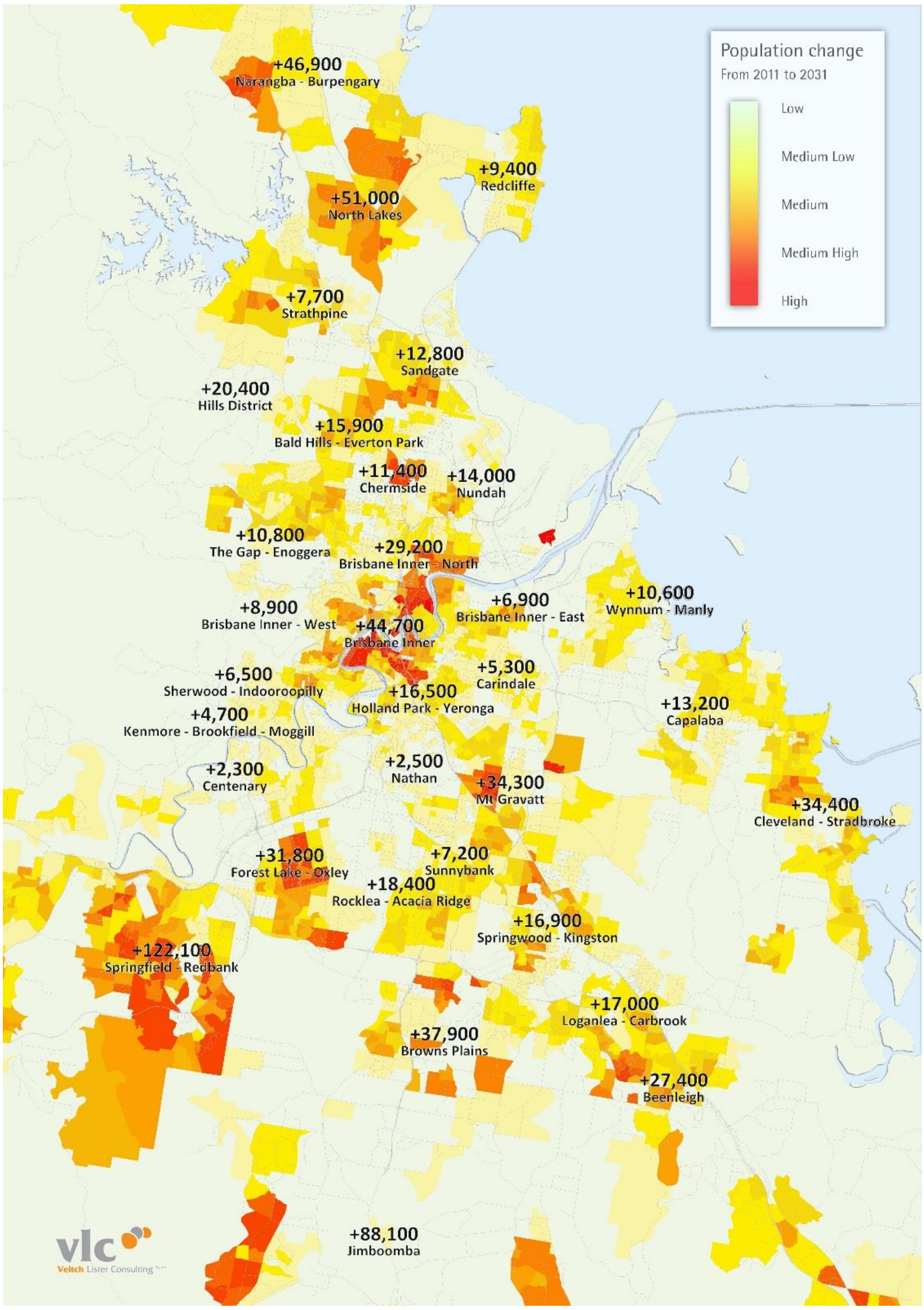
6.7 Projections for 2031

6.7.1 Demand drivers for urban transport

Projected population growth

The population of the Brisbane-South-East-Queensland area is projected to grow by 1.4 million people between 2010-11 and 2030-31. Figure 64 shows projected changes in population for Brisbane-South-East-Queensland area by transport zone.

Figure 64 **Projected population growth 2010-11 to 2030-31 – Brisbane-South-East-Queensland**



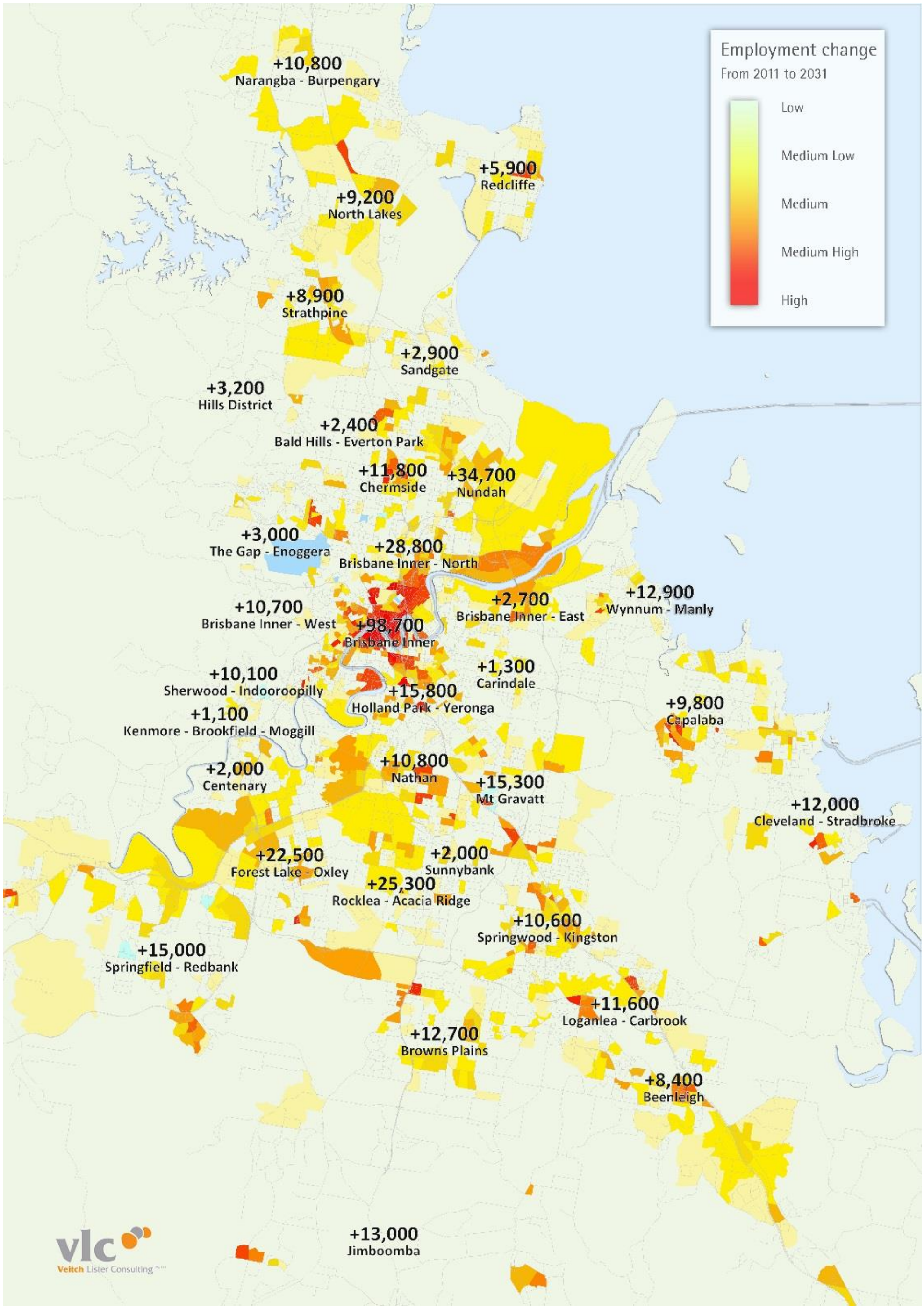
Source: (VLC, 2014)

The majority of projected population growth in the Brisbane-South-East-Queensland region is projected to occur within the Brisbane GCCSA. This includes the growth centres of 'Springfield - Redbank', 'Jimboomba' and 'Ormeau - Oxenford' in the south of the Brisbane GCCSA which is not shown on the map above.

Projected employment growth

Figure 65 shows projected employment growth in the Brisbane-South-East-Queensland area. Growth in employment is projected to be concentrated on the inner city area.

Figure 65 **Projected employment growth 2010-11 to 2030-31 – Brisbane-South-East-Queensland**



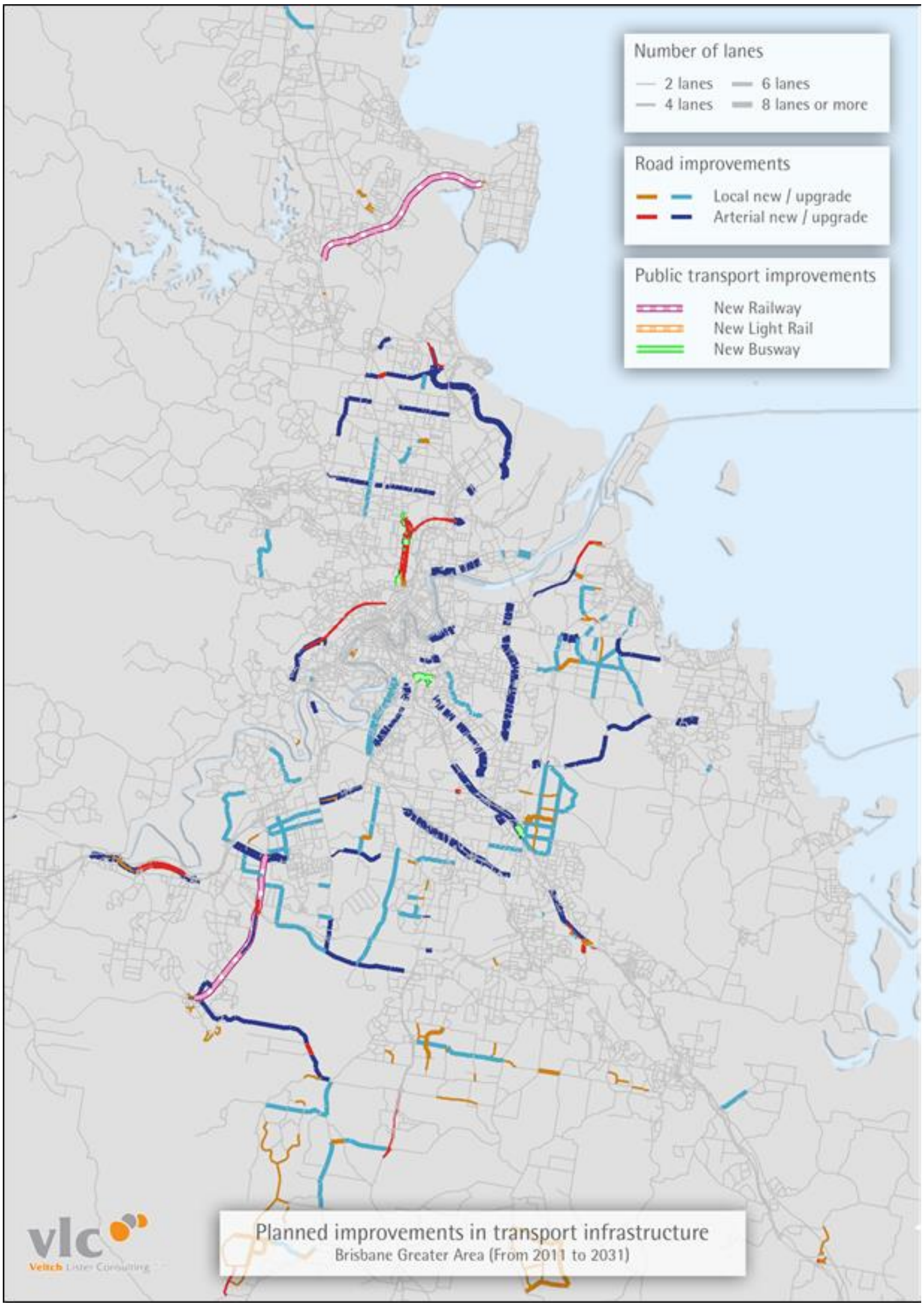
Source: (VLC, 2014)

While some 43,000 jobs are projected to be created in the population growth centre of 'Ormeau Oxenford' only 15,000 new jobs are projected to be created in the 'Springfield – Redbank' SA3. As a result the majority of workers in these two growth centres will have to travel to other suburbs, especially the inner city, to find work.

6.7.2 Planned expansion of urban transport infrastructure

Figure 66 gives an overview of assumed changes in rail and road infrastructure between 2010-11 and 2030-31. This includes projects that have already gone ahead at the time of writing this report.

Figure 66 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 – Brisbane GCCSA**



Source: (VLC, 2014)

Between 2010-11 and 2030-31 the Redcliffe rail extension and Richlands to Springfield rail project are assumed to have been completed.

Table 67 provides an overview of the key additions to the road transport system in the Brisbane-South-East-Queensland region that are assumed to go ahead between 2010-11 and 2030-31.

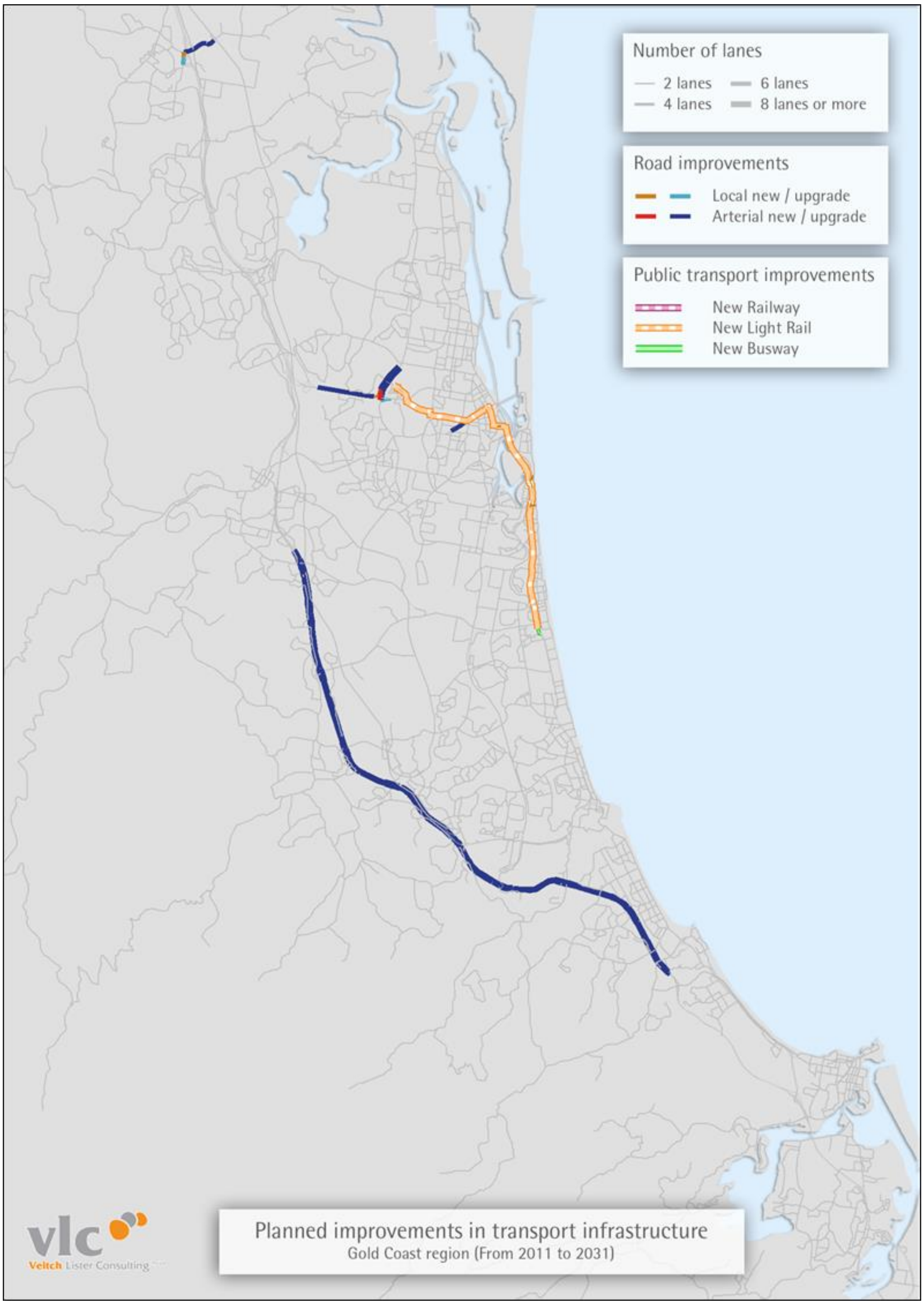
Table 67 **Major additions to road infrastructure between 2010-11 and 2030-31 assumed in transport modelling – Brisbane-South-East-Queensland**

Item	Description	Standard
1	Gateway Motorway (Nudgee Road to Deagon Deviation)	6 lane expressway
2	Kingsford Smith Drive (Seymour Road to Theodore Street)	6 lane arterial
3	Legacy Way (Western Freeway to Inner City Bypass)	4 lane expressway
4	Port of Brisbane Motorway (Gateway Motorway to Pritchard Street)	4 lane expressway
5	Ipswich Motorway (Rocklea to Darra)	6 lane expressway
6	Centenary Highway (Logan Motorway to Augusta Parkway)	4 lane expressway
7	Mt Lindesay Highway (Stoney Campy Road to Chambers Flat Road)	4 lane expressway
8	Brisbane Valley Highway (Warrego Highway and Wulkuraka Connection Road)	Improve intersection
9	Cunningham Highway (Ripley Road to Ipswich Western Bypass)	4 lane freeway
10	Pacific Highway (Fitzgerald Avenue to Aranda Street)	8 lane expressway
11	Beenleigh Road (Boundary Road to Warrigal Road Extension)	6 lane arterial
12	Pacific Highway (Mt Gravatt to Eight Mile Plains) – removal of T2 lanes	8 lane expressway
13	Mt Gravatt-Capalaba Road (Broadwater Road to Gardner Road)	Improve intersection
14	Creek Road (Lytton Road to Cavendish Road)	6 lane arterial
15	Logan Road (Cornwell Street to Kessels Road)	6 lane arterial
16	Kingsford Smith Drive (Racecourse Road to Cooksley Street)	6 lane arterial
17	Johnson Road (Southlink Street to Woongaroo Road)	4 lane arterial
18	Park Ridge Road (Mt Lindesay Highway to Beenleigh Road)	4 lane arterial

Source: (VLC, 2014)

A full list of the projects that are assumed to go ahead in the Brisbane-South-East-Queensland region between 2010-11 and 2030-31 is provided Appendix A.

Figure 67 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 – Gold Coast**

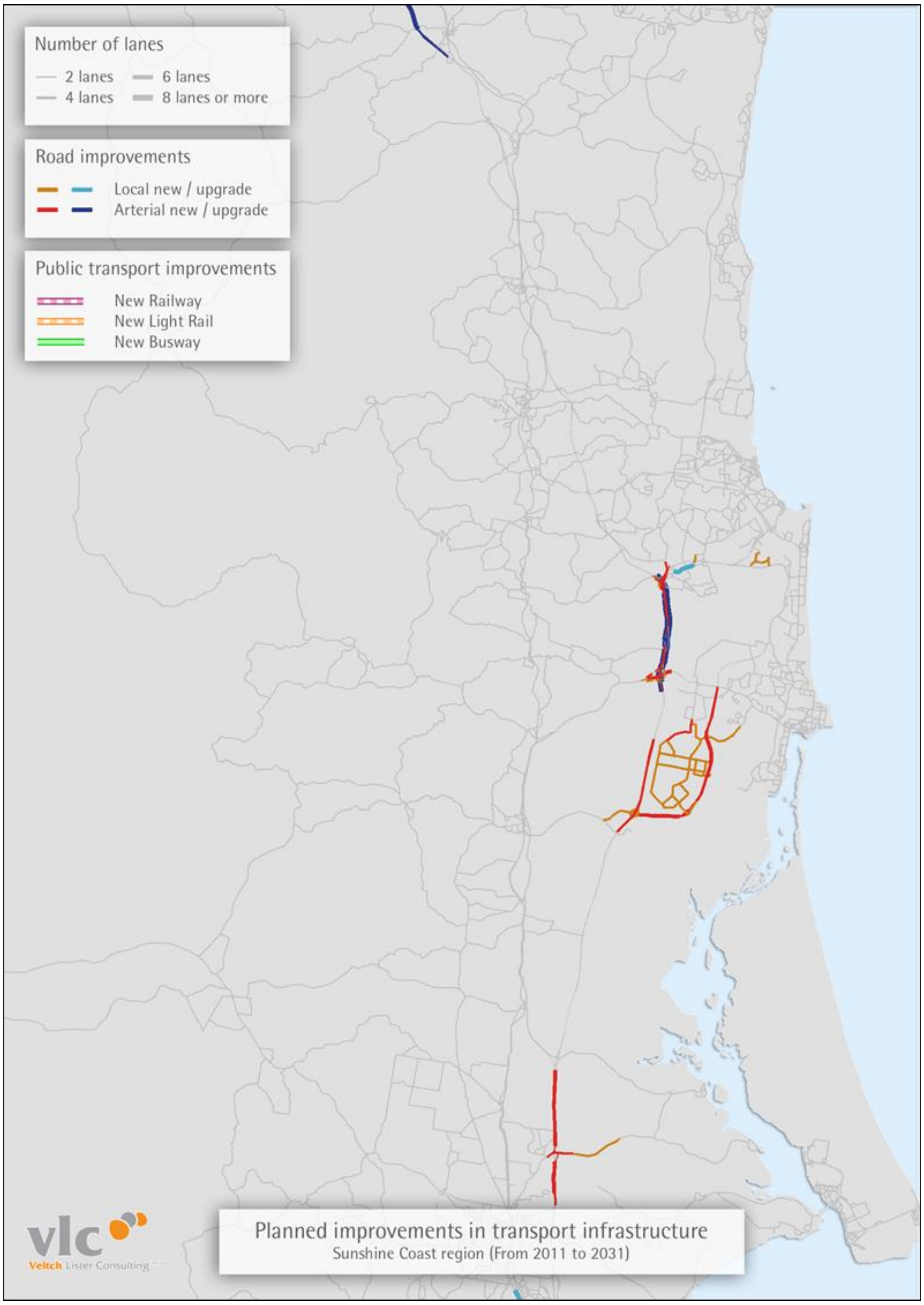


Source: VLC, 2014

In the Gold Coast region the major addition to the urban transport network between 2010-11 and 2030-31 is the Gold Coast light rail.

Figure 68 provides an overview of assumed additions to the urban transport infrastructure of the Sunshine Coast between 2010-11 and 2030-31.

Figure 68 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 – Sunshine Coast**



Source: VLC, 2014

6.7.3 DEC in 2031

Table 68 shows the DEC of different transport modes within the urban transport sector of the Brisbane-South-East-Queensland area.

Table 68 **Urban transport DEC by transport mode – 2030-31 – Brisbane-South-East-Queensland**

Mode	DEC	DEC
	(2011) $m	(2031) $m
Car	11,429	27,686
LCV	528	658
HCV	516	1,078
Rail	190	795
Bus	398	805
Ferries	14	67
Light Rail	-	13
Total	13,075	31,103

Source: ACIL Allen Consulting, 2014

The DEC of urban transport infrastructure in the Brisbane-South-East-Queensland region is projected to more than double between 2010-11 and 2030-31. The projected increase in the DEC is largely driven by increases in the DEC from car passenger travel. The DEC of all transport modes except for light commercial vehicles is projected to double while the introduction of light rail services is projected to add to DEC of this transport mode.

6.7.4 Capacity, utilisation and congestion in 2031

Table 69 provides an overview of the road network capacity in 2030-31 compared to the capacity in 2010-11.

Table 69 **Road network capacity – 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

Road network	Capacity	Capacity
	VKT per day	kms of road
2011	457,374,113	22,764
2031	490,562,616	23,058

Source: ACIL Allen Consulting, 2014

The assumed expansions of the road network in the Brisbane-South-East-Queensland area between 2010-11 and 2030-31, amount to an increase in total VKT capacity of around 7 per cent.

While the capacity of the network is assumed to only grow at a modest rate the utilisation of the network is projected to increase significantly. Table 70 compares road network utilisation in the Brisbane-South-East-Queensland area in 2030-31 with 2010-11.

Table 70 **Road network utilisation and congestion – 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
2011	83,745,007	36%	18%	17%	1,914
2031	134,939,469	53%	28%	33%	9,206

Source: ACIL Allen Consulting, 2014

Between 2010-11 and 2030-31 the VKT on roads in the Brisbane-South-East-Queensland area is projected to increase by 61 per cent.

The cost of congestion increases disproportional to the increase in utilisation of the road network once a certain threshold of congestion is reached. In the Brisbane-South-East-Queensland area the cost of road congestion is projected to quadruple between 2010-11 and 2030-31 to reach a total of $9.2 billion in 2030-31.

Table 71 provides a comparison of the projected capacity of public transport in the Brisbane-South-East-Queensland area in 2030-31 to the capacity in 2010-11.

Table 71 **Public transport network capacity – 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

Year	Public Transport Networks	Capacity	Capacity
		Passenger seat kms per day	Passenger crush kms per day
2011	Rail Network	16,494,696	33,676,233
2011	Bus Network	12,753,276	18,421,399
2011	Ferry Network	487,447	584,990
2011	Light rail Network	-	-
2031	Rail Network	19,291,864	39,334,378
2031	Bus Network	14,959,187	21,607,504
2031	Ferry Network	522,203	626,525
2031	Light rail Network	327,076	1,263,330

Source: ACIL Allen Consulting, 2014

Under the assumed low investment scenario the capacity of the public transport system in the Brisbane-South-East-Queensland region is projected to increase by around 19 per cent in terms of passenger crush capacity between 2010-11 and 2030-31. The majority of the increase in transport capacity is to come from increases in the capacity of the heavy rail and bus network.

Table 72 compares the utilisation of different public transport modes in 2010-11 and 2030-31.

Table 72 **Public transport network utilisation – 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

Year	Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
		kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
2011	Rail Network	4,320,496	46%	22%	26%	13%
2011	Bus Network	3,214,913	34%	24%	25%	17%
2011	Ferry Network	75,928	19%	16%	16%	13%
2011	Light rail Network		0%	0%	0%	0%
2031	Rail Network	9,697,901	79%	39%	50%	25%
2031	Bus Network	4,770,881	42%	29%	32%	22%
2031	Ferry Network	206,342	52%	43%	40%	33%
2031	Light rail Network	59,684	25%	7%	18%	5%

Source: ACIL Allen Consulting, 2014

The utilisation of the train and ferry network is projected to more than double over the 2010-11 to 2030-31 period. During the morning peak the congestion as measured by passenger volume over crush capacity in the morning peak is projected to reach 43 per cent on the Ferry network. The light rail network is projected to be the least utilised of the public transport modes on offer in the Brisbane-South-East-Queensland region in 2030-31.

Analysis of key journeys

This section examines the changes in the DEC of origin-destination pairs for public transport and road transport between 2010-11 and 2030-31.

Table 73 provides an overview of the ten origin-destination pairs with the highest projected change in DEC between 2010-11 and 2030-31.

Table 73 **Roads – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Brisbane GCCSA**

From	To	∆ DEC ($m)
Springfield - Redbank	Ipswich Inner	183.4
Ipswich Hinterland	Ipswich Inner	136.7
Forest Lake - Oxley	Springfield - Redbank	75.5
Caboolture	Narangba - Burpengary	71.4
Jimboomba	Browns Plains	70.0
Forest Lake - Oxley	Ipswich Inner	63.4
Ormeau - Oxenford	Beenleigh	51.3
Springfield - Redbank	Jimboomba	46.6
Narangba - Burpengary	North Lakes	43.9
Ipswich Inner	Rocklea - Acacia Ridge	40.7

Source: ACIL Allen Consulting, 2014

Trips between the SA3s of ‘Springfield – Redbank’ and ‘Ipswich Inner’ are projected to have the highest change in DEC between 2010-11 and 2030-31. Other origin-destination pairs with noticeable increases in DEC from road transport include trips between ‘Ipswich Hinterland’ and ‘Ipswich Inner’, ‘Forest Lake-Oxley’ and ‘Springfield Redbank’. The change in road DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C5 in Appendix C.

Table 74 shows the ten origin-destination pairs with the highest projected change in public transport DEC between 2010-11 and 2030-31.

Table 74 **Public transport – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Brisbane GCCSA**

From	To	∆ DEC ($m)
Springfield - Redbank	Brisbane Inner	15.5
Ipswich Inner	Brisbane Inner	13.6
Cleveland - Stradbroke	Brisbane Inner	11.6
Jimboomba	Brisbane Inner	11.4
Ormeau - Oxenford	Brisbane Inner	11.0
Brisbane Inner - North	Brisbane Inner	10.9
Nundah	Brisbane Inner	9.9
Hills District	Brisbane Inner	9.5
North Lakes	Brisbane Inner	8.7
Narangba - Burpengary	Brisbane Inner	7.9

Source: ACIL Allen Consulting, 2014

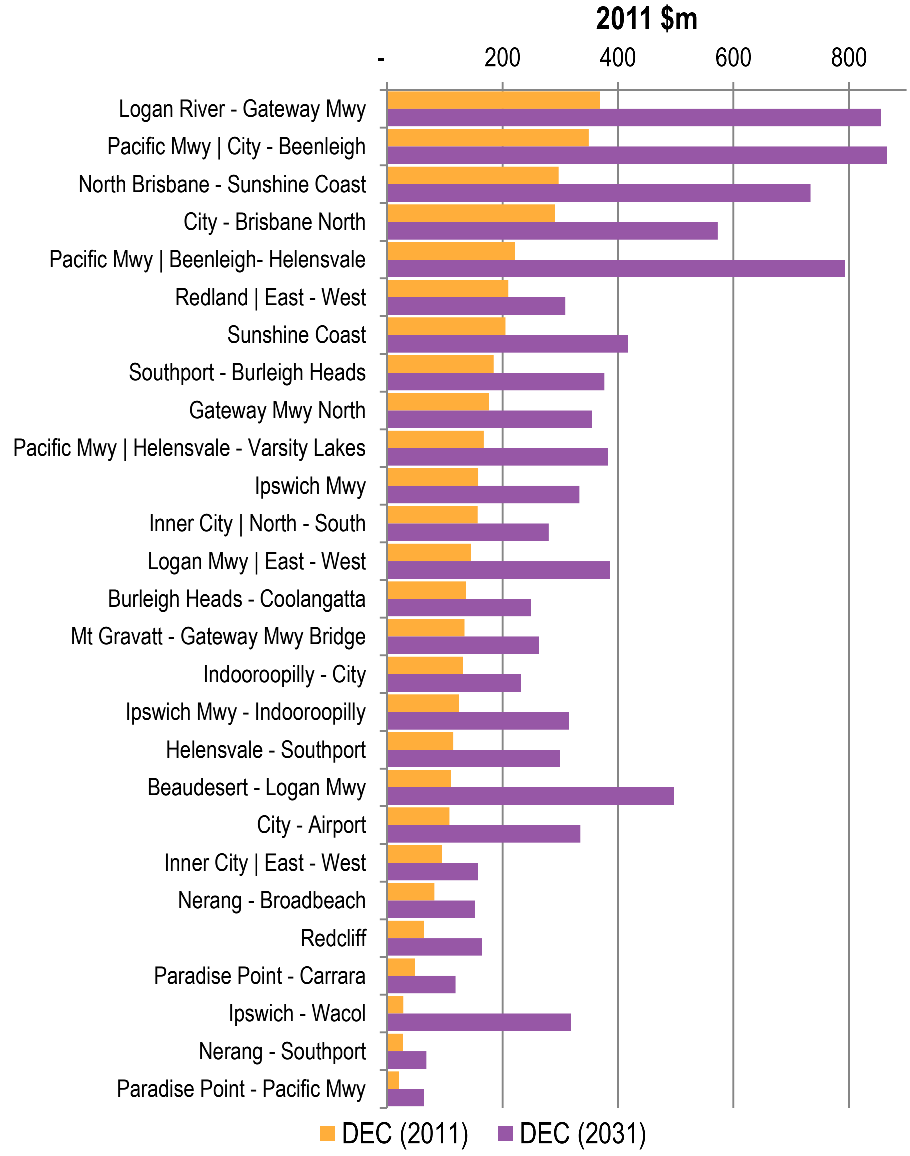
The ten origin-destination pairs with the highest change in DEC between 2010-11 and 2030-31 all have the ‘Brisbane Inner’ SA3 as destination. The change in DEC is highest for trips between the ‘Springfield – Redbank’ SA3 and the ‘Brisbane Inner’ SA3. The change in public transport DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C6 in Appendix C.

Analysis of corridors

This section examines the changes in the DEC of key road corridors in the Brisbane-South-East-Queensland area between 2010-11 and 2030-31.

Figure 69 compares the projected DEC of major transport corridors in the Brisbane-South-East-Queensland area in 2030-11 to the DEC of these corridors in 2010-11.

Figure 69 **Transport corridors – DEC 2010-11 and 2030-31 – Brisbane-South-East-Queensland**



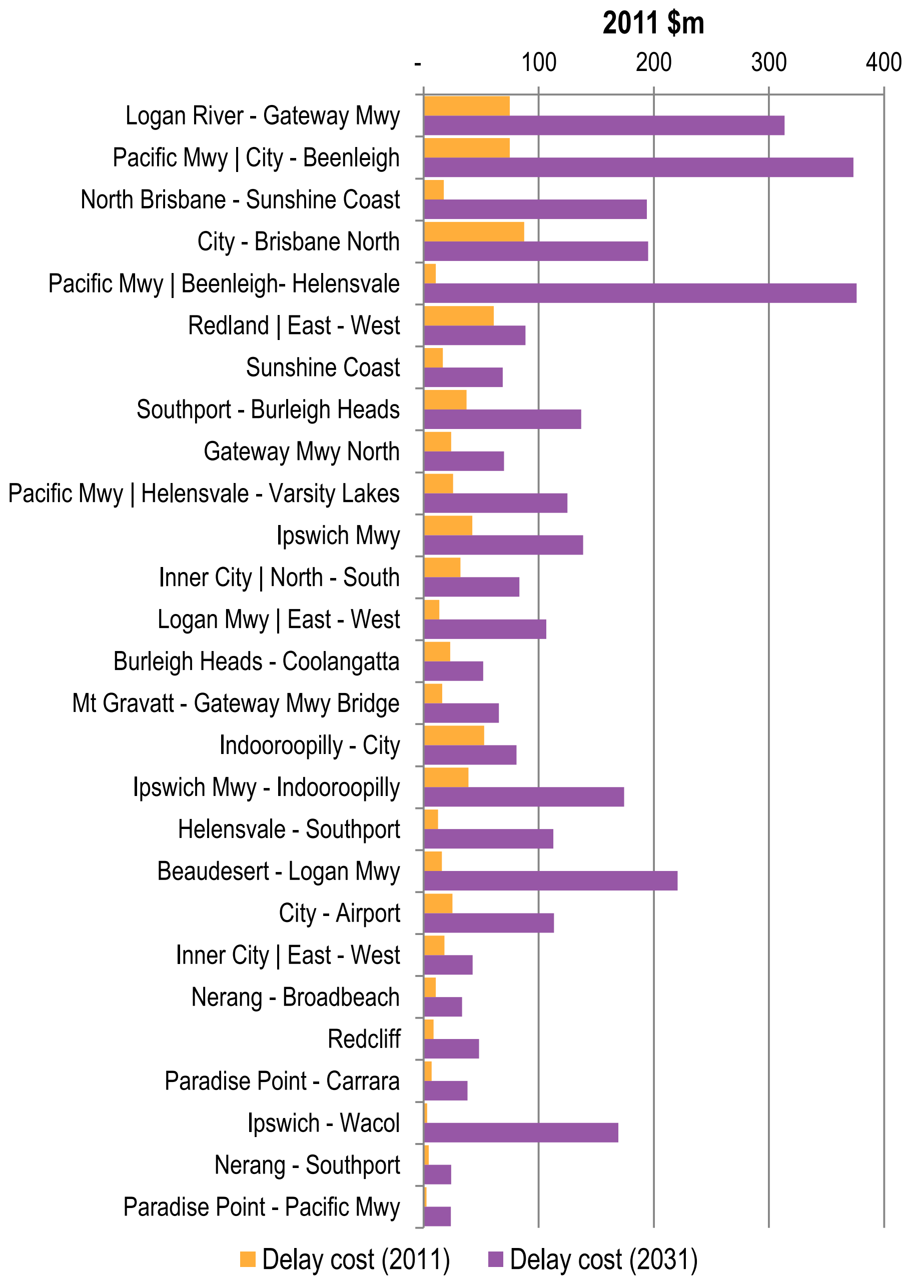
Source: ACIL Allen Consulting, 2014

In 2030-31 the 'Pacific Mwy | City – Beenleigh' corridor is projected to have the highest DEC of the corridors selected for this study. The DECs of the 'Logan River – Gateway Mwy', the 'Pacific Mwy | City – Beenleigh' and the 'Pacific Mwy | Beenleigh – Helensvale' are projected to reach over $1 billion dollars.

Delay costs on key corridors in the Brisbane-South-East-Queensland area are projected to increase substantially.

Figure 70 compares the projected delay costs on major transport corridors in 2030-31 to the delay cost on these corridors in 2010-11.

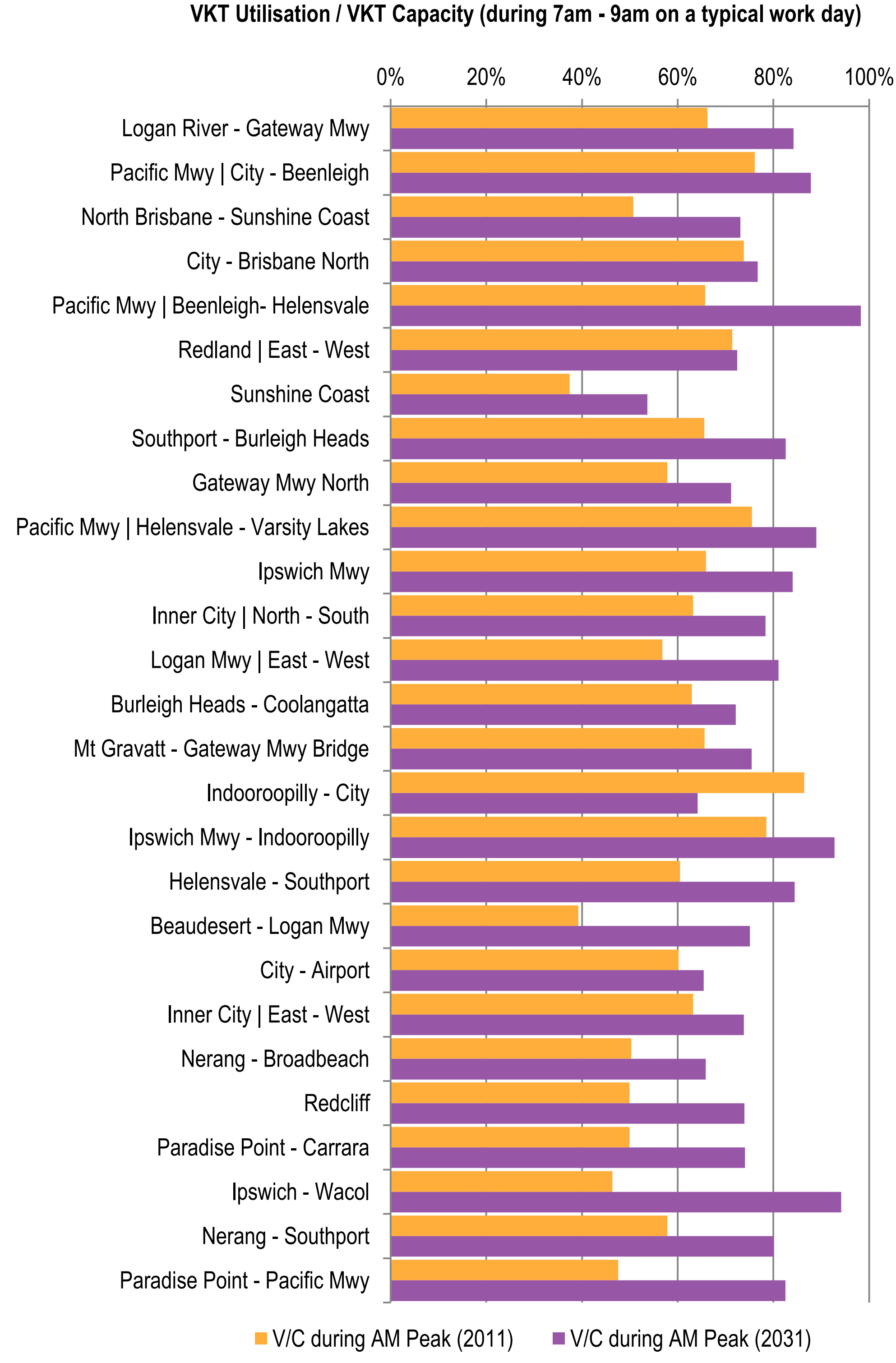
Figure 70 **Transport corridors – delay cost 2010-11 and 2030-31 – Brisbane-South-East-Queensland**



Source: ACIL Allen Consulting, 2014

Figure 71 provides a comparison of projected congestion on major transport corridors during the morning peak in 2030-31 to congestion on these corridors in 2010-11. The figure shows the ratio VKT to the VKT capacity of the corridors.

Figure 71 **Transport corridors – change in congestion 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

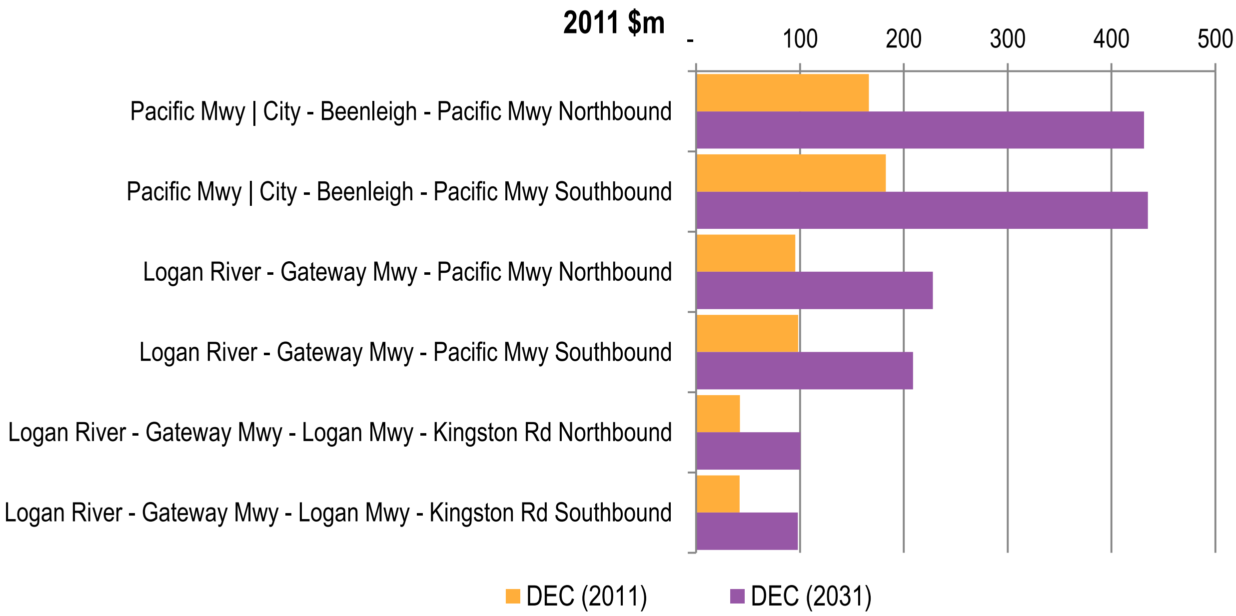


Source: ACIL Allen Consulting, 2014

Analysis of key routes

Figure 72 compares the DEC and delay costs of routes within the two corridors with the highest DEC in the Brisbane-South-East-Queensland area in 2010-11 and 2030-31.

Figure 72 **Key routes– DEC 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

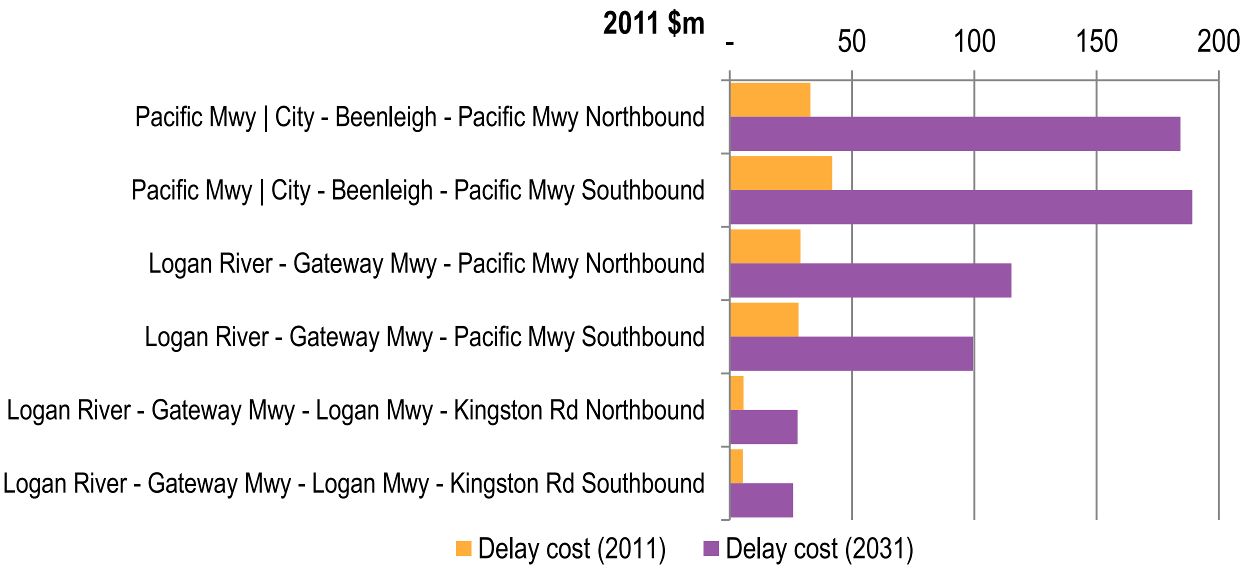


Source: ACIL Allen Consulting, 2014

The DEC of major transport corridors is split relatively evenly between northbound and south bound lanes.

Figure 73 shows a comparison of delay cost on routes within the two corridors with the highest DEC in the Brisbane-South-East-Queensland area between 2010-11 and 2030-31.

Figure 73 **Key routes– change in delay cost 2010-11 and 2030-31 – Brisbane-South-East-Queensland**

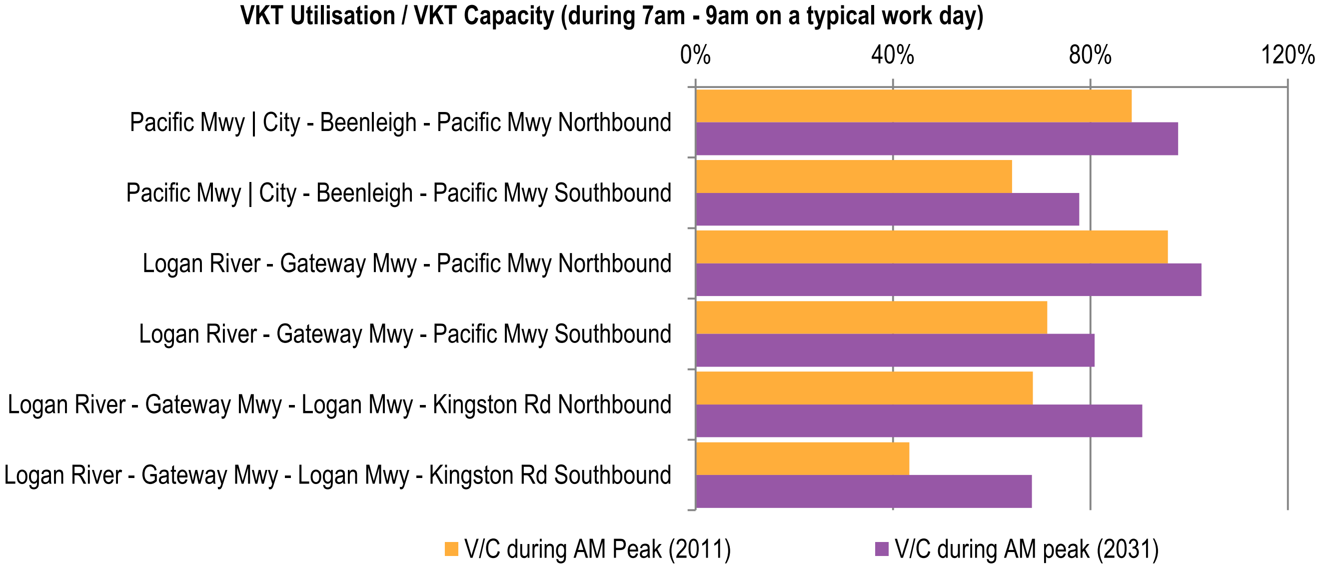


Source: ACIL Allen Consulting, 2014

Delay costs on the key routes are projected to increase more than threefold on most routes. Projected delay costs on the 'Pacific Motorway (City – Beenleigh)' are projected to increase more than fivefold.

Figure 74 compares congestion on key routes in the Brisbane-South-East-Queensland area between 2010-11 and 2030-31.

Figure 74 **Key routes– change in congestion 2010-11 and 2030-31 – Brisbane-South-East-Queensland**



Source: ACIL Allen Consulting, 2014

Under the low investment scenario congestion on the north bound lane on the Pacific Motorway and the Centenary Highway is assumed to reach 100 per cent.

6.7.5 Reconciliation with macro-economic data

Table 75 provides a comparison between the estimates of DEC based on transport activity modelling i.e. a bottom-up analysis and DEC estimates based on analysis of national statistics i.e. a top-down analysis.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014) using SDs as basic units rather than GCCSAs (details of this is provided in the earlier section of this chapter). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements. The bottom-up projections of the DEC of urban transport infrastructure are based on transport activity projections from VLC's Zenith model. The top-down, projections of DEC are based on national statistics. Household expenditure on personal transport is based on data from the household expenditure survey and scaled to the number of households in each region. Household expenditure is assumed to grow in line with income growth as a proxy for expenditure growth. Income growth projections are obtained from ACIL Allen's Tasman Global modelling for the Baseline Scenario of the broader AIA. DEC from road and rail freight is projected to grow in line with projections of gross value add for rail and road transport which is also obtained from the Tasman Global model projections.

Table 75 **Macro-reconciliation – DEC of urban transport infrastructure 2030-31 – Brisbane-South-East-Queensland**

DEC (Based on transport simulation modelling)					DEC (Based on national statistics)				
	Brisbane	**Gold Coast**	**Sunshine Coast**	**Total**		**Brisbane**	**Gold Coast**	**Sunshine Coast**	**Total**
Car/private vehicle	22,358	5,054	2,740	**30,152**	Household private vehicle expenditure	22,355	2,832	2,499	**27,686**
LCV	4,768	702	376	**5,846**	Road transport (freight)	541	64	54	**658**
HCV	2,311	24	19	**2,354**	Rail transport (freight)	895	95	88	**1,078**
Rail	188	26	14	**229**	Rail (household expenditure)	642	81	72	**795**
Bus	427	64	34	**525**	Bus/tram/light rail (household expenditure)	650	82	73	**805**
Brisbane Ferries	29	8	4	**41**	Ferry (household expenditure)	0	75	0	**75**
Light Rail						13	0	0	**13**
Total	**30,082**	**5,879**	**3,187**	**39,148**	**Total**	**25,095**	**3,231**	**2,785**	**31,111**
Growth (index 2010-11 = 1)	**2.43**	**2.16**	**2.20**	**2.38**	**Growth (index 2010-11 = 1)**	**2.58**	**2.56**	**2.25**	**2.55**

Source: ACIL Allen Consulting, 2014

7 Perth-Wheatbelt

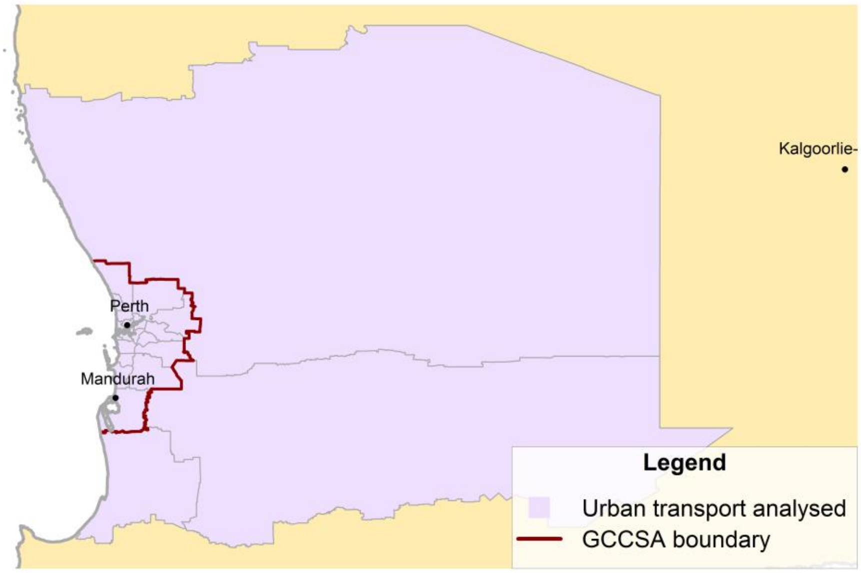
Figure 75 provides an overview of the Perth-Wheatbelt region for which the urban transport system has been analysed. There are two public transport systems in this area servicing the greater Perth Metropolitan Area, and the greater Bunbury Area.

The wider Perth Metropolitan Area is serviced by an integrated road, bus, train and ferry network. The public transport system extends from Two Rocks in the north, to Wundowie in the east and Mandurah in the south. The Perth suburban rail network consists of five rail lines that radiate from the central Perth Railway Station and service Butler in the north, Mandurah in the south, Midland in the east, Fremantle in the west, and Armadale in the south east. Perth's bus system comprises of a network of nearly 300 timetabled routes and over 320 school routes which service the greater Perth Metropolitan Area as well as two free Central Area Transit bus systems which operate within the central business districts of Perth and Fremantle. Ferries operate between and the Perth central business district and the adjacent South Perth.

The Bunbury public transport system is serviced by a bus network that comprises of around twenty timetabled routes plus school routes servicing the greater Bunbury Area as far as the adjacent towns of Australind and Eaton.

There are some rail and bus services that connect the Perth Metropolitan Area to the regional centres located within the Perth region shown in Figure 75 however these are not commuter services.

Figure 75 **Map of Perth-Wheatbelt Region**



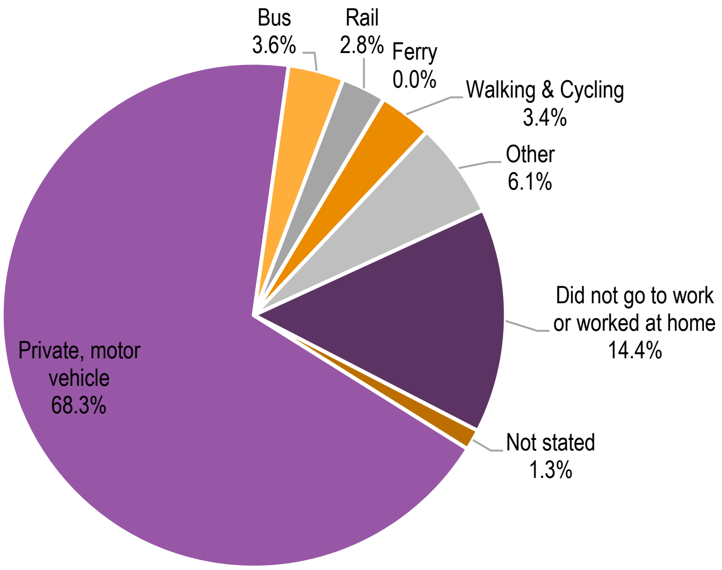
Source: ACIL Allen Consulting, 2014

We note that the area covered by the urban transport analysis covers some non-urban areas. The boundaries of the urban transport analysis were chosen to ensure that the entire conurbation of a city is included in the analysis. This is to ensure that the transport system of the city is captured as accurately as possible.

7.1 Key issues and challenges

The most common form of transport for people travelling to work in the Perth GCCSA is private motor vehicle which accounts for just over 68 per cent of all commuters (Figure 76). Only 6.4 per cent of travellers in the Perth region travel to work by public transport means. Despite this low use of public transport, its use (in terms of passengers) in the greater Perth Metropolitan Area has risen by 27 per cent over the period from 2007-08 to 2012-13. On a typical weekday during 2012-13, around 14,548[13] standard bus services, 323 school service bus trips, 1,045 rail services, and 92 ferry trips (summer timetable only 60 trips during the winter timetable) were operated (Public Transport Authority, 2013 p. 25).

Figure 76 **Method of travel to work Perth GCCSA - 2011**

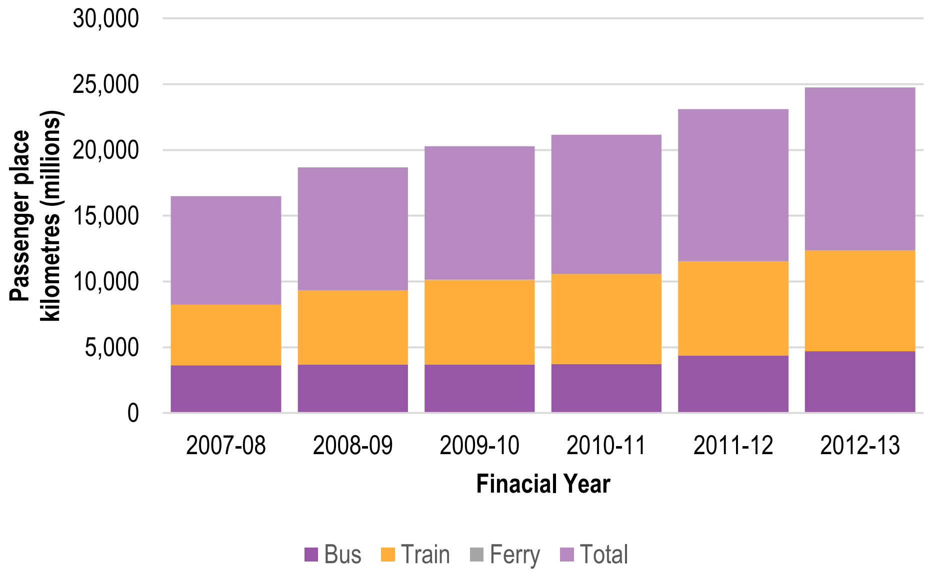


Note: Transport methods have been grouped e.g. 'private motor vehicle' include trucks and motorbikes, 'other' includes multimodal public and private transport, does not include: Unemployed persons looking for either part-time or full-time work, Persons not in the labour force, Persons with Labour Force Status (LFSP) not stated, Persons aged under 15 years
Source: (ABS, 2011)

Figure 77 shows the growth in public transport patronage for the greater Perth GCCSA for the period from 2007-08 to 2012-13. It shows that total boardings have increased from around 108.8 million in 2007-08 to 149.7 million in 2012-13. Whilst the patronage has increased substantially for both bus and train users, the largest growth has been in the number of rail passengers which has increased by 35 per cent. Ferry transport comprises a very small part of the Perth urban transport system and its patronage is largely impacted by the level of tourism.

[13] Note these figures do not include the Bunbury bus system which is not reported.

Figure 77 **Number of boardings: Perth GCCSA**



Note: Services offered for greater Perth GCCSA
Source: (Public Transport Authority, 2013 pp. 27-29)

This increase in patronage is in part due to a number of recent improvements in the urban transport system including an increase in public transport kilometres, an increase in the public transport fleet and improvements to infrastructure. This includes an increase in the number of bus service kilometres from 51 million in 2007-08 to 61 million in 2012-13 and increases in the rail network primarily the commencement of the Mandurah rail line in December of 2007.There have also been significant additions to the bus and rail fleet, and improvements to supporting infrastructure such as the construction of additional park and ride car bays at rail stations.

Growth in urban transport capacity in the Perth region is expected to continue with: further committed increases in the bus and rail fleets; an extension to the northern rail system by 7.5 km (completed in September 2014); and increased bus services. Further infrastructure works are also planned such as improvements to the central Perth station and the construction of a new rail station on the Mandurah line.

The future of urban transport in the Perth region is guided by a series of policy documents. Those that relate focus on urban transport include the Metropolitan Transport Strategy 1995-2029 (Department of Transport, 1995) and the draft Public Transport for Perth in 2031 which is a strategy for public transport in the Perth Metropolitan Area (Department of Transport, July 2011).

Both documents identify a number of immediate challenges for the urban transport system in Perth that primarily surround road congestion issues and continued urban growth. The Perth Central Business District is the primary employment centre in Western Australia accounting for around 18 per cent of all jobs in the metropolitan area. This concentration of jobs means that the urban transport network and the public transport effort is focussed on the Perth central business district. Seventy six per cent of public transport trips occur within 15 km of it (Department of Transport, July 2011 p. 12). This concentration of business activity results in peak morning and evening travel periods associated with work commitments.

There are increasing levels of road congestion caused by the commuter focus and the predominant use of private vehicles as a means of transport.

A large share of these road users travel into the central business district via the freeway system which provides linkages to the north, south and east. Road congestion impacts the bus network as services are vulnerable to delays in traffic. It also impacts the ability of public transport providers to improve services with additional buses adding to road congestion and to congestion at stops.

Perth has experienced high population growth of 2.7 per cent per annum over the ten years to 2013. This is equivalent to an additional 434,000 people living in the city. Population growth is expected to continue placing additional pressure on public transport and on road systems. Directions 2031 which is the key planning document for Perth has forecast the population of the greater Perth area[14] to grow to more than to more than 2.2 million by 2031. (WA Planning Commission, 2010 p. 7). Further, employment in the Perth Central Business District is expected to grow to 135,000 by 2016 and 147,000 by 2031 (Department of Transport, 2012).

Directions 2031 recognises the need to plan and develop key public transport corridors, urban corridors and transit oriented developments to accommodate increased housing needs and encourage reduced vehicle use (WA Planning Commission, 2010 p. 4). The Department of Transport's draft public transport strategy reflects the issues identified in Directions 2031. It has identified that much of the investment in public transport infrastructure and system improvements is needed within 15km of the Perth central area. Further, the public transport system can be enhanced by increasing capacity on the existing network, expanding the network and developing transformational projects. Transformational projects include a new rapid transit system for the central northern suburbs, and extending the northern railway line from Butler to Yanchep (Department of Transport, July 2011 pp. 6-7).

To complement this planning, the Department of Transport is currently developing the Perth Central Area Transport Plan. This document will be a 10-year transport planning strategy for the central metropolitan area which will address the impact of population growth and development in the Perth Central Business District on the urban transport network[15]. It will build on the current Perth Central Business District Transport Plan 2012 whose planning timeframe comes an end in 2016.

7.2 Regulation, policy and governance context

Urban transport in Western Australia is primarily planned and regulated by the State Government.

Key policy issues in Western Australia urban transport include the implications of public transport priority on other road users, and parking availability and regulation in strategic centres. Key issues in public transport include demand management, the low level of cost recovery, and State Government powers to establish transit ways.

7.2.1 Planning

The Department of Main Roads is responsible for planning highways and main roads. Local governments are responsible for planning their local road networks.

[14] Defined by the Perth Metropolitan Area and Peel region boundaries.

[15] Defined by the Perth Central Business District and extends to Subiaco, Leederville, Mt Lawley, South Perth, the QEII/UWA precinct, and the Burswood Peninsula.

The Public Transport Authority (PTA) is responsible for planning metropolitan railway, bus and ferry services. The Network and Infrastructure division of the PTA is responsible for planning expansions to the rail network.

In 2011, the State Government published the *Public Transport for Perth in 2031* plan. This document identifies the main public transport infrastructure needs in the medium term.

7.2.2 Regulation

The Department of Transport is responsible for regulation of much of the Western Australian transport networks (including the taxi sector). Local councils regulate local road networks.

From published information, the policy basis on which public transport fares is set is unclear.

7.2.3 Funding

Urban transport in Western Australia is funded from a combination of grants/subsidies from all levels of government and user charges.

During 2012-13, the PTA delivered public transport services in Western Australia at a cost of $1,152 million with total revenues and funding of $912 million. User charges and fees comprised 23 per cent of PTA's revenue, funding from the State Government comprised 72 per cent, and income from other sources comprised 5 per cent.[16]

7.2.4 Service delivery

The Department of Main Roads is responsible for building and maintaining highways and main roads. Local governments are responsible for delivering local roads in their area.

The PTA is responsible for delivery of public transport services.

The Network and Infrastructure division of the PTA is responsible for managing and maintaining the metropolitan railway infrastructure and protecting the long-term viability of the freight rail corridor and infrastructure. It constructs expansions to the rail network.

The Transperth division of the PTA is responsible for delivering public rail, bus and ferry services in the Perth metropolitan area. It contracts service provision to Transperth Train Operations (a separate Division of the PTA, through a service level agreement), three bus companies and one ferry operator.

The Transwa division of the PTA operate four regional rail services (Australind, Prospector, MerredinLink and AvonLink) in addition to a fleet of coaches to regional Western Australia.

The Regional Town (Bus) Services branch plans schools services in the state and contracts their delivery by bus operators.

7.3 Current network capacity, utilisation and congestion

7.3.1 Capacity

The Perth-Wheatbelt region is serviced by an extensive road network. Table 76 provides an overview of the road network capacity in the Perth-Wheatbelt area. The Perth-Wheatbelt

16 Public Transport Authority, *Annual Report 2012-13*, http://www.pta.wa.gov.au/portals/0/annualreports/2013/docs/pta-annual-report.pdf

region has a total of 12,044 kilometres of road (only approximately 7 per cent less than the Sydney-Newcastle-Wollongong area) and a capacity for just over 300 million vehicle kilometres travelled per day.

Table 76 **Road network capacity – 2010-11 – Perth-Wheatbelt**

Road network	Capacity	Capacity
	VKT per day	kms of road
Road network	300,045,588	12,044

Source: ACIL Allen Consulting, 2014

Table 77 shows the network capacity for the public transport network in the Perth area. Capacity is expressed as the number of kilometres of seats (and standing capacity in the case of crush capacity) that are available on all services offered in the region multiplied by the distance these services travel.

Table 77 **Public transport network capacity – 2010-11 – Perth-Wheatbelt**

Public Transport Networks	Capacity	Capacity
	Passenger seat kms per day	Passenger crush kms per day
Rail network	8,999,781	25,514,855
Bus network	8,691,320	13,047,254
Ferry network	6,533	12,086
Light rail network	-	-

Source: ACIL Allen Consulting, 2014

In terms of passenger seat kilometres per day capacity, the rail and bus network in the Perth-Wheatbelt region are relatively similar. However when looking at passenger crush kilometres per day, the standing room available on the rail network is significantly more (almost three times more). The capacity of the ferry is very small, although there is only one service route between the central business district and South Perth, and it is a short distance of around 1.5 kilometres.

7.3.2 Utilisation and congestion

Table 78 provides an overview of utilisation and congestion in the road network of the Perth area. Although the Perth-Wheatbelt region has a vehicle kilometre travel capacity of over 300 million per day, the utilisation is around 49 million VKT per day. Congestion during the peak morning time (from 7am-9am) is almost double the volume to capacity ratio experienced during the typical day. Congestion of the road network in Perth can result in travel taking an extra 22 per cent of time, and in 2010-11 amounted to a total of $1.8 billion dollars.

Table 78 **Road network utilisation and congestion – 2010-11 –** Perth-Wheatbelt

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
Road Network	49,845,107	32%	17%	22%	1,784

Source: ACIL Allen Consulting, 2014

Table 79 shows the overall utilisation public transport networks in the Perth-Wheatbelt area. The rail network is the most highly utilised public transport network while the ferry is the most lightly used network. Utilisation across all transport modes is highest during the morning peak compared to utilisation on a typical day. During the typical day there is little difference in congestion between the rail and bus network, however at the peak morning time rail network congestion is considerably higher than bus congestion.

Congestion on the public transport system can cause delays as people take longer to board trains and buses or when passengers have to be left behind at stops. The cost of these delays has not been measured separately as part of this analysis but is expected to be significantly smaller than the cost of congestion on the road system.

Table 79 **Public transport network utilisation and congestion – 2010-11 –** Perth-Wheatbelt

Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
	passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity during typical day	V/Seat Capacity at AM Peak	V/Crush Capacity during typical day
Rail Network	2,965,370	42%	15%	33%	12%
Bus Network	1,367,563	21%	14%	16%	10%
Ferry Network	303	4%	2%	5%	3%
Light rail Network	-	-	-	-	-

Source: ACIL Allen Consulting, 2014

7.4 Current network Direct Economic Contribution

7.4.1 Aggregate DEC

In 2010-11 the total DEC from urban transport infrastructure in the Perth-Wheatbelt region was $9.1 billion.

7.4.2 DEC by mode

Table 80 provides an overview of the DEC by transport mode for the Perth-Wheatbelt area. Cars were the major contributor ($7.6 billion), with the ferry actually making a small, but negative contribution. Combining cars with light commercial vehicles (LCV) and heavy commercial vehicles (HCV), car travel represented 94 per cent of the total DEC. It is important to note that $1.8 billion of the total DEC of road travel arises from congestion costs.

Table 80 **Urban transport DEC by transport mode – 2010-11 –** Perth-Wheatbelt

Mode	DEC
	$m
Car	7,647
LCV	400
HCV	448
Rail	290
Bus	350
Ferries	-0.1
Light Rail	0
Total	**9,134**

Source: ACIL Allen Consulting, 2014

7.4.3 Reconciliation with macro-economic data

Calculating the DEC based on travel activity data from VLC's transport model represents a bottom-up approach. DEC can be calculated for discrete links within the transport network and aggregate figures for local areas can also be provided.

In this section of the report, the results of the bottom-up analysis are compared to top down estimates of DEC from urban transport infrastructure in the Perth area.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements.

The macro reconciliation is aiming to provide a broad indication as to whether the results of the bottom-up modelling reconcile with macro-economic data. National account statistics available at the time of writing this report were available on the basis of statistical divisions (SD's). SDs were used as a basic geographical unit for understanding and interpreting the geographical context of statistics published by the ABS before 2011. Generally SDs are broadly consistent with the GCCSA; detailed mapping of the SDs and their consistency with the GCCSAs can be found on the ABS website[17]. To reduce the potential mismatch between the national account statistics provided on a SD basis and the bottom-up modelling results the macro data has been scaled to the population of the relevant bottom-up modelling areas.

Table 81 provides a comparison of estimates of DEC of urban transport infrastructure in the Perth area using a bottom-up and top-down approach. The column to the right of Table 81 show estimates of the DEC of urban transport infrastructure based on household expenditure and national accounts statistics, while the column to the left shows the DEC by mode as calculated using a bottom-up approach based on VLC's transport modelling.

Table 81 **Macro-reconciliation – DEC of urban transport infrastructure 2010-11 – Perth-Wheatbelt area - $ million**

DEC (Based on transport simulation modelling)		DEC (Based on national statistics)	
Car/PMV	7,647	Household private vehicle expenditure	6,239
LCV	400	Road transport (freight)	1,770
HCV	448	Rail transport (freight)	266
Rail	290	Rail (household expenditure)	29
Bus	350	Bus/tram/light rail (household expenditure)	100
Ferry	-0.1	Ferry (household expenditure)	18
Light Rail	0		
Total Transport	**9,134**	**Total Transport**	**8,421**

Source: ACIL Allen Consulting, 2014

The estimated total DEC of urban transport infrastructure as calculated using the top-down approach based on national statistics is closely aligned with the DEC calculated using the bottom-up approach; there is a difference of approximately seven per cent between the two.

[17] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1216.0July%202011?OpenDocument

The estimate of DEC from travel in private motor vehicles and public transport (excluding the ferry) is higher in the bottom-up approach. The bottom-up DEC estimate of travel includes the value of time spent travelling while the household expenditure survey does not capture the value of travel time. The largest component of the DEC estimate of private vehicle travel in the household expenditure survey is expenditure on vehicle operating costs and expenditures related to vehicle purchases. For public transport, the household expenditure survey only captures money spent on fares. The ferry is recorded as a negative amount in the bottom-up approach. This is due to low patronage on the ferry network and relatively large operation and maintenance costs for the ferry network.

There is also a significant difference between the bottom-up and the top-down approach for freight movements. The top-down approach accounts for freight movements on road and rail transport while the bottom-up approach excludes freight transport by rail. The estimated DEC from road transport also differs between the bottom-up and top-down approach. In the national accounts statistics the value of road transport is allocated to an area based on where the contract for transport is struck. This differs from the bottom-up approach where the value of freight transport is allocated to the area through which the freight is moved. We would expect that some of the contracts for freight transport that are struck in Perth do not involve freight that is actually moved through the urban transport infrastructure of the city. This would explain why the DEC estimate of road freight transport obtained from national account statistics is higher than the bottom-up estimate of the DEC of road transport.

7.5 Demand analysis by origin/destination

7.5.1 Overview of demand analysis

The demand analysis assesses the value (measured as DEC) of journeys from combinations of origins and destinations. The demand analysis is distinguished from other levels of analysis as it shows the demand for mobility (the value that is placed on trips that transport people or goods from one SA3 to another) as opposed to the value that is being derived from use of a physical network or infrastructure component.

A significant proportion of this demand (24.1% of road journeys and 14.7% of public transport journeys in the Perth GCCSA) is within each SA3 (i.e. where the SA3 is both the origin and destination). The focus of this demand analysis however, is on infrastructure connecting separate origins and destinations. Specifically, the DEC of road journeys and public transport for combinations of different SA3 origins and destinations, for the GCCSA area, is shown in the form of 'heat-map' matrices.

7.5.2 Roads

Overview of DEC for all origin-destination pairs

Figure 78 shows the DEC for all origin-destination pairs in 2010-11 in the Perth GCCSA region. Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys originating in the SA3 'Cottesloe-Claremont' whereas the first column shows the DEC of trips ending in the SA3 'Cottesloe-Claremont'. The DEC is colour coded from green to red where green indicates a low DEC and red indicates a high DEC.

The right hand side of the figure provides an overview range of the DEC values across the matrix. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure 78 **Roads – origin-destination pairs – DEC 2011 – Perth GCCSA**

SA3 Origin / Destination	Cottesloe - Claremont	Perth City	Bayswater - Bassendean	Mundaring	Swan	Joondalup	Stirling	Wanneroo	Armadale	Belmont - Victoria Park	Canning	Gosnells	Kalamunda	Serpentine - Jarrahdale	South Perth	Cockburn	Fremantle	Kwinana	Melville	Rockingham	Bunbury	Mandurah	Wheat Belt - South	Wheat Belt - North
Cottesloe - Claremont		74.3	9.3	4.8	28.1	20.1	41.9	46.3	9.0	27.9	19.0	13.5	5.2	5.4	9.5	25.4	31.9	6.6	19.1	11.2	0.3	5.2	0.4	4.0
Perth City	72.6		70.4	27.1	180.6	80.5	189.2	163.2	36.6	182.0	95.5	66.9	35.0	17.3	57.3	66.9	34.5	17.4	60.1	23.3	3.4	12.4	2.6	24.6
Bayswater - Bassendean	9.1	70.2		13.2	135.4	18.9	47.2	51.6	15.1	56.4	27.4	24.8	15.1	6.5	8.1	10.9	6.3	3.9	8.9	5.2	1.9	3.2	1.1	9.2
Mundaring	4.5	26.3	12.7		70.5	7.9	17.1	13.0	7.0	22.0	16.9	12.0	10.6	2.3	2.8	6.2	2.7	1.8	4.2	2.8	0.5	1.7	0.3	5.3
Swan	27.3	175.7	133.0	71.6		98.3	167.1	201.8	38.6	135.8	88.1	64.2	54.4	15.2	18.6	31.5	16.4	10.3	26.0	14.3	6.3	9.2	4.1	38.9
Joondalup	19.5	79.7	18.6	8.0	98.8		116.8	536.6	7.3	39.5	22.2	12.9	6.5	3.5	8.6	14.7	11.1	4.4	12.4	6.0	0.6	3.7	0.6	12.5
Stirling	44.2	197.1	48.8	17.8	172.4	121.9		256.7	22.5	79.2	47.6	34.9	16.8	10.8	21.3	37.7	22.9	11.9	28.8	17.2	2.8	10.0	2.1	18.5
Wanneroo	45.1	162.2	50.2	12.9	199.1	521.7	249.6		10.8	105.6	50.0	21.3	13.0	4.6	15.5	24.0	22.2	6.6	26.0	8.6	2.7	4.9	1.5	36.5
Armadale	8.8	36.6	14.8	7.2	38.6	7.2	21.8	10.8		47.1	68.88	132.9	22.3	49.1	7.9	45.8	13.9	16.1	24.0	23.3	0.8	13.3	1.8	4.1
Belmont - Victoria Park	27.9	183.4	59.0	23.5	142.4	39.7	77.7	107.0	48.3		97.7	81.5	35.1	21.9	32.5	45.5	23.3	18.6	32.6	39.0	5.7	34.0	4.4	21.4
Canning	19.0	95.8	28.1	18.0	91.2	22.2	46.4	51.1	70.3	96.7		147.6	35.4	31.3	28.4	78.8	26.8	25.5	52.0	37.1	5.8	20.3	3.8	18.3
Gosnells	13.2	66.7	24.5	12.6	65.0	12.8	33.6	21.4	132.7	79.4	145.6		39.6	31.4	15.9	59.0	19.2	17.0	36.7	23.9	2.0	13.1	2.3	8.1
Kalamunda	4.9	34.0	14.9	11.4	55.4	6.4	16.0	13.2	22.0	34.0	34.7	38.8		6.7	4.4	12.7	5.0	4.1	7.0	5.9	1.5	3.4	0.8	4.7
Serpentine - Jarrahdale	5.2	17.4	6.4	2.3	15.1	3.4	10.6	4.6	49.5	21.4	30.6	31.0	6.7		3.6	23.3	8.0	17.4	13.0	36.0	0.6	20.7	1.3	1.4
South Perth	9.6	57.4	8.2	3.0	19.1	8.5	20.3	15.7	8.1	32.4	27.9	16.1	4.4	3.6		15.5	6.5	4.7	16.7	6.6	0.1	3.1	0.1	2.0
Cockburn	25.4	68.6	11.1	6.7	32.6	14.9	37.1	24.8	49.0	46.9	85.8	63.0	13.5	24.7	16.5		64.1	54.8	76.3	77.2	3.9	28.1	2.8	10.3
Fremantle	31.5	35.3	6.4	2.9	16.7	11.3	22.6	23.2	14.3	23.4	27.2	19.6	5.0	8.3	6.6	63.7		16.6	28.5	26.2	2.4	9.9	1.4	5.6
Kwinana	6.6	18.0	4.0	1.9	10.5	4.4	12.1	6.6	16.8	19.1	26.6	17.5	4.2	18.2	4.8	53.2	16.6		19.0	98.1	2.6	28.7	1.8	6.2
Melville	18.9	59.7	8.9	4.5	26.6	12.5	27.5	26.7	24.3	32.5	52.1	36.9	7.1	13.2	17.4	70.0	27.8	18.5		28.1	0.9	13.4	1.0	4.2
Rockingham	11.1	24.0	5.2	2.9	14.6	5.9	17.7	8.4	23.3	39.7	38.0	23.9	5.9	36.5	6.5	74.0	25.7	93.7	28.1		1.7	170.3	2.2	3.1
Bunbury	0.3	3.4	2.0	0.5	6.3	0.6	2.8	2.7	0.8	5.8	5.9	2.0	1.5	0.6	0.1	3.9	2.4	2.6	0.9	1.7		8.0	0.3	0.9
Mandurah	5.1	12.7	3.2	1.8	9.4	3.7	10.4	4.8	13.0	34.4	20.6	13.0	3.4	20.5	3.2	27.0	9.8	27.0	13.4	165.6	8.0		7.6	4.0
Wheat Belt - South	0.4	2.7	1.1	0.3	4.1	0.6	2.1	1.5	1.8	4.4	3.8	2.3	0.8	1.3	0.1	2.7	1.4	1.8	1.0	2.1	0.2	7.6		0.8
Wheat Belt - North	3.8	23.6	8.6	5.1	37.1	11.7	17.5	35.9	4.0	20.2	17.4	7.8	4.5	1.4	1.9	9.8	5.5	6.0	4.0	3.0	0.8	4.0	0.8	

Source: ACIL Allen Consulting, 2014

The figure above provides a broad overview of the DEC of journeys between origin-destination pairs in the Perth GCCSA. It can be seen that high DEC journeys are concentrated in the top left quadrant of matrix where the SA3s closer to the city's centre can be found.

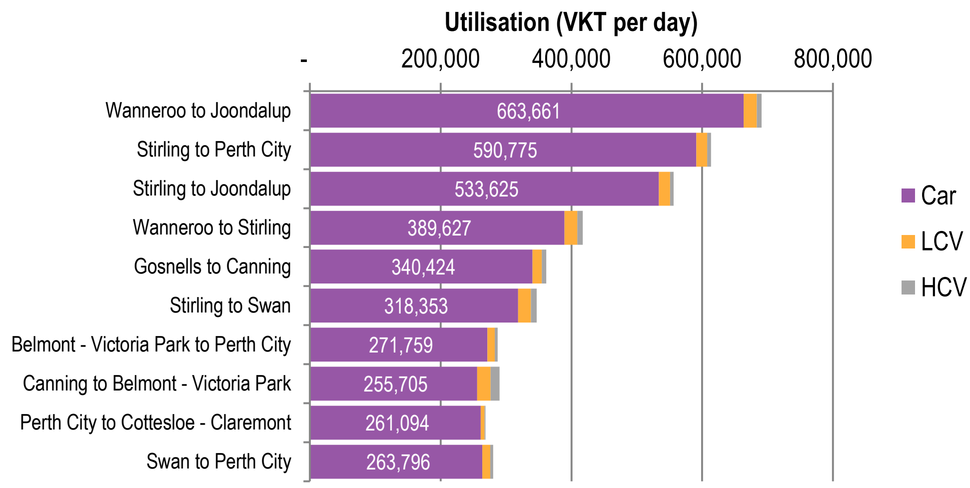
The major hotspot journeys are to and from Perth City. Journeys between the SA3s 'Perth City' and 'Wanneroo' have the highest DEC. This is followed by journeys between the SA3s 'Perth City' and 'Rockingham'. Wanneroo is located in the fast growing north-west metropolitan corridor of Perth, covering a vast area and including many coastal locations. Access to public transport in these areas is limited, with the closest train line being the Joondalup/Butler line.

It is important to note that SA3s are not the same size. Some SA3s can cover geographical areas multiple times larger than some of the SA3s closer to the city centre. As a result the DEC calculated for these areas and other SA3s further from the city centre is spread out over a larger area.

Utilisation for top 10 origin-destination trips

Figure 79 provides an overview of the ten origin-destination pairs with the greatest utilisation of the road network in the Perth GCCSA in 2010-11.

Figure 79 **Roads – top ten origin-destination pairs – utilisation 2010-11 – Perth GCCSA**



Source: ACIL Allen Consulting, 2014

Utilisation in terms of vehicle kilometres travelled (VKT) is highest between Wanneroo and Joondalup; recording around 700,000 VKT per day, with the majority made up of car movements. Following that is trips between Stirling and Perth City.

It is important to note that some of the journeys may share the same corridor for travel and hence contribute to congestion on the same road segments. Section 7.6 covers an analysis of key road corridors, and will expand on this issue further.

DEC for top 10 origin-destination trips

Table 82 provides an overview of the ten origin-destination pairs with the greatest DEC in the Perth GCCSA in 2011.

Table 82 **Roads – top ten origin-destination pairs – DEC 2011 – Perth GCCSA**

From	To	DEC
		$m
Wanneroo	Joondalup	116.5
Stirling	Perth City	109.0
Stirling	Joondalup	87.1
Wanneroo	Stirling	67.4
Gosnells	Canning	66.8
Stirling	Swan	56.9
Belmont - Victoria Park	Perth City	56.3
Canning	Belmont - Victoria Park	55.8
Perth City	Cottesloe - Claremont	52.0
Swan	Perth City	48.4

Source: ACIL Allen Consulting, 2014

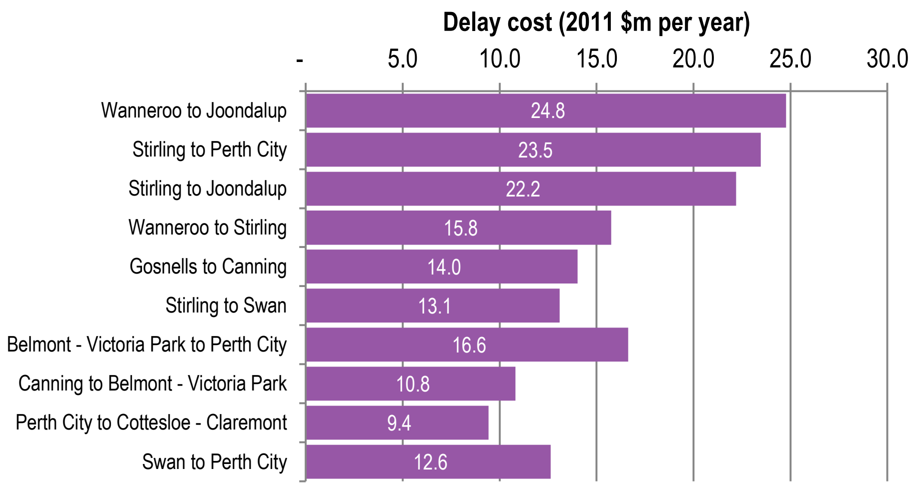
The DEC for trips between the SA3s of Wanneroo and Joondalup is the highest of all origin-destination pairs in the Perth area, closely followed by Stirling to Perth City and Stirling to Joondalup.

Delay costs for top 10 origin-destination trips

Delay costs are measured by evaluating delay time – the additional time it takes to travel a road link due to congestion – with the value of travel time. The measurement of delay cost does not include costs associated with increased vehicle wear and tear or increased fuel consumption through stop and go travel.

Figure 80 shows the ten origin-destination pairs with the greatest delay cost in the Perth GCCSA in 2011.

Figure 80 **Roads – top ten origin-destination pairs – delay cost 2011 – Perth GCCSA**



Source: ACIL Allen Consulting, 2014

Delay costs for car travel are highest for trips between Wanneroo and Joondalup.

DEC by cluster

Origin-destination areas in the Perth-Wheatbelt region were grouped into eight clusters. The clusters were designed to be geographically continuous areas with similar characteristics in terms of employment opportunities and demographics. Table 83 shows what regions make up the clusters in the Perth-Wheatbelt area.

Table 83 **Definition of clusters –** Perth-Wheatbelt

Cluster	Regions
Perth - Inner	Cottesloe – Claremont, Perth City
Perth - North East	Bayswater – Bassendean, Mundaring, Swan
Perth - North West	Joondalup, Stirling, Wanneroo
Perth - South East	Armadale, Belmont - Victoria Park, Canning, Gosnells, Kalamunda, Serpentine – Jarrahdale, South Perth
Perth - South West	Cockburn, Fremantle, Kwinana, Melville, Rockingham
Bunbury	Bunbury
Mandurah	Mandurah
Western Australia - Wheat Belt	Wheat Belt - South Wheat Belt - North

Source: ACIL Allen Consulting, 2014

Analysis of trips between clusters provides an overview of the transport system. Trips to and from Perth – North West and Perth – South East make up a large proportion of the total DEC in the Perth area.

It must be noted though that sizeable amounts of the trips to and from these places is absorbed in congestion costs. Table 84 provides an overview of the delay costs incurred by car transport in 2010-11 in the Perth-Wheatbelt area. The table also shows the percentage of DEC that is absorbed in delay costs.

Table 84 **Car delay cost – 2010-11 –** Perth-Wheatbelt

Cluster	Car delay cost	Car DEC	Car delay cost
	($m)	($m)	% of DEC
Perth - Inner	31.99	158.05	20%
Perth - North East	27.25	100.75	27%
Perth - North West	50.29	183.57	27%
Perth - South East	55.26	163.26	34%
Perth - South West	30.27	76.95	39%
Bunbury	0.37	0.22	171%
Mandurah	0.97	3.57	27%
Western Australia - Wheat Belt	2.51	11.12	23%

Source: ACIL Allen Consulting, 2014

Delay costs for trips from the Bunbury to Perth – Inner Cluster are larger than the DEC of trips from this cluster to the inner city.

7.5.3 Public transport

Overview of DEC for all origin-destination pairs

Figure 81 provides a matrix overview of the DEC of public transport for all SA3 origin-destination pairs in the greater Perth area. Each cell represents the DEC of public transport journeys from an origin (rows of the matrix) to a destination (column of the matrix).

Figure 81 **Public transport – all origin-destination pairs – DEC 2011 – Perth GCCSA**

SA3 Origin / Destination	Cottesloe - Claremont	Perth City	Bayswater - Bassendean	Mundaring	Swan	Joondalup	Stirling	Wanneroo	Armadale	Belmont - Victoria Park	Canning	Gosnells	Kalamunda	Serpentine - Jarrahdale	South Perth	Cockburn	Fremantle	Kwinana	Melville	Rockingham	Bunbury	Mandurah	Wheat Belt - South	Wheat Belt - North
Cottesloe - Claremont		10.0	0.5	0.4	1.5	1.1	1.7	5.2	1.0	0.9	0.7	0.8	0.4	0.5	0.3	1.7	1.1	0.9	0.7	2.6	0.0	1.8	0.0	0.1
Perth City	10.2		7.3	4.8	24.1	16.5	17.5	58.5	14.0	14.5	13.5	15.0	5.4	6.5	6.6	18.2	7.4	8.1	8.1	21.5	0.2	14.1	0.3	2.0
Bayswater - Bassendean	0.4	7.0		0.2	2.5	0.4	0.8	2.5	0.5	0.7	1.0	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	1.1	0.0	0.6	0.0	0.0
Mundaring	0.3	4.6	0.1		0.8	0.2	0.1	0.2	0.1	0.1	0.4	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
Swan	1.3	24.2	3.2	0.9		1.8	1.8	4.5	0.6	1.1	2.6	0.7	0.5	0.2	0.3	0.4	0.5	0.5	0.8	1.6	0.0	1.3	0.0	0.1
Joondalup	1.0	17.6	0.5	0.2	1.6		2.6	19.0	1.0	1.1	1.6	1.0	0.2	0.4	0.4	1.1	0.6	0.9	1.0	2.2	0.0	1.7	0.0	0.1
Stirling	1.7	18.9	0.9	0.2	1.5	2.3		10.3	1.0	0.9	1.6	0.9	0.1	0.5	0.3	1.0	0.7	0.9	0.9	3.0	0.0	2.4	0.0	0.0
Wanneroo	4.6	57.3	2.2	0.2	4.2	19.8	9.3		1.6	5.1	7.0	2.1	0.3	0.1	1.4	2.5	2.6	0.9	3.9	2.2	0.0	1.5	0.0	0.1
Armadale	1.0	13.3	0.5	0.1	0.8	0.9	0.9	2.0		0.6	2.38	1.5	0.2	1.0	0.2	0.5	0.4	0.2	0.7	0.5	0.0	0.5	0.0	0.0
Belmont - Victoria Park	0.8	15.3	0.8	0.1	1.1	0.9	1.0	5.6	1.1		2.5	1.0	0.4	0.3	0.6	0.6	0.6	0.6	0.7	2.4	0.0	2.0	0.0	0.0
Canning	0.8	13.1	1.1	0.3	2.4	1.6	1.3	7.5	2.3	2.4		3.3	0.9	1.0	1.0	2.6	0.7	1.6	1.9	4.9	0.1	3.8	0.0	0.1
Gosnells	0.7	15.4	0.5	0.0	0.8	1.1	0.5	2.2	1.6	1.1	3.6		0.3	0.4	0.3	0.8	0.5	0.4	1.7	1.0	0.0	0.7	0.0	0.0
Kalamunda	0.3	5.4	0.1	0.2	0.6	0.1	0.1	0.4	0.3	0.7	1.0	0.3		0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0
Serpentine - Jarrahdale	0.5	6.2	0.2	0.0	0.2	0.4	0.3	0.2	1.6	0.3	1.0	0.4	0.0		0.0	0.1	0.2	0.1	0.4	0.1	0.0	0.0	0.0	0.0
South Perth	0.1	5.8	0.2	0.0	0.3	0.2	0.2	1.2	0.2	0.6	1.1	0.4	0.0	0.1		0.4	0.2	0.3	0.4	0.7	0.0	0.5	0.0	0.0
Cockburn	1.4	15.7	0.4	0.0	0.5	1.1	0.7	2.3	0.4	0.7	2.7	0.7	0.0	0.1	0.3		2.6	1.0	2.7	2.1	0.0	1.3	0.0	0.0
Fremantle	1.1	6.2	0.2	0.1	0.5	0.6	0.6	2.5	0.4	0.4	0.7	0.3	0.0	0.3	0.3	2.3		0.8	0.8	2.0	0.0	1.5	0.0	0.0
Kwinana	0.8	7.1	0.3	0.0	0.4	0.7	0.8	0.9	0.4	0.7	1.3	0.4	0.0	0.1	0.2	1.1	0.7		0.9	1.8	0.0	0.7	0.0	0.0
Melville	0.6	5.9	0.2	0.1	0.8	0.9	0.6	3.7	0.6	0.6	1.9	1.3	0.1	0.3	0.3	2.3	0.8	0.9		3.0	0.0	2.3	0.0	0.1
Rockingham	2.6	20.2	0.9	0.1	1.5	2.3	2.5	1.9	0.7	1.9	4.5	0.8	0.1	0.2	0.6	1.9	1.9	2.0	2.7		0.0	4.8	0.0	0.0
Bunbury	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Mandurah	1.9	13.5	0.7	0.0	1.0	1.8	2.0	1.4	0.6	2.0	3.4	0.6	0.0	0.1	0.4	1.1	1.0	0.7	2.2	4.6	0.0		0.0	0.1
Wheat Belt - South	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Wheat Belt - North	0.2	1.6	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

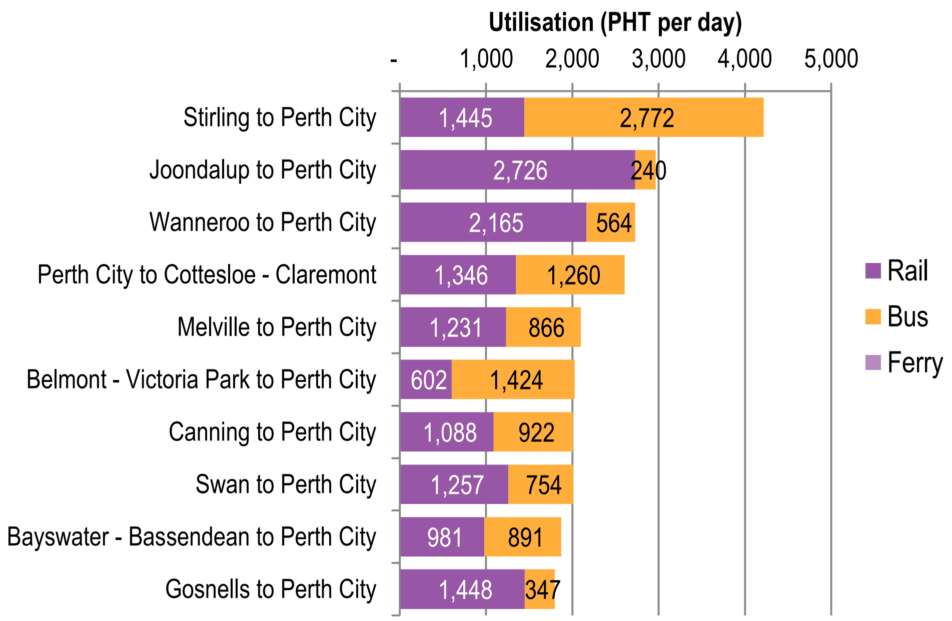
Source: ACIL Allen Consulting, 2014

The upper left quadrant of the matrix contains many hotspots, in particular journeys between Wanneroo and Joondalup and Stirling and Perth City. These journeys would be serviced by trains and buses.

Utilisation for top 10 origin-destination trips

Figure 82 provides an overview of the ten origin-destination pairs with the greatest utilisation in the Perth GCCSA in 2011.

Figure 82 **Public transport – top ten origin-destination pairs – utilisation 2011 – Perth GCCSA**



Source: ACIL Allen Consulting, 2014

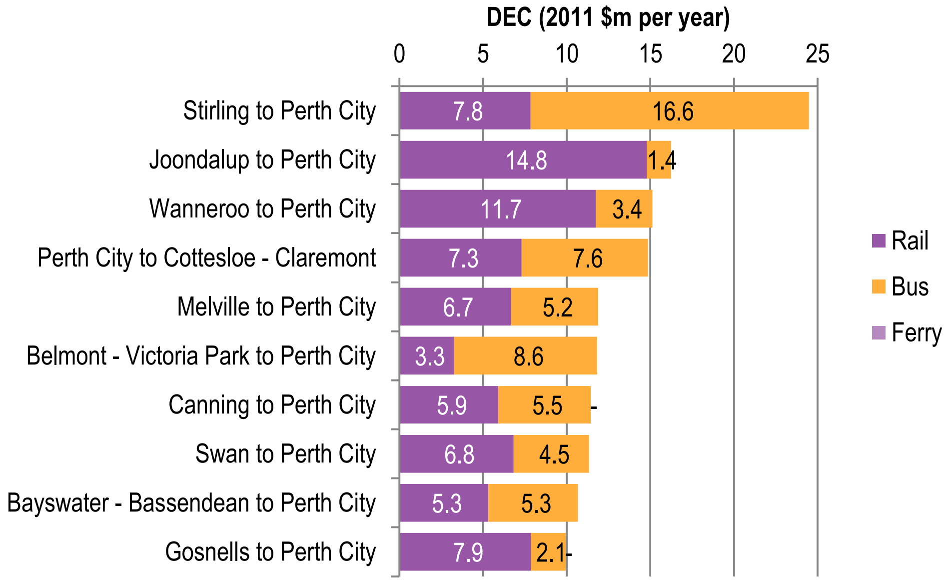
Nine of the ten most highly utilised public transport links have Perth City as their destination.

The one that does not has Perth City as the origin, with the destination being Cottesloe-Claremont. In most origin-destination pairs above, rail has a higher utilisation rate (PHT per day) than buses. Interestingly the highest utilisation pair (Stirling to Perth City) has a higher bus utilisation than rail, even though Stirling is on a direct rail line to Perth City. This is because of the longer travel times associated with bus travel.

DEC for top 10 origin-destination trips

Figure 83 shows the ten origin-destination pairs that in 2011 had the highest DEC in the Perth GCCSA.

Figure 83 **Public transport – top ten origin-destination pairs – DEC 2011 – Perth GCCSA**



Source: ACIL Allen Consulting, 2014

The public transport DEC for the top ten origin-destination pairs is mixed, with some pairs heavily skewed to rail or bus and others relatively equal. Overall there is little difference between the total of the top ten; $60.2 million DEC for bus and $55 million DEC for rail.

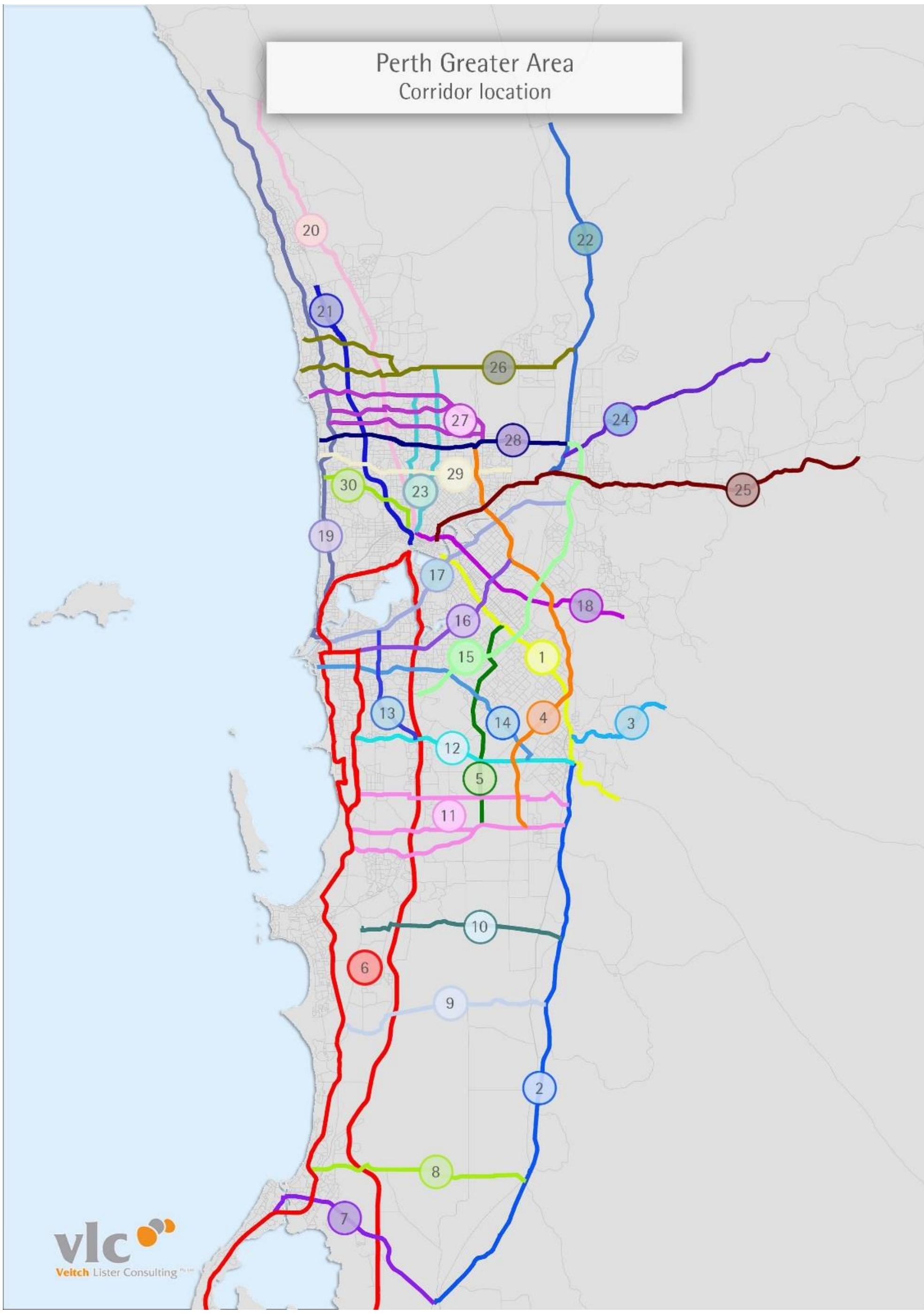
7.6 Corridor analysis

The previous chapter presented modelling results at the level of the SA3 regions. Corridors provide some increased granularity and allow the identification of urban infrastructure 'hot spots' with more precision than analysis by SA3 origin-destination pairs.

The analysis of corridors focusses on the road network only. For the Perth area a set of 27 major road corridors was selected. Some corridors consist of multiple parallel roads. This allows an assessment of capacity, utilisation, congestion and DEC based on commonly travelled routes between destinations.

Figure 84 provides an overview of the 27 major transport corridors that are assessed in Perth-Wheatbelt.

Figure 84 Perth-Wheatbelt **urban transport corridors**



Source: VLC, 2014

Table 85 provides a legend and description to the corridors shown in the figure above.

Table 85 Perth-Wheatbelt **corridors**

Corridor	Description	Corridor	Description
1	Albany Hwy Corridor	16	Leach Hwy Corridor
2	South Western Hwy Corridor	17	Canning Hwy/Great Eastern Hwy (west) Corridor
3	Brookton Hwy Corridor	18	Graham Farmer Fwy/Orrong Rd/Welshpool Rd East Corridor
4	Tonkin Hwy Corridor	19	Marmion Ave/West Coast Hwy Corridor
5	Nicholson Rd Corridor	20	Wanneroo Rd Corridor
6	Kwinana Fwy Corridor	21	Mitchell Fwy Corridor
7	Pinjarra Rd Corridor	22	Great Northern Hwy Corridor
8	Lakes Rd/Gordon Rd Corridor	23	Mirrabooka Ave Corridor
9	Karnup Rd/Stakehill Rd Corridor	24	Toodyay Rd Corridor
10	Mundijong Rd Corridor	25	Great Eastern Hwy (east)/Guildford Rd Corridor
11	Thomas Rd Corridor	26	Gnangara Rd/Whitfords Ave Corridor
12	Beeliar Dr/Armadale Rd Corridor	27	Hepburn Ave Corridor
13	North Lake Rd Corridor	28	Reid Hwy Corridor
14	South St/Ranford Rd Corridor	29	Morley Dr/Karrinyup Rd Corridor
15	Roe Hwy Corridor	30	Scarborough Beach Rd Corridor

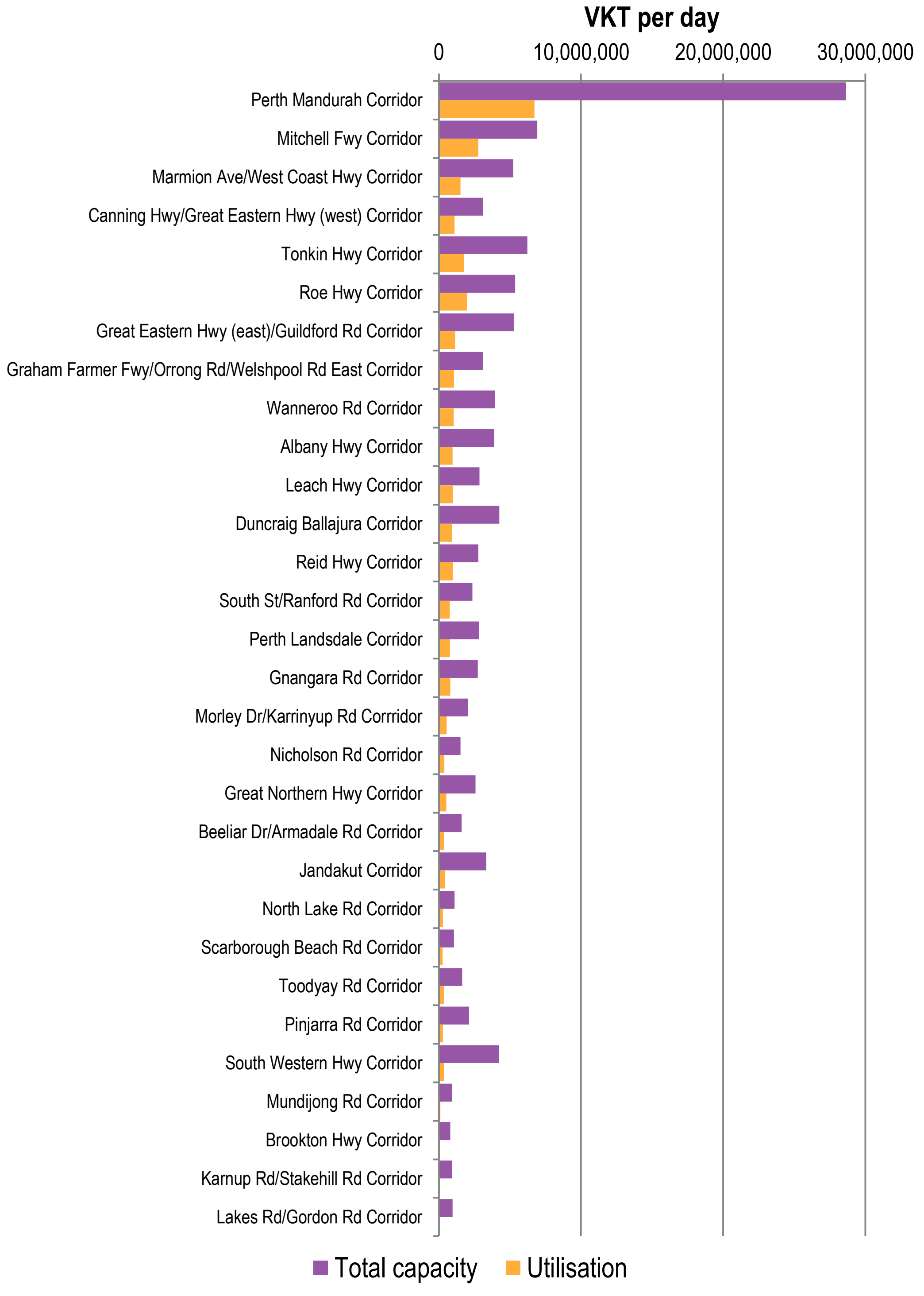
Source: ACIL Allen Consulting, 2014

7.6.1 DEC of corridors

Corridor capacity and utilisation

Figure 85 provides an overview of the capacity and utilisation of key transport links in the Perth area. We distinguish between the utilisation of corridors on a daily basis i.e. the average utilisation over the entire day, and the utilisation during the two hour morning peak. The percentage figures shown in the graph indicate the utilisation during the morning peak while the bars indicate the capacity and average utilisation during the day.

Figure 85 **Transport corridors – Capacity and utilisation 2011 –** Perth-Wheatbelt



Note: Percentage figures indicate the utilisation during the AM peak
Source: ACIL Allen Consulting, 2014

Capacity as measured by the VKT that can be achieved on a corridor are influenced by the length of the corridor and the capacity of the roads making up the corridor. Of the selected corridors the three largest corridors in the Perth area are ‘Perth Mandurah’, ‘Mitchell Fwy Corridor’ and ‘Marmion Ave/West Coast Hwy’ corridors. The Perth Mandurah corridor has the largest VKT by far.

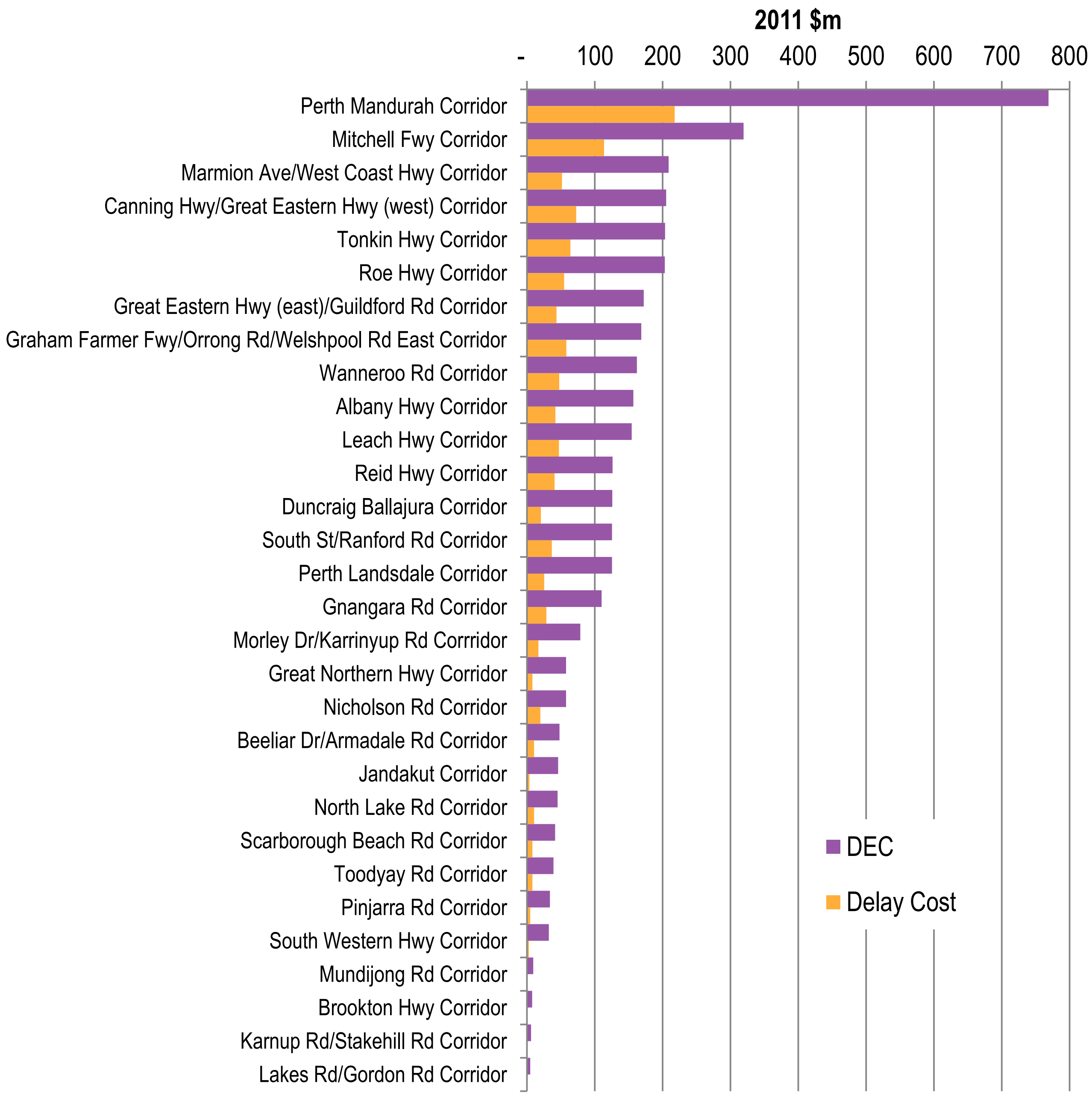
The ‘Perth Mandurah’ corridor, ‘Great Northern Hwy’ corridor and the ‘Roe Hwy’ corridor are the three corridors with the highest utilisation over a typical day.

The 'Mitchell Fwy' and 'Roe Hwy' corridors generally have a high utilisation over the course of a typical day and also experience the highest congestion during the morning peak. In the morning peak the 'Mitchell Fwy' corridor experiences utilisation of 70 per cent of capacity, and the 'Roe Hwy' corridor 65 per cent of capacity.

Corridor DEC and delay costs

Figure 86 shows the DEC and utilisation of major transport corridors in the Perth-Wheatbelt area.

Figure 86 **Transport corridors – DEC and delay cost 2010-11 –** Perth-Wheatbelt



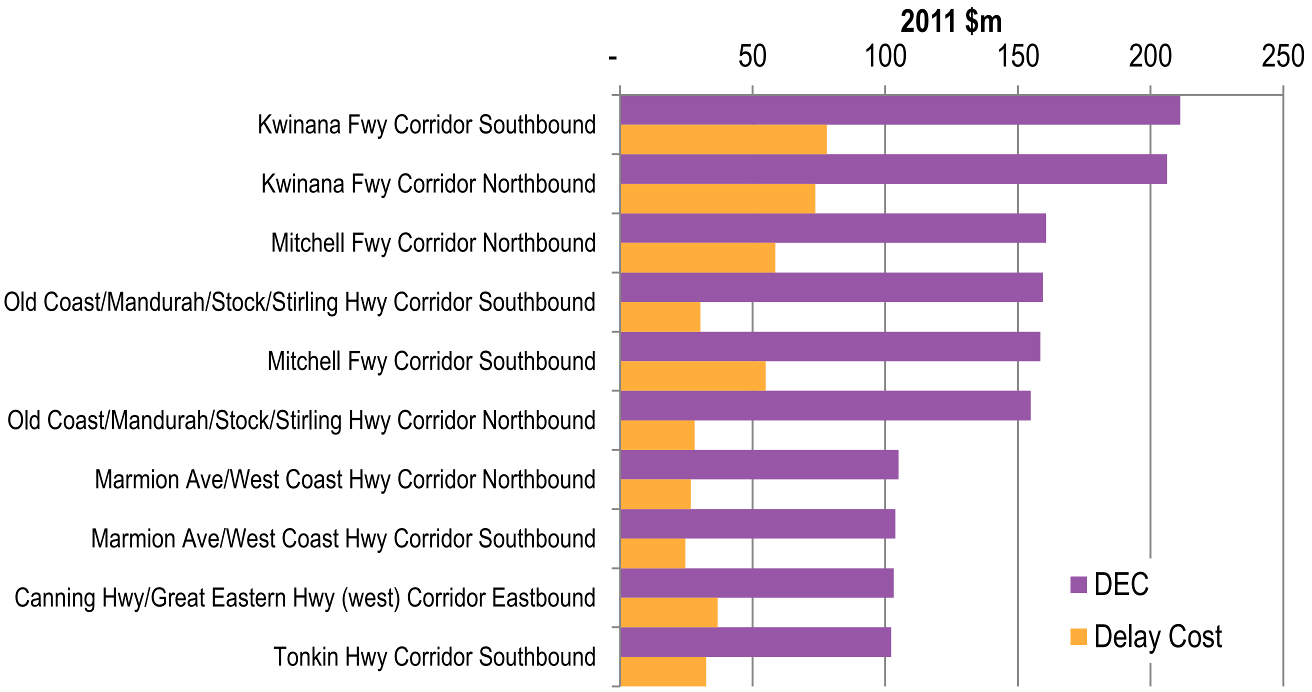
Source: ACIL Allen Consulting, 2014

The 'Perth Mandurah' corridor has the highest DEC of the major transport corridors in the Perth area, and also the highest associated delay cost of around $300 million, per annum.

7.6.2 Analysis of routes within major corridors

Figure 87 shows the DEC and delay costs of routes within the five corridors with the highest DEC in the Perth-Wheatbelt area.

Figure 87 **Transport corridors – DEC and delay cost of routes within major corridors –** Perth-Wheatbelt



Note: Shown are routes within the five corridors with the highest DEC.
Source: ACIL Allen Consulting, 2014

7.7 Projections for 2031

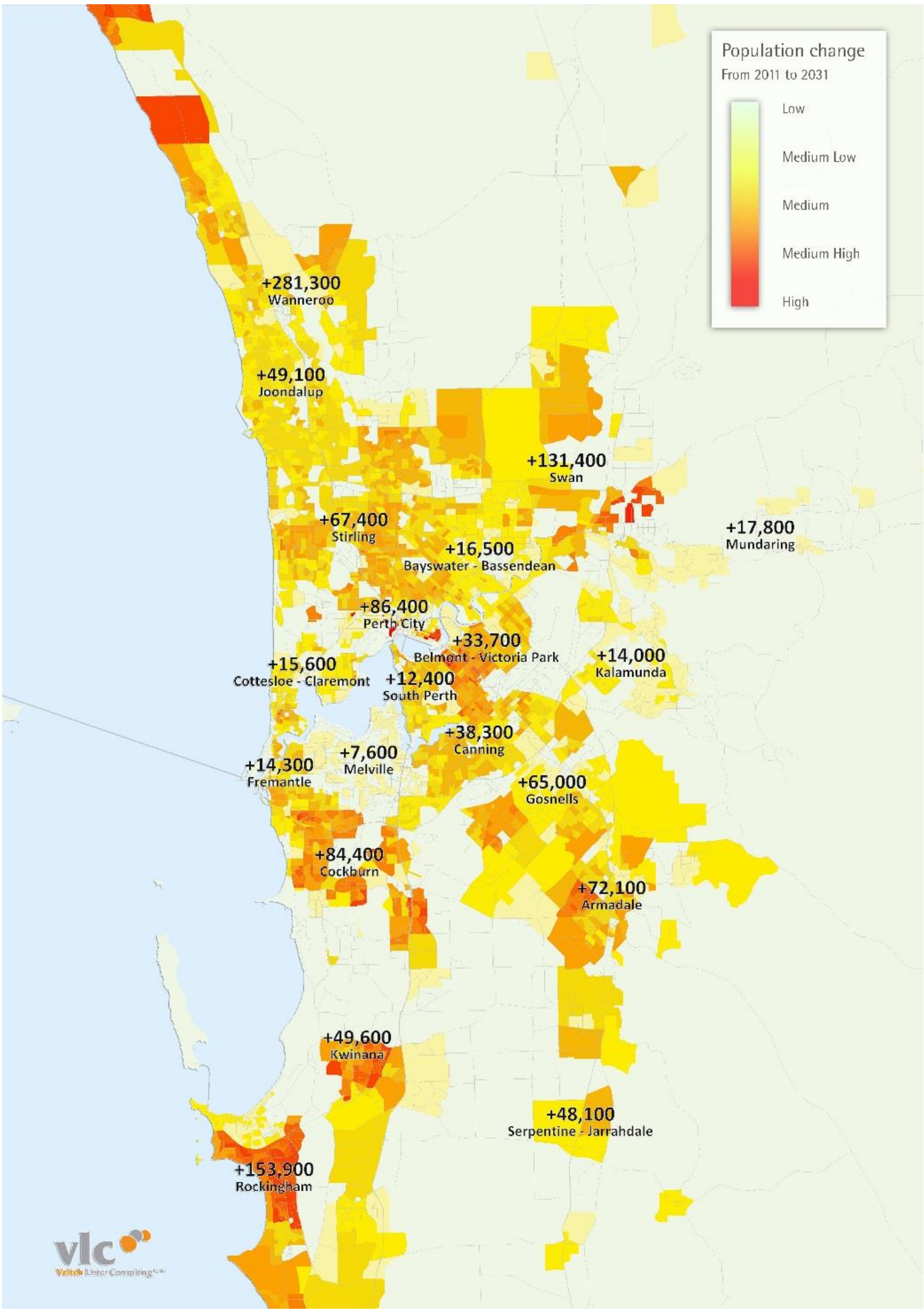
7.7.1 Demand drivers for urban transport

Key drivers of demand for urban transport infrastructure are population growth and where future jobs are going to be located.

Projected population growth

Between 2010-11 and 2030-31 Perth-Wheatbelt's population is projected to grow strongly with growth concentrated on the Wanneroo and Rockingham areas in the north and south of Perth. Figure 88 shows projected changes in population for Perth-Wheatbelt area by transport zone.

Figure 88 **Projected population growth 2010-11 to 2030-31 –** Perth-Wheatbelt



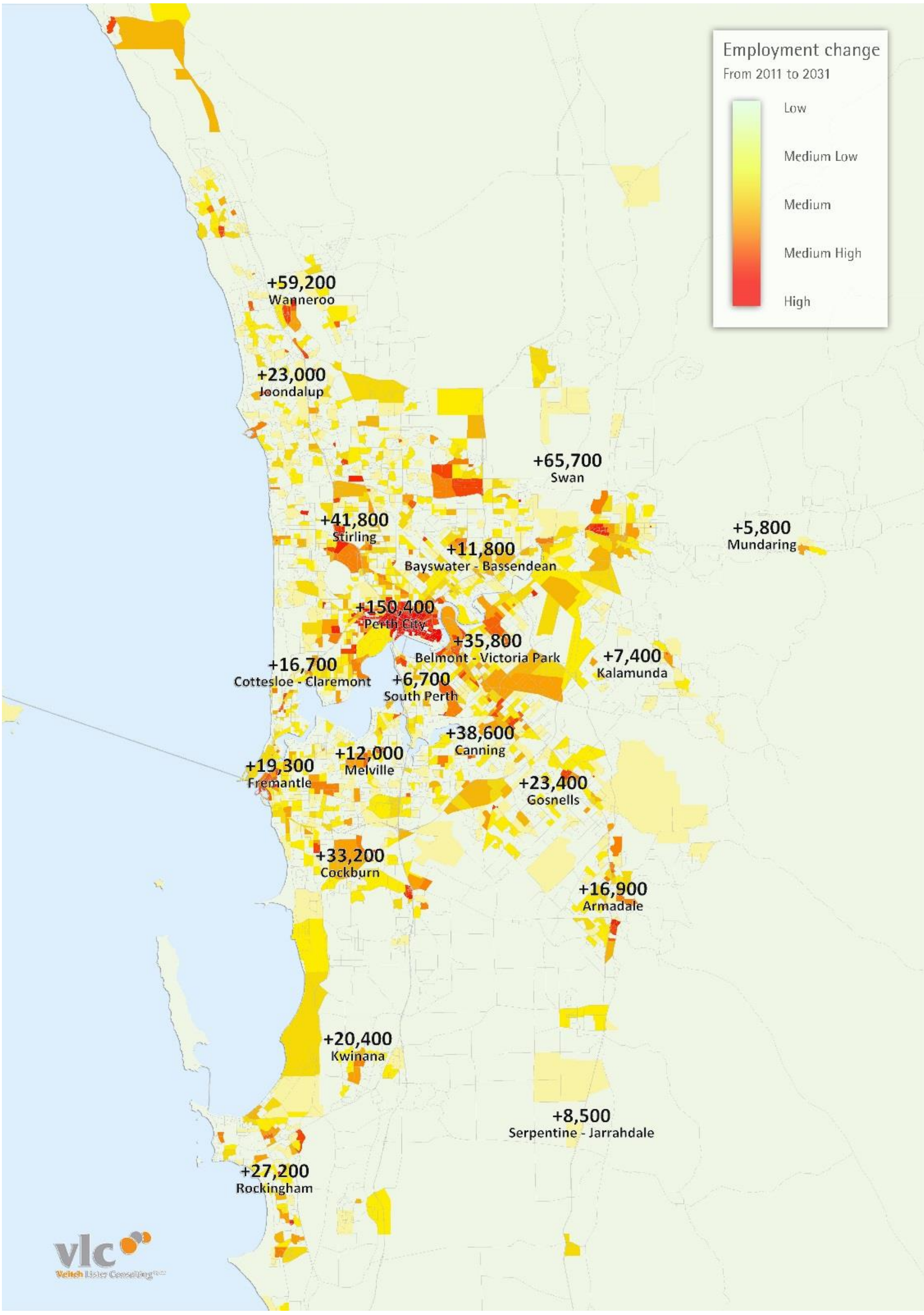
Source: (VLC, 2014)

Between 2010-11 and 2030-31 the population of the Perth region is projected to increase by more than 1.4 million people, an increase of 77 per cent.

Projected employment growth

While population growth is projected to occur in the outer suburbs of Rockingham and Wanneroo most new jobs are projected to be created in the city centre. Figure 89 shows projected employment growth in the Perth-Wheatbelt area.

Figure 89 **Projected employment growth 2010-11 to 2030-31 –** Perth-Wheatbelt



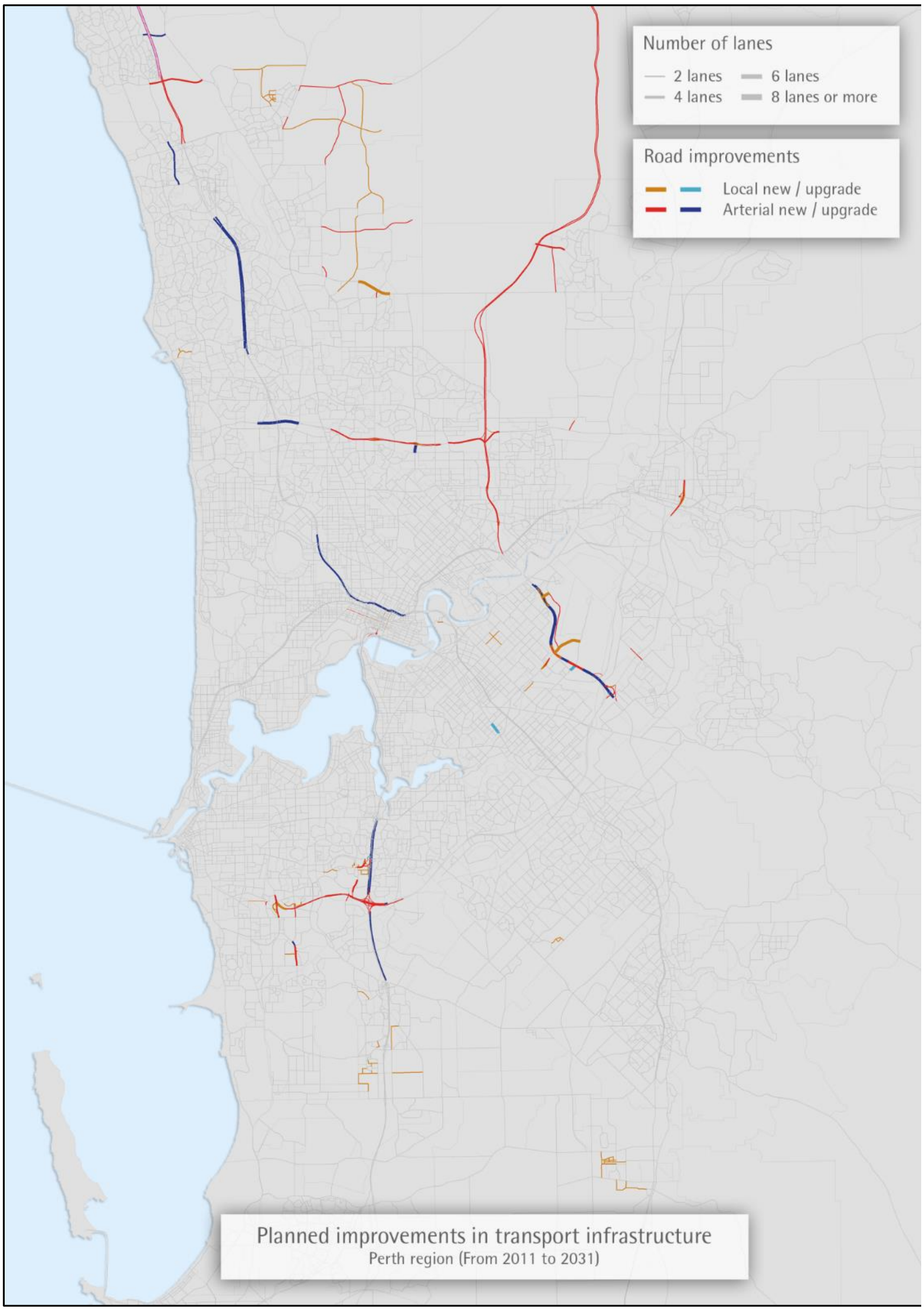
Source: (VLC, 2014)

Further concentration of employment in Perth's inner city will increase the demand for urban transport infrastructure services between the inner city and the new population growth centres in the north and south of Perth-Wheatbelt.

7.7.2 Planned expansion of urban transport infrastructure

Figure 90 gives an overview of assumed changes in rail and road infrastructure between 2010-11 and 2030-31.

Figure 90 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 –** Perth-Wheatbelt



Source: (VLC, 2014)

The figure above shows additions to Perth-Wheatbelt's urban transport infrastructure that are assumed to go ahead under a low investment scenario. This includes projects for which funding has been committed or where significant political capital has been invested.

Table 86 provides an overview of the key additions to the urban transport system in the Perth-Wheatbelt region that are assumed to go ahead between 2010-11 and 2030-31.

Table 86 **Major additions to transport infrastructure between 2010-11 and 2030-31 assumed in transport modelling -** Perth-Wheatbelt

Item	Description
1	Perth City Link (sinking of Fremantle line)
2	Perth City Link (construction of Perth Busport)
3	Perth Stadium Transport Project (Swan River Pedestrian bridge, bus terminal, internal roads)
4	Joondalup Line extension to Butler
5	Aubin Grove station construction
7	Gateway WA - Perth Airport and Freight Access
8	Kwinana Fwy - addition of third lane (SB only) btn Roe Hwy and Armadale Rd
9	Mitchell Freeway extension btn Burns Beach Rd and Hester Ave
10	NorthLink WA - Swan Valley Section
11	Reid Hwy - Duffy Road to Erindale Road Dual Carriageway
12	Reid Hwy - Malaga Dr grade separation
13	Graham Farmer Fwy - Tunnel Conversion to 3L
14	Great Eastern Hwy - Kooyong Rd to Tonkin Hwy Stage 1 - Construct Dual Carriageway (6L)
15	Great Eastern Hwy - construction of interchange with Roe Hwy
16	Kwinana Fwy - addition of third lane btn Leach Hwy and Roe Hwy
17	Mitchell Fwy - addition of third lane (NB only) btn Hepburn Ave and Hodges Dr

Source: (VLC, 2014)

A full list of projects that are assumed to go ahead between 2010-11 and 2030-31 can be found in Appendix B.

7.7.3 DEC in 2031

Table 87 shows the DEC of different transport modes within the urban transport sector of the Perth-Wheatbelt area.

Table 87 **Urban transport DEC by transport mode – 2030-31 –** Perth-Wheatbelt

Mode	DEC	DEC
	(2011) $m	(2031) $m
Car	7,647	28,699
LCV	400	1,489
HCV	448	1,599
Rail	290	1,007
Bus	350	826
Ferries	-0.1	0
Light Rail	0	0
Total	**9,134**	**33,619**

Note:
Source: ACIL Allen Consulting, 2014

7.7.4 Capacity, utilisation and congestion in 2031

Table 88 provides an overview of the road network capacity in 2030-31 compared to the capacity in 2010-11.

Table 88 **Road network capacity – 2010-11 and 2030-31 –** Perth-Wheatbelt

Year	Road network	Capacity	Capacity
		VKT per day	kms of road
2011	Road Network	300,045,588	12,044
2031	Road Network	315,206,758	12,323

Source: ACIL Allen Consulting, 2014

The capacity increase in the road network is based on a low investment scenario and only includes expansions for which funding has been committed. Between 2010-11 and 2030-31, 279 kilometres of road are assumed to be added to the urban transport network of the Perth area. These new roads and expansions of existing roads are projected to add 15 million VKT of capacity to the overall network.

Table 89 compares road network utilisation in the Perth-Wheatbelt area in 2030-31 with 2010-11.

Table 89 **Road network utilisation and congestion – 2010-11 and 2030-31 –** Perth-Wheatbelt

Year	Road network	Utilisation VKT per day	Congestion V/C at AM Peak	Congestion V/C during typical day	Congestion Total passenger delay as a % of travel time (daily)	Congestion Cost of delay ($m per year)
2011	Road Network	49,845,107	32%	17%	22%	1,784
2031	Road Network	94,241,231	56%	30%	52%	15,865

Source: ACIL Allen Consulting, 2014

Utilisation of the road network in the Perth-Wheatbelt area is projected to increase by 91 per cent over the period to 2031. As a result, congestion on a typical day will increase significantly from 17 per cent in 2011 to an estimated 30 per cent in 2031, despite the additions to the road network capacity assumed in this study. The cost of congestion is projected to swell to $16 billion per annum.

Table 90 provides a comparison of the projected capacity of public transport in the Perth-Wheatbelt area in 2030-31 to the capacity in 2010-11.

Table 90 **Public transport network capacity – 2010-11 and 2030-31 –** Perth-Wheatbelt

Year	Public Transport Networks	Capacity	Capacity
		Passenger seat kms per day	Passenger crush kms per day
2011	Rail Network	8,999,781	25,514,855
2011	Bus Network	8,691,320	13,047,254
2011	Ferry Network	6,533	12,086
2011	Light rail Network	-	-
2031	Rail Network	12,349,826	31,033,477
2031	Bus Network	8,727,253	13,101,196
2031	Ferry Network	6,538	12,095
2031	Light rail Network	-	-

Source: ACIL Allen Consulting, 2014

Under the low investment scenario the seated capacity of the rail network is projected to grow by approximately 37 per cent. The bus and ferry network are not projected to change.

Table 91 compares the utilisation of different public transport modes in 2010-11 and 2030-31.

Table 91 **Public transport network utilisation – 2010-11 and 2030-31 – Perth-Wheatbelt**

Year	Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
		Passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
2011	Rail Network	2,965,370	42%	15%	33%	12%
2011	Bus Network	1,367,563	21%	14%	16%	10%
2011	Ferry Network	303	4%	2%	5%	3%
2011	Light rail Network	-	0%	0%	0%	0%
2031	Rail Network	8,843,400	86%	33%	72%	28%
2031	Bus Network	2,166,951	35%	24%	25%	17%
2031	Ferry Network	771	10%	5%	12%	6%
2031	Light rail Network	-	0%	0%	0%	0%

Source: ACIL Allen Consulting, 2014

Aggregate utilisation of all transport networks is projected to increase from 2010-11 to 2030-31. The largest increase in utilisation is seen in the rail network; passenger kilometres travelled is expected to increase from around 4 million kilometres per day to 11 million. The bus network is projected to double from 1 million passenger kilometres per day to 2 million. The ferry network is also expected to approximately double.

Significant increases in congestion in the morning peak and during the day are projected for the rail network. In 2030-31, congestion in terms of seat capacity in the morning will reach 86 per cent, and 72 per cent during the typical day.

This is considerably alleviated by the crush capacity which brings the morning peak congestion down to 33 per cent and 28 per cent during the day.

Analysis of key journeys

Table 92 provides an overview of the ten origin-destination pairs with the highest projected change in DEC between 2010-11 and 2030-31.

Table 92 **Roads – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Perth GCCSA**

From	To	Δ DEC ($m)
Wanneroo	Joondalup	521.7
Wanneroo	Stirling	249.6
Wanneroo	Swan	199.1
Stirling	Perth City	197.1
Belmont - Victoria Park	Perth City	183.4
Swan	Perth City	175.7
Stirling	Swan	172.4
Mandurah	Rockingham	165.6
Wanneroo	Perth City	162.2
Gosnells	Canning	145.6

Source: ACIL Allen Consulting, 2014

Increases in DEC can be the result of a higher utilisation of links between different suburbs, increased cost of congestion and network extensions between origin-destination pairs. For road travel, the three largest changes in DEC concern travel from the origin of Wanneroo to Joondalup, Stirling and Swan. The origin-destination pair Wanneroo to Joondalup is projected to have a change in DEC of $522 million. The change in road DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C7 in Appendix C.

Table 93 shows the ten origin-destination pairs with the highest projected change in public transport DEC between 2010-11 and 2030-31.

Table 93 **Public transport – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Perth GCCSA**

From	To	Δ DEC ($m)
Wanneroo	Perth City	57.3
Swan	Perth City	24.2
Rockingham	Perth City	20.2
Wanneroo	Joondalup	19.8
Stirling	Perth City	18.9
Joondalup	Perth City	17.6
Cockburn	Perth City	15.7
Gosnells	Perth City	15.4
Belmont - Victoria Park	Perth City	15.3
Mandurah	Perth City	13.5

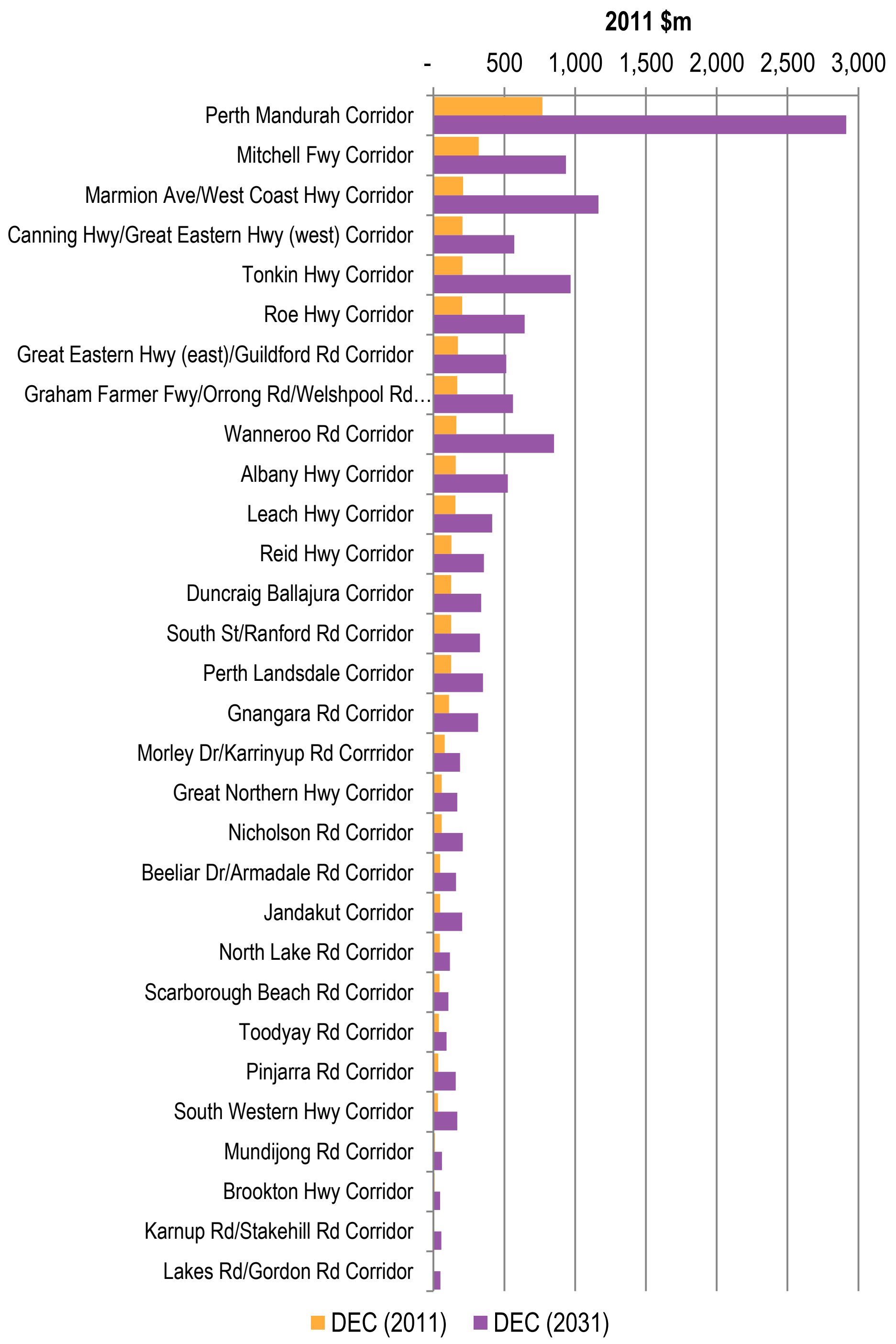
Source: ACIL Allen Consulting, 2014

The change in DEC in terms of public transport is much lower than for road travel. The largest change is projected to be seen between Wanneroo and Perth City; a change of $55 million. The change in public transport DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C8 in Appendix C.

Analysis of corridors

Figure 91 compares the projected DEC of major transport corridors in the Perth-Wheatbelt area in 2030-11 to the DEC of these corridors in 2010-11.

Figure 91 **Transport corridors – DEC 2010-11 and 2030-31 –** Perth-Wheatbelt

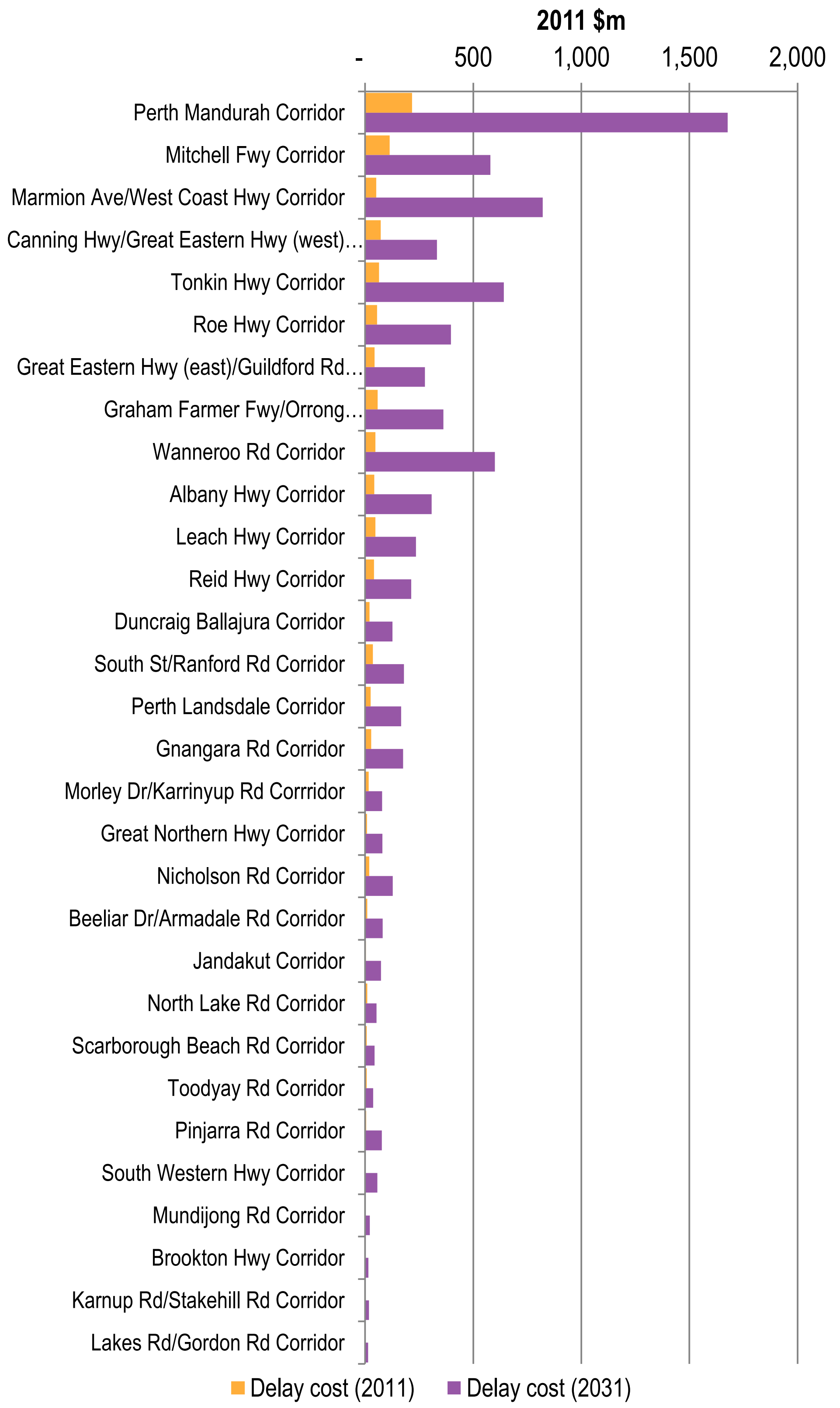


Source: ACIL Allen Consulting, 2014

Under the low investment scenario the 'Perth Mandurah Corridor' is projected reach a DEC of over $2.91 by 2030-31.

Figure 92 compares the projected delay costs on major transport corridors in 2030-31 to the delay cost on these corridors in 2010-11.

Figure 92 **Transport corridors – delay cost 2010-11 and 2030-31 –** Perth-Wheatbelt



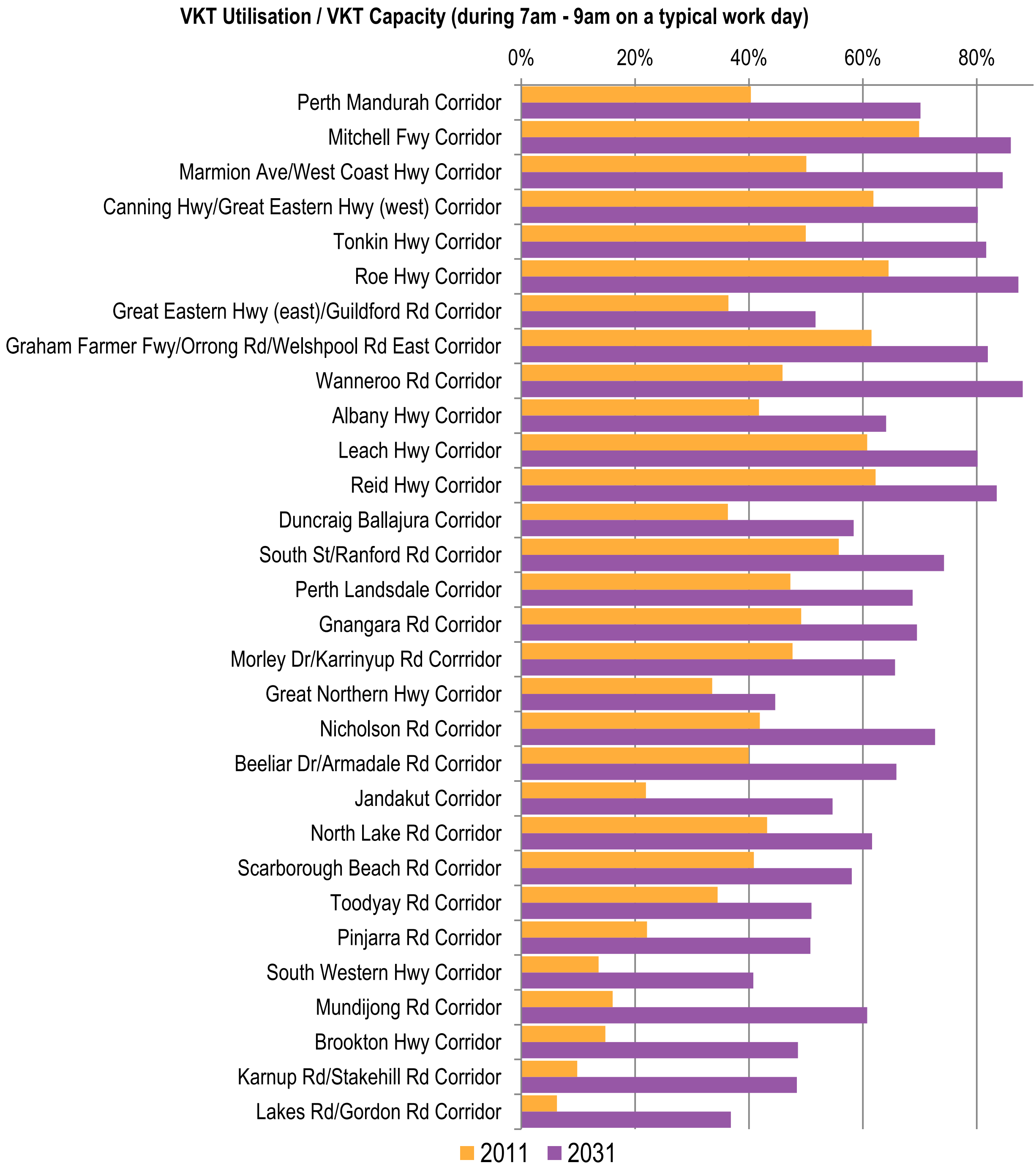
Source: ACIL Allen Consulting, 2014

Under the low investment scenario, delay costs are projected to increase across all major corridors, in particular the 'Perth Mandurah', 'Marmion Ave/ West Coast Hwy' and 'Wanneroo Rd' corridors.

The delay costs to be experienced on the 'Perth Mandurah' corridor in 2030-31 are approximately $1.68 billion, an increase of around 10 fold compared to 2010-11.

Figure 93 provides a comparison of projected congestion on major transport corridors during the morning peak in 2030-31 to congestion on these corridors in 2010-11. The figure shows the ratio of VKT to the VKT capacity of the corridors.

Figure 93 **Transport corridors – change in congestion 2010-11 and 2030-31 –** Perth-Wheatbelt



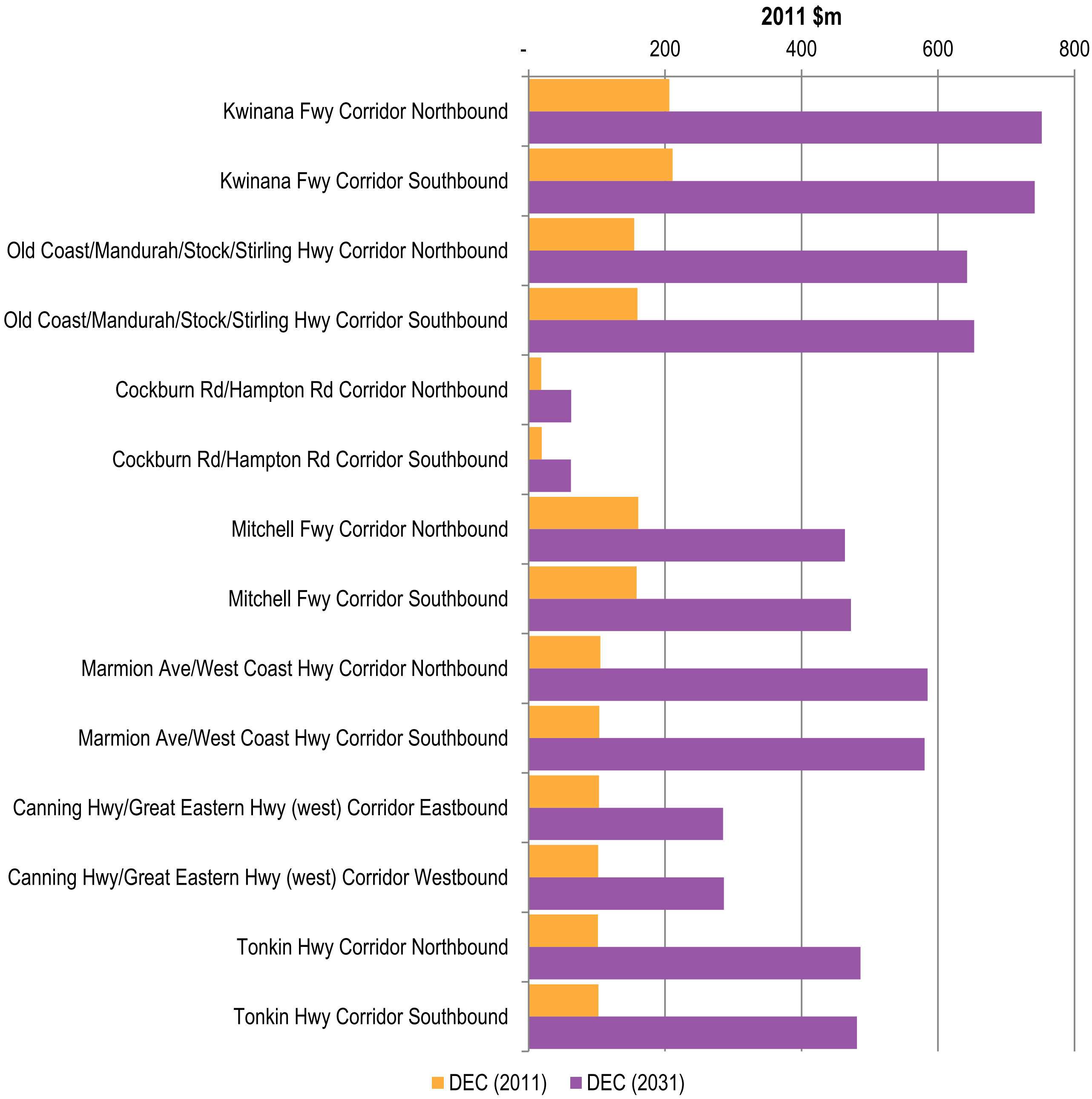
Source: ACIL Allen Consulting, 2014

Congestion during the morning peak from 7am-9am is expected to increase on all corridors, with nine corridors projected to experience equal to or greater than 80 per cent congestion.

Analysis of key routes

The analysis in this section focusses on key routes within the two major transport corridors. Figure 94 compares the DEC and delay costs of routes within the two corridors with the highest DEC in the Perth-Wheatbelt area in 2010-11 and 2030-31.

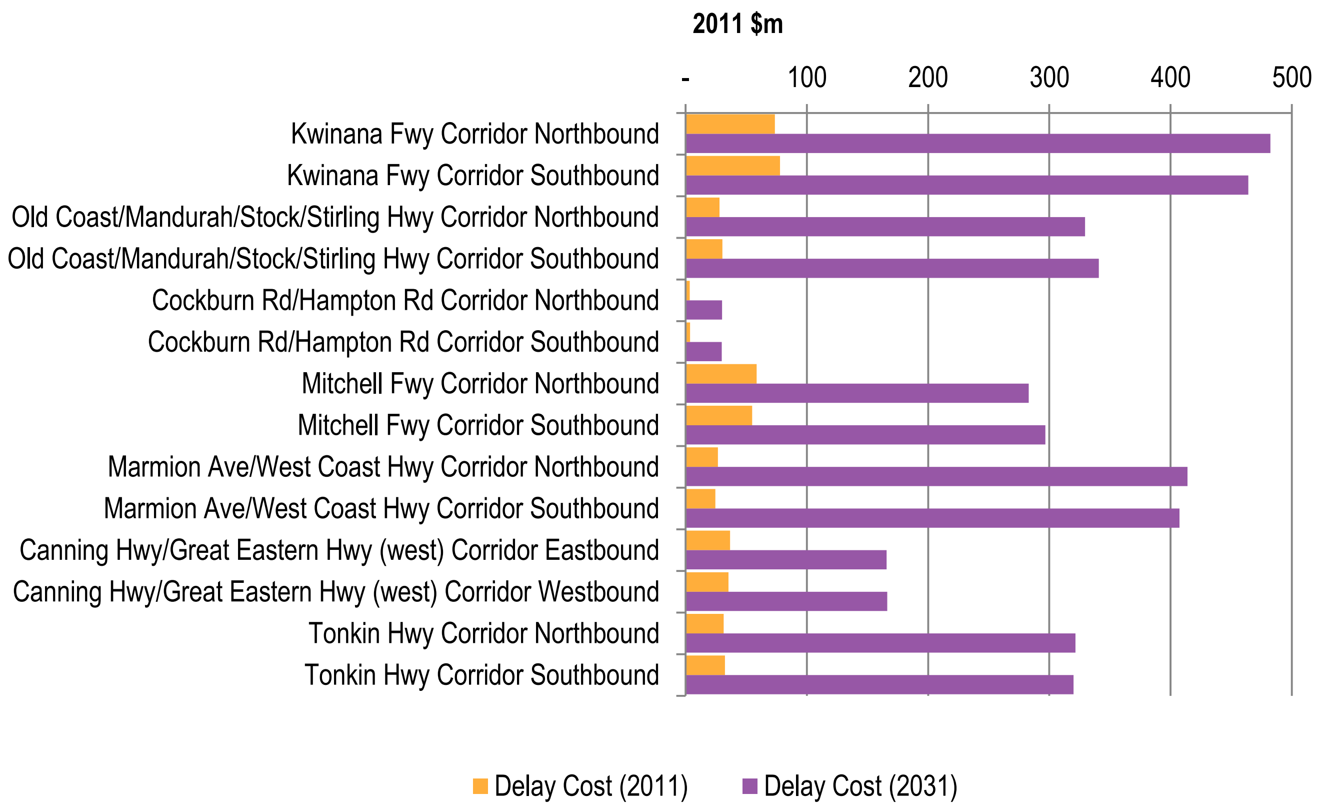
Figure 94 **Key routes– DEC 2010-11 and 2030-31 –** Perth-Wheatbelt



Source: ACIL Allen Consulting, 2014

Figure 95 shows a comparison of delay cost on routes within the two corridors with the highest DEC in the Perth-Wheatbelt area between 2010-11 and 2030-31.

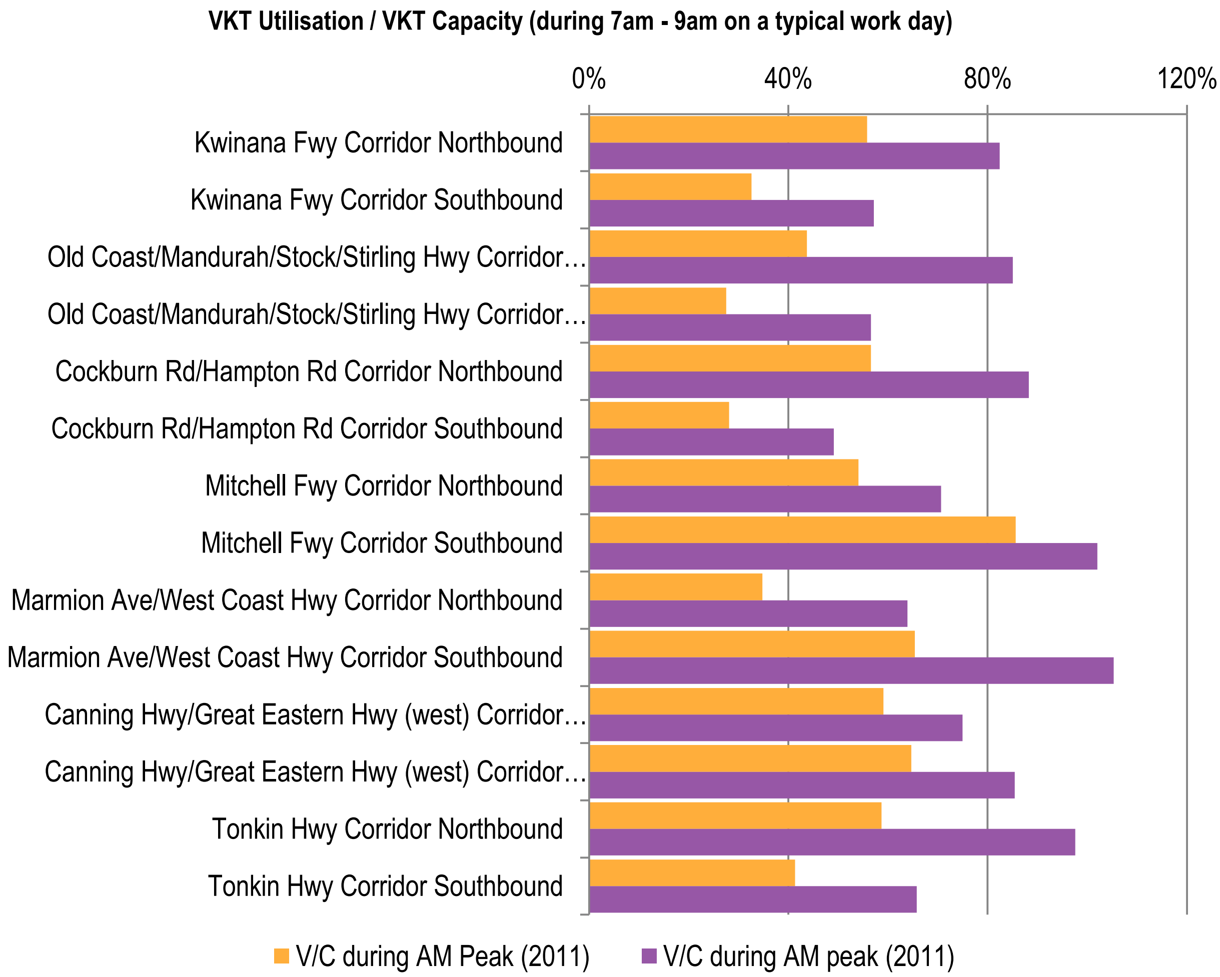
Figure 95 **Key routes– change in delay cost 2010-11 and 2030-31 –** Perth-Wheatbelt



Source: ACIL Allen Consulting, 2014

Figure 96 compares congestion on key routes in the Perth-Wheatbelt area between 2010-11 and 2030-31.

Figure 96 **Key routes– change in congestion 2010-11 and 2030-31 –** Perth-Wheatbelt



Source: ACIL Allen Consulting, 2014

7.7.5 Reconciliation with macro-economic data

In this section the projections of DEC from urban transport infrastructure based on transport activity data are reconciled with projections based on national statistics.

The bottom-up projections of DEC are based on transport activity projections from VLC's Zenith model. The top-down, projections of DEC from urban transport infrastructure are based on national statistics. Household expenditure on personal transport are based on data from the household expenditure survey using SDs as basic unis rather than GCCSAs (details of this is provided in the earlier section of this chapter). Household expenditure is assumed to grow in line with income growth as a proxy for expenditure growth. Income growth projections are obtained from ACIL Allen's Tasman Global modelling for the Baseline Scenario of the broader AIA. DEC from road and rail freight is projected to grow in line with projections of gross value add for rail and road transport which is also obtained from the Tasman Global model projections.

Table 94 provides a comparison between bottom-up and top-down estimates of DEC for the Perth-Wheatbelt area.

Table 94 **Macro-reconciliation –DEC of urban transport infrastructure 2030-31 – Perth-Wheatbelt- $ million**

DEC (Based on transport simulation modelling)		DEC (Based on national statistics)	
Car/PMV	28,699	Car/PMV	26,128
LCV	1,489	Road (freight)	4,418
HCV	1,599	Rail (freight)	465
Rail	1,007	Rail	119
Bus	826	Bus/tram/mixed	418
Ferry	0	Ferry	77
Light Rail	0		
Total Transport	**33,619**	**Total Transport**	**31,624**

Source: ACIL Allen Consulting, 2014

8 Adelaide-Yorketown

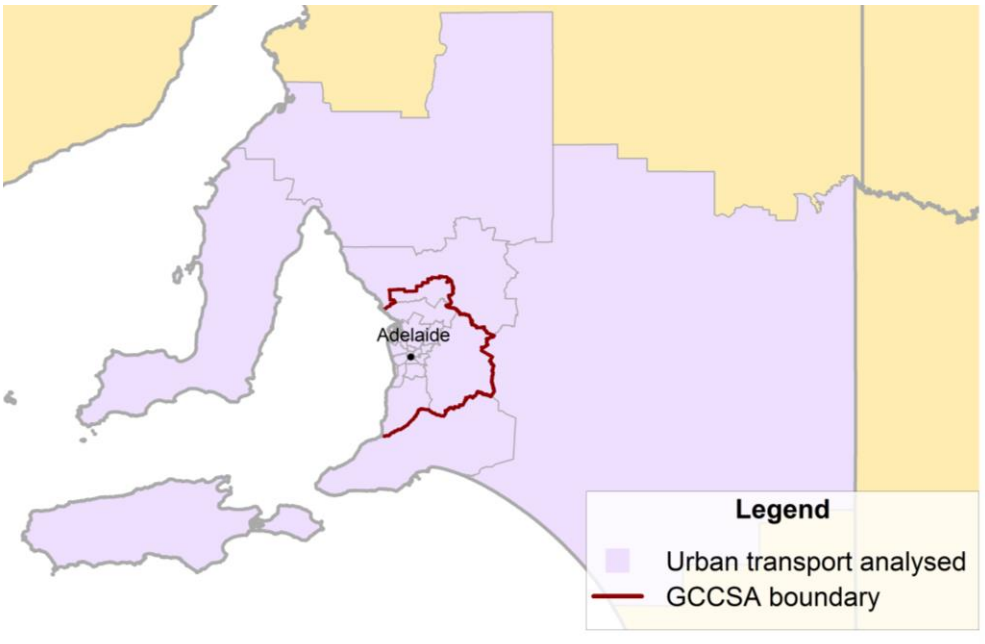
Adelaide- is serviced by set of major expressways, heavy rail, a tram line and a bus network that includes a guided busway.

Adelaide's suburban rail system consists of five lines and is currently undergoing a major investment program which includes the electrification of the rail system. Heavy rail services operate between Gawler, Outer Harbor, Belair, Seaford and the inner city. The Glenelg tram runs from Hindmarsh through Adelaide's city centre to the beach-side suburb of Glenelg. Adelaide's bus system includes a network of guided buses on tracks, the O-Bahn Busway.

The Princess Highway enters Adelaide from the east via the suburbs of Mt Barker and Hahndorf. The Northern Expressway provides services to the northern suburb of Gawler and merges with Port Wakefield Rd leading to the Adelaide city centre. The Southern Expressway leads from Old Noarlunga in the south to the suburb of Darlington where it merges with South Road.

Figure 97 provides an overview of the Adelaide region for which the urban transport system has been analysed.

Figure 97 Adelaide-Yorketown



Source: ACIL Allen Consulting, 2014

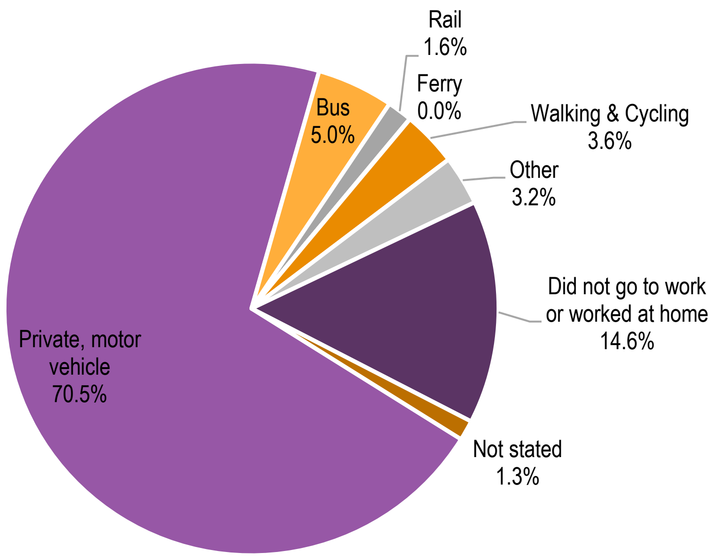
We note that the area covered by the urban transport analysis covers some non-urban areas. The boundaries of the urban transport analysis were chosen to ensure that the entire conurbation of a city is included in the analysis. This is to ensure that the transport system of the city is captured as accurately as possible.

8.1 Key issues and challenges

In 2009 motor vehicles travelled an estimated 28 million vehicle kilometres on the roads of the Adelaide capital city area (BITRE, 2011). Adelaide's public transport system carried a total of 63 million passengers in 2012-13.

Employment in Adelaide is highly concentrated. Adelaide's inner city[18] attracts 19 per cent of the workforce of the Greater Adelaide region and a large share of Adelaide residents travel to work by car. Figure 98 shows the mode share for travel to work in the Adelaide GCCSA.

Figure 98 **Method of travel to work, Adelaide GCCSA - 2011**



Note: Transport methods have been grouped e.g. 'private motor vehicle' include trucks and motorbikes, 'other' includes multimodal public and private transport. This does not include: Unemployed persons looking for either part-time or full-time work; Persons not in the labour force; Persons with Labour Force Status (LFSP) not stated; and Persons aged under 15 years.
Source: (ABS, 2011)

The 1968 Metropolitan Adelaide Transport Study (MATS) recommended the construction of a series of freeways and expressways to form a high capacity ring road system for Adelaide. The recommendations of the MATS plan were ultimately discarded and today Adelaide has a radial system of roads that funnel considerable amounts of traffic through Adelaide's inner city area. Arterial roads serving Adelaide's inner city such as Greenhill and Goodwood road experience congestion during the morning and evening peak (RAA, 2013).

The Greater Adelaide area has a higher proportion of elderly people than the rest of Australia and the proportion of people over 65 living in the greater Adelaide region is projected to increase to 22 per cent by 2036 (DPLG, 2010). Apart from catering for the needs of elderly people for well-connected smaller accommodation, the Government is seeking to ensure that a healthy balance between the working age population and the elderly population remains intact. Affordable housing is seen as the key to retaining and attracting working age people to live in the Greater Adelaide area.

In 2010, the South Australian Government released, *The 30-Year-Plan for Greater Adelaide*. With the '30-Year Plan for Greater Adelaide' (DPLG, 2010) the Government of South Australia is planning for an increase in Adelaide's population of 560,000 people over 30

[18] Defined here as the SA3 'Adelaide City'

years. To facilitate a decreased reliance on road transport for these new developments, the Government is seeking to encourage transit-orientated development where possible. In other words, new developments are to be located in the vicinity of existing transport corridors where possible. New growth areas are concentrated in the north of the city, in the suburbs of Two Wells, Virginia and Roseworthy. Other strategic new growth areas are planned for the suburbs of Angle Vale, Buckland Park, Cheetham, Concordia, Goolwa, Mount Barker, Murray Bridge, Playford North, Victor Harbour and Yankalilla.

Catering for a projected increase in population while maintaining housing affordability through the development of key growth areas will provide challenges for Adelaide's urban transport infrastructure.

8.2 Regulation, policy and governance context

Urban transport in South Australia is primarily planned and regulated by the State Government. Key issues in South Australian urban transport include:

- aligning land use for housing and jobs with the proposed expansion of the public transport network
- protecting the functionality of major freight routes and preventing inappropriate residential development
- increasing residential housing in transit corridors where the network will be expanded.

8.2.1 Planning

The 30-Year-Plan for Greater Adelaide is designed to guide the State Government's planning and delivery of services and infrastructure across South Australia, including transport. The Department of Planning and Local Government is the lead agency to facilitate the implementation of the plan.

The South Australian Government is currently considering submissions on a new Integrated Transport and Land Use Plan, which includes among other things the development of a new tram network and modernised bus networks.

Local Governments are responsible for planning local roads.

8.2.2 Regulation

The Public Transport Services Division of the Department of Planning, Transport and Infrastructure (DPTI) is responsible for the regulation of bus, train, tram and taxi passenger services.

The Transport Services Division of DPTI is responsible for the maintenance, upgrading and operation of the arterial and outback road network and the regulation of heavy vehicles.

The Minister for Transport may determine fares for passenger transport services (including motor vehicle, trains, and trams).

Adelaide Metro, the trading name of the Public Transport Services division of DPTI, monitors the performance of bus services. The Rail Commissioner monitors and publishes service standard reports for trains and trams.

8.2.3 Funding

Urban transport in South Australia is funded from a combination of grants/subsidies from all levels of government and user charges.

The estimated expense to the State Government of providing public transport services across South Australia was approximately $502 million in 2013-14, with an income of approximately $164 million (South Australian Government, 2014).

8.2.4 Service delivery

The Transport Services Division of DPTI is responsible for the delivery of major infrastructure projects. Local councils are responsible for delivering and maintaining local roads in their local areas.

Adelaide Metro is responsible for the operation of bus, train, and tram passenger services. Adelaide Metro contracts out the provision of bus services to three private parties: Transfield (Light City Buses), Australia Transit Enterprises (SouthLink) and Transit Systems (Torrens Transit).

8.3 Current network capacity, utilisation and congestion

8.3.1 Capacity

Table 95 provides an overview of the road network capacity in the Adelaide-Yorketown area.

Table 95 **Road network capacity – 2010-11 –** Adelaide-Yorketown

Road network	Capacity	Capacity
	VKT per day	kms of road
Road network	169,385,298	7,016

Source: ACIL Allen Consulting, 2014

The area covered by the urban transport analysis for Adelaide-Yorketown comprises a road network that is comparable to that of Sydney. We note however that this includes roads that cannot be strictly classified as urban.

Table 96 shows the network capacity for the public transport network in the Adelaide-Yorketown area.

Table 96 **Public transport network capacity – 2010-11 –** Adelaide-Yorketown

Public Transport Networks	Capacity	Capacity
	Passenger seat kms per day	Passenger crush kms per day
Rail Network	2,565,689	4,205,226
Bus Network	7,237,787	10,454,581
Ferry Network	-	-
Light rail Network	163,743	382,067

Source: ACIL Allen Consulting, 2014

Adelaide-Yorketown's bus network has a capacity that is more than twice as large as the Adelaide-Yorketown rail network. The capacity of the only light rail line in Adelaide, the Glenelg light rail, is an order of magnitude smaller than the capacity of the bus or rail network.

8.3.2 Utilisation and congestion

Table 97 provides an overview of utilisation and congestion in the road network of the Adelaide-Yorketown area.

Table 97 **Road network utilisation and congestion in** Adelaide-Yorketown

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
Road Network	28,225,360	40%	17%	24%	1,442

Source: ACIL Allen Consulting, 2014

Congestion of the road network in the Adelaide-Yorketown region is less severe than in other cities covered by this report. We note that the congestion numbers shown in the table above refer to average congestion in the entire urban transport system of the Adelaide-Yorketown region. Specific links within the transport network may experience congestion far greater than the average.

Table 98 shows the overall utilisation of public transport networks in the Adelaide-Yorketown area.

Table 98 **Public transport network utilisation and congestion** Adelaide-Yorketown

Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
	passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
Rail network	582,748	42%	26%	23%	14%
Bus network	1,141,167	26%	18%	16%	11%
Light rail	24,613	33%	14%	15%	6%

Source: ACIL Allen Consulting, 2014

In aggregate, the rail system in the Adelaide-Yorketown region is highly utilised and has the highest utilisation of public transport modes in the Adelaide-Yorketown region. Adelaide-Yorketown's bus network is much more extensive than the rail network but has a lower utilisation. This can be partly explained by the fact that a more extensive network is bound to include services that have lower patronage than those to central areas.

8.4 Current network Direct Economic Contribution

8.4.1 Aggregate DEC

Total DEC from Urban transport in the Adelaide-Yorketown region in 2011 was $6,705 million in 2010-11.

8.4.2 DEC by mode

Table 99 provides an overview of the DEC by transport for the Adelaide area.

Table 99 **Urban transport DEC by transport mode – 2010-11 – Adelaide**

Mode	DEC
	$m
Car	5,830
LCV	194
HCV	383
Rail	42
Bus	254
Ferries	0
Light Rail	1
Total	**6,705**

Source: ACIL Allen Consulting, 2014

The DEC of car travel in the Adelaide-Yorketown region accounted for the majority of DEC from urban transport in Adelaide-Yorketown in 2010-11. Despite a higher utilisation of the train network the DEC from rail was lower than that from buses. This is because the time spent travelling on buses tends to be longer for the same distance travelled.

8.4.3 Reconciliation with macro-economic data

Table 100 provides a comparison of estimates of DEC of urban transport infrastructure in the Adelaide-Yorketown area using a bottom-up and using a top-down approach. The columns to the right of Table 100 show estimates of the DEC of urban transport infrastructure based on household expenditure and national accounts statistics i.e. the top-down estimates. The columns to the left of Table 100 show estimates of DEC from urban transport infrastructure based on modelled transport activity data i.e. the bottom-up estimates.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements.

The macro reconciliation is aiming to provide a broad indication as to whether the results of the bottom-up modelling reconcile with macro-economic data. National account statistics available at the time of writing this report were available on the basis of statistical divisions (SD's). SDs were used as a basic geographical unit for understanding and interpreting the geographical context of statistics published by the ABS before 2011. Generally SDs are broadly consistent with the GCCSA; detailed mapping of the SDs and their consistency with the GCCSAs can be found on the ABS website[19]. To reduce the potential mismatch between the national account statistics provided on a SD basis and the bottom-up modelling results the macro data has been scaled to the population of the relevant bottom-up modelling areas.

[19] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1216.0July%202011?OpenDocument

Table 100 **Macro-reconciliation – DEC of urban transport infrastructure 2010-11 –** Adelaide-Yorketown **area**

DEC (Based on transport simulation modelling)		DEC (Based on national statistics)	
Car/PMV	5,830	Household private vehicle expenditure	4,008
LCV	194	Road transport (freight)	1,171
HCV	383	Rail transport (freight)	266
Rail	42	Rail (household expenditure)	15
Bus	254	Bus/tram/light rail (household expenditure)	74
Ferry	-	Ferry (household expenditure)	10
Light Rail	1		
Total Transport	**6,705**	**Total Transport**	**5,543**

Source: ACIL Allen Consulting, 2014

In the Adelaide-Yorketown region the biggest difference between the top-down and bottom-up estimates of the DEC of urban transport infrastructure lies in the estimates of the DEC of freight services and car travel. The bottom-up estimates of the DEC of freight services do not include rail freight.

In the bottom-up model, the DEC from road freight is based on estimated freight movements on the roads within the study area. In the top-down model the DEC of freight services is calculated based on the gross value added of freight services from national account statistics. The national account statistics account for freight services at the point where contracts for freight movements are struck. As such contracts tend to be struck in the city, and since the study area covers a largely urban area, the top-down DEC estimates of road freight transport tend to be higher in the top-down model than in the bottom-up model.

The DEC estimates of public transport infrastructure in the top-down model are based on household expenditure survey data in which households report expenditure on public transport fares. The bottom-up model of the DEC from public transport accounts for the fares spent on public transport as well as the value of time spent travelling. As a result the estimates of DEC from public transport tend to be higher in the bottom-up model than in the top-down. We note that while Adelaide has no public transport network using ferries, the top-down modelling indicates DEC from ferry services. The household expenditure survey for Adelaide included reported spending on water transport which has been used to calculate the DEC of ferry services in the Adelaide region. This reported spending could stem from people reporting spending on water transport that they have made in other cities. We also note that the reported spending on water transport in the household expenditure survey is associated with a very high relative standard error.

8.5 Demand analysis by origin-destination

8.5.1 Overview of demand analysis

The demand analysis assesses the value (measured as DEC) of journeys from combinations of origins and destinations. The demand analysis is distinguished from other levels of analysis as it shows the demand for mobility (the value that is placed on trips that transport people or goods from one SA3 to another) as opposed to the value that is being derived from use of a physical network or infrastructure component.

A significant proportion of this demand (27.3% of road journeys and 9.4% of public transport journeys in Adelaide GCCSA) is within each SA3 (i.e. where the SA3 is both the origin and destination). The focus of this demand analysis however, is on infrastructure connecting separate origins and destinations. Specifically, the DEC of road journeys and public transport for combinations of different SA3 origins and destinations, for the GCCSA area, is shown in the form of 'heat-map' matrices.

8.5.2 Roads

Overview of DEC for all origin-destination pairs

Figure 99 shows the DEC for all origin-destination pairs in 2010-11 in the Adelaide GCCSA. Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys *originating* in the SA3 'Adelaide City' whereas the first column shows the DEC of trips *ending* in the SA3 'Adelaide City.

The DEC is colour coded from green to red, where green indicates a low DEC and red indicates a high DEC. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure 99 **Roads – origin-destination pairs – DEC 2011 – Adelaide GCCSA**

SA3 Origin / Destination	Adelaide City	Adelaide Hills	Burnside	Campbelltown (SA)	Norwood - Payneham - St Peters	Prospect - Walkerville	Unley	Gawler - Two Wells	Playford	Port Adelaide - East	Salisbury	Tea Tree Gully	Holdfast Bay	Marion	Mitcham	Onkaparinga	Charles Sturt	Port Adelaide - West	West Torrens	Fleurieu - Kangaroo Island	Barossa	Lower North	Yorke Peninsula	Murray and Mallee
Adelaide City		32.4	15.8	14.2	17.8	12.3	17.8	4.2	45.6	20.3	20.4	12.6	8.1	21.3	20.9	25.9	42.4	18.8	50.5	7.5	10.2	1.7	0.7	4.9
Adelaide Hills	31.4		5.3	3.5	6.9	1.7	6.5	1.6	6.4	3.6	4.3	5.4	2.9	7.9	8.7	10.1	6.8	4.1	14.3	9.6	3.1	0.1	0.1	6.2
Burnside	16.3	5.3		4.3	6.2	1.2	4.5	0.7	4.7	1.8	1.3	2.1	1.0	3.1	3.6	2.7	4.3	1.7	7.7	0.6	1.5	0.1	0.2	0.4
Campbelltown (SA)	13.9	3.5	4.2		7.2	0.8	2.3	0.8	6.3	0.9	1.0	5.0	0.6	1.8	1.8	1.5	3.2	1.4	6.3	0.5	2.1	0.1	0.1	0.4
Norwood - Payneham - St Peters	18.2	7.0	6.1	7.2		2.2	4.7	1.1	10.4	3.6	3.0	3.8	1.1	3.6	3.7	3.8	6.2	2.7	9.6	1.0	3.1	0.4	0.0	0.8
Prospect - Walkerville	12.4	1.8	1.2	0.8	2.2		2.1	1.1	8.5	6.4	5.2	2.2	0.8	2.0	1.6	1.7	7.6	3.8	6.8	0.4	2.0	0.3	0.1	0.3
Unley	18.5	6.7	4.6	2.4	4.8	2.1		0.7	6.7	3.0	3.0	2.1	2.6	8.1	8.6	6.3	7.8	3.0	13.9	1.2	2.1	0.3	0.1	0.7
Gawler - Two Wells	4.2	1.6	0.7	0.8	1.1	1.0	0.7		56.9	3.9	15.1	6.5	0.4	0.8	0.6	0.4	3.4	4.1	5.5	0.3	28.3	2.5	0.2	1.2
Playford	44.3	6.3	4.5	6.1	9.9	8.1	6.5	56.7		28.5	122.26	41.4	3.1	6.2	5.5	4.4	26.8	31.8	26.6	0.7	39.1	5.6	0.8	2.3
Port Adelaide - East	19.9	3.7	1.8	1.0	3.6	6.5	2.9	4.1	30.0		21.8	13.5	1.0	3.3	2.4	3.3	13.1	10.8	11.0	0.6	6.7	0.9	0.3	0.8
Salisbury	19.7	4.4	1.3	1.0	2.9	5.0	2.9	16.0	125.0	21.3		30.8	1.4	3.3	2.6	3.1	15.5	18.7	14.0	0.8	20.2	2.1	0.4	1.0
Tea Tree Gully	11.9	5.5	2.1	5.0	3.7	2.1	2.0	6.9	43.4	13.3	31.1		0.7	1.9	1.5	1.6	8.1	7.8	9.1	0.5	9.9	1.0	0.3	1.2
Holdfast Bay	8.2	3.0	1.0	0.6	1.1	0.8	2.6	0.4	3.3	1.0	1.4	0.7		15.2	6.1	9.6	6.4	2.3	10.9	1.1	1.1	0.0	0.1	0.4
Marion	20.7	7.9	2.9	1.8	3.5	1.9	7.6	0.8	6.4	3.3	3.3	2.0	14.7		23.5	38.3	12.2	4.9	24.8	4.0	2.1	0.4	0.0	1.2
Mitcham	20.6	8.7	3.6	1.8	3.8	1.6	8.4	0.6	5.6	2.4	2.6	1.5	6.0	25.0		18.1	7.2	2.9	15.2	3.3	1.9	0.2	0.2	1.2
Onkaparinga	25.3	10.2	2.7	1.4	3.8	1.6	6.2	0.4	4.5	3.3	3.1	1.5	9.5	38.2	19.3		11.2	5.7	26.1	15.4	1.8	0.3	0.1	1.4
Charles Sturt	43.0	7.1	4.4	3.3	6.3	7.8	7.8	3.6	28.4	13.4	16.1	8.5	6.4	12.5	7.3	11.5		27.0	40.3	2.0	7.5	1.2	0.4	1.0
Port Adelaide - West	18.8	4.2	1.7	1.4	2.7	3.9	3.0	4.3	33.3	10.9	19.3	8.0	2.3	5.0	3.0	5.8	27.1		14.7	1.0	7.6	1.1	0.2	0.8
West Torrens	50.9	14.4	7.6	6.4	9.6	6.9	13.7	5.6	27.3	11.0	14.2	9.2	10.8	25.2	15.3	26.0	39.8	14.4		6.9	9.7	2.5	2.3	5.7
Fleurieu - Kangaroo Island	7.3	9.6	0.6	0.5	1.0	0.3	1.1	0.3	0.7	0.6	0.8	0.5	1.1	3.9	3.4	15.2	1.9	1.0	6.9		0.3	0.1	0.0	1.7
Barossa	10.0	3.0	1.4	2.0	3.0	1.9	2.0	28.9	39.0	6.4	19.3	9.5	1.1	2.0	1.9	1.8	7.0	7.3	9.6	0.3		6.0	0.3	3.8
Lower North	1.7	0.1	0.1	0.1	0.3	0.3	0.3	2.5	5.5	0.8	2.0	0.9	0.0	0.4	0.2	0.3	1.1	1.1	2.4	0.1	6.0		2.1	0.2
Yorke Peninsula	0.7	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.8	0.2	0.4	0.3	0.1	0.0	0.2	0.1	0.4	0.2	2.3	0.0	0.2	2.1		0.0
Murray and Mallee	4.8	6.2	0.4	0.4	0.8	0.3	0.7	1.2	2.3	0.7	1.0	1.2	0.4	1.2	1.2	1.4	0.9	0.8	5.8	1.7	3.8	0.2	0.0	

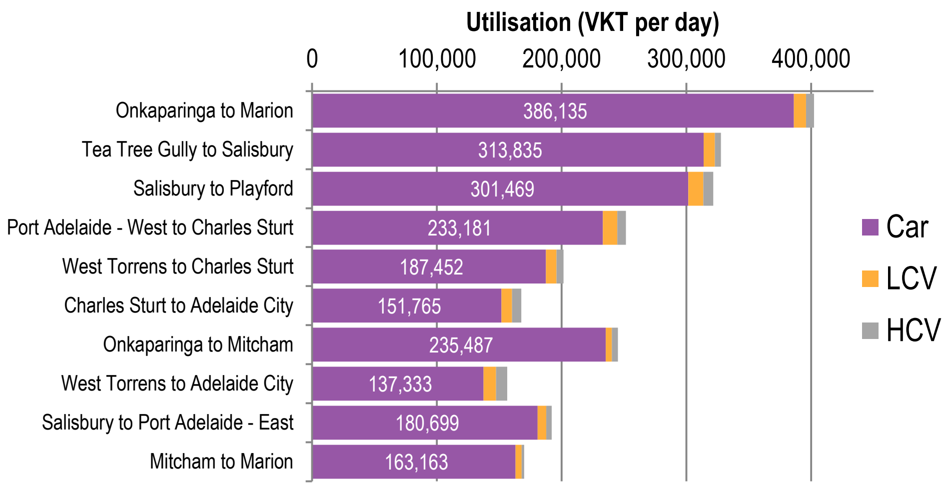
Source: ACIL Allen Consulting, 2014

Hot spots include trips between 'Onkaparinga' and 'Marion' and between 'Tea Tree Gully' and 'Salisbury'. Other hot spots in the greater Adelaide area include trips that originate or finish in the 'Adelaide City', 'West Torrens' and 'Charles Sturt' SA3s. We note that SA3s do not all have the same population size. The 'Onkaparinga' SA3 has the highest population of the SA3s in the greater Adelaide region and hence appears as a hot spot in terms of trips originating from this SA3.

Utilisation for top 10 origin-destination trips

Figure 100 provides an overview of the ten origin-destination pairs with the greatest utilisation of the road network in the Adelaide GCCSA area in 2010-11.

Figure 100 **Roads – top ten origin-destination pairs – utilisation 2010-11 – Adelaide GCCSA**



Source: ACIL Allen Consulting, 2014

The utilisation in terms of VKT per day is highest for trips between the 'Onkaparinga' and the neighbouring 'Marion' SA3. Due to the fact that the 'Onkaparinga' SA3 has the largest population of any SA3 in the greater Adelaide region, it can be expected that a high number of trips originate from this SA3.

DEC for top 10 origin-destination trips

Table 101 provides an overview of the ten origin-destination pairs with the greatest DEC in the Adelaide GCCSA area in 2011.

Table 101 **Roads – top ten origin-destination pairs – DEC 2011 – Adelaide GCCSA**

From	To	DEC
		$m
Onkaparinga	Marion	61.6
Tea Tree Gully	Salisbury	60.5
Salisbury	Playford	55.9
Port Adelaide - West	Charles Sturt	49.7
West Torrens	Charles Sturt	46.2
Charles Sturt	Adelaide City	38.0
Onkaparinga	Mitcham	38.0
West Torrens	Adelaide City	37.9
Salisbury	Port Adelaide - East	36.2
Mitcham	Marion	35.7

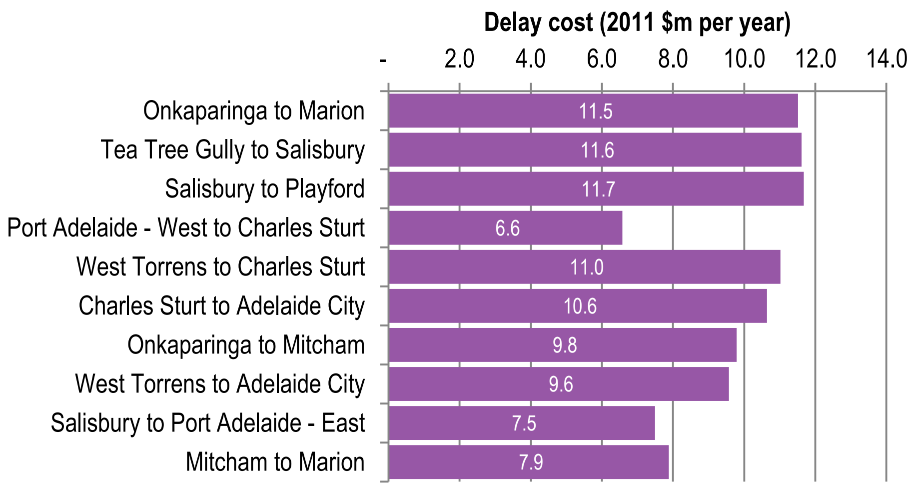
Source: ACIL Allen Consulting, 2014

The combined DEC of trips between the top ten origin-destination pairs was $460 million.

Delay costs for top 10 origin-destination trips

Figure 101 shows the ten origin-destination pairs with the greatest delay cost in the Adelaide GCCSA area in 2011.

Figure 101 **Roads – top ten origin-destination pairs – delay cost 2011 – Adelaide GCCSA**



Source: ACIL Allen Consulting, 2014

While trips between the ‘Onkaparinga’ SA3 and the neighbouring ‘Marion’ SA3 had the highest DEC in 2010-11, there were higher delay costs for trips between the ‘Salisbury’ and ‘Playford’ SA3s.

DEC by cluster

Trips to the inner city areas make up a large proportion of the DEC of road travel in the Adelaide-Yorketown region. To provide high level insights into car travel patterns for trips to the inner city, regions within the Adelaide area were grouped into clusters. SA3s within the Adelaide area were grouped into clusters of areas with similar demographics and travel demand characteristics. Table 102 provides the clusters that were defined in the Adelaide-Yorketown area.

Table 102 **Definition of clusters –** Adelaide-Yorketown

Cluster	Regions
Central	Adelaide City
Eastern	Adelaide Hills Burnside Campbelltown (SA) Norwood - Payneham - St Peters
Northern	Prospect – Walkerville Gawler - Two Wells Playford Port Adelaide - East Salisbury Tea Tree Gully
Southern	Unley Holdfast Bay Marion Mitcham Onkaparinga
Western	Charles Sturt Port Adelaide - West West Torrens
Outer	Fleurieu - Kangaroo Island Barossa
Yorke and Lower North	Lower North Yorke Peninsula
Murray Lands	Murray and Mallee

Source: ACIL Allen Consulting, 2014

Table 103 provides an overview of the delay costs incurred by car transport in 2010-11 in the Adelaide-Yorketown area for trips from the defined clusters to the Central cluster. The table includes data for trips that originate and end in the central cluster i.e. trips within the central cluster.

Table 103 **Car delay cost and DEC – 2010-11 –** Adelaide-Yorketown

Cluster	Car delay cost	Car DEC	Car delay cost
	($m)	($m)	% of DEC
Central	3.99	16.19	25%
Eastern	30.90	79.43	39%
Northern	31.33	77.74	40%
Southern	38.00	95.07	40%
Western	24.77	80.67	31%
Outer	2.97	12.74	23%
Yorke and Lower North	0.58	3.76	15%
Murray Lands	0.98	6.77	14%

Source: ACIL Allen Consulting, 2014

Trips between from the Northern and Southern cluster to the central cluster had the highest delay cost as a percentage of DEC. Trips between the Murray Lands cluster and the Central cluster had a low DEC and also low congestion cost as a percentage of DEC.

8.5.3 Public transport

Overview of DEC for all origin-destination pairs

Figure 102 provides an overview of the DEC of public transport for all SA3 origin-destination pairs in the Adelaide GCCSA.

Figure 102 **Public transport – all origin-destination pairs – DEC 2011 – Adelaide GCCSA**

SA3 Origin / Destination	Adelaide City	Adelaide Hills	Burnside	Campbelltown (SA)	Norwood - Payneham - St Peters	Prospect - Walkerville	Unley	Gawler - Two Wells	Playford	Port Adelaide - East	Salisbury	Tea Tree Gully	Holdfast Bay	Marion	Mitcham	Onkaparinga	Charles Sturt	Port Adelaide - West	West Torrens	Fleurieu - Kangaroo Island	Barossa	Lower North	Yorke Peninsula	Murray and Mallee
Adelaide City		6.9	3.9	4.7	3.4	2.9	3.4	2.6	7.2	5.4	6.0	6.0	2.6	5.7	4.6	8.4	9.7	3.5	6.9	0.8	3.6	0.5	0.0	0.5
Adelaide Hills	7.6		0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Burnside	3.6	0.0		0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Campbelltown (SA)	4.5	0.1	0.0		0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Norwood - Payneham - St Peters	3.0	0.0	0.0	0.0		0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Prospect - Walkerville	2.6	0.0	0.0	0.0	0.1		0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Unley	2.8	0.0	0.0	0.1	0.1	0.1		0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Gawler - Two Wells	2.5	0.0	0.0	0.0	0.0	0.0	0.1		0.4	0.0	0.3	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Playford	7.3	0.0	0.0	0.2	0.1	0.0	0.1	0.3		0.3	1.43	0.4	0.0	0.1	0.2	0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0
Port Adelaide - East	5.2	0.1	0.1	0.0	0.1	0.2	0.1	0.0	0.2		0.3	0.1	0.0	0.1	0.2	0.0	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Salisbury	6.6	0.1	0.0	0.1	0.0	0.2	0.0	0.2	0.9	0.5		0.3	0.0	0.1	0.1	0.0	0.1	0.3	0.1	0.0	0.1	0.0	0.0	0.0
Tea Tree Gully	5.9	0.0	0.1	0.2	0.0	0.1	0.1	0.1	0.4	0.2	0.4		0.0	0.1	0.2	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0
Holdfast Bay	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.2	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Marion	5.8	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.3		0.7	0.6	0.2	0.1	0.3	0.0	0.1	0.0	0.0	0.0
Mitcham	4.3	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.1	0.2	0.6		1.0	0.2	0.0	0.2	0.1	0.1	0.0	0.0	0.1
Onkaparinga	9.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.7	1.1		0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Charles Sturt	8.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.1		0.4	0.3	0.0	0.0	0.0	0.0	0.0
Port Adelaide - West	3.3	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.4		0.1	0.0	0.1	0.0	0.0	0.0
West Torrens	6.6	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.2	0.2	0.1	0.4	0.2		0.0	0.0	0.0	0.0	0.0
Fleurieu - Kangaroo Island	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Barossa	3.4	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0		0.0	0.0	0.0
Lower North	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Yorke Peninsula	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Murray and Mallee	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

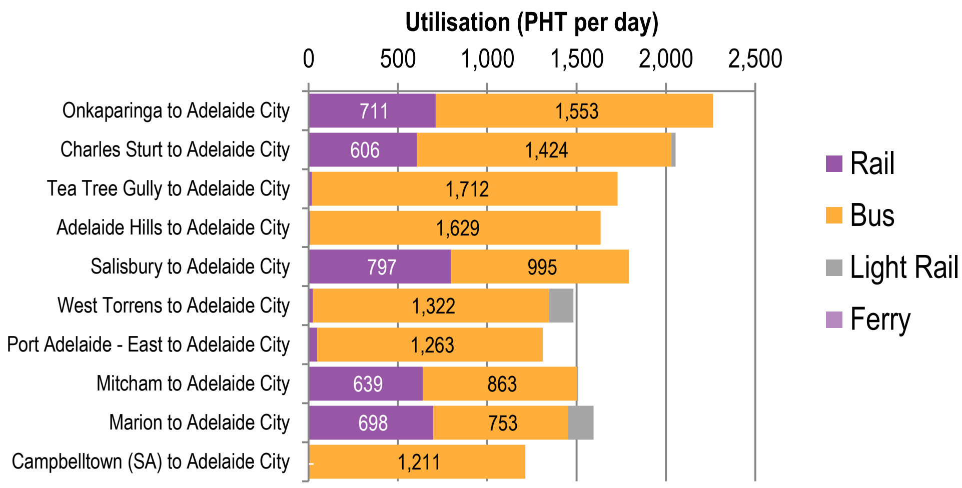
Source: ACIL Allen Consulting, 2014

Trips to and from the ‘Adelaide City’ SA3 dominate the matrix of DEC by origin-destination pair shown above. This is because public transport services are centred on providing connectivity between Adelaide’s outer suburbs and the inner city.

Utilisation for top 10 origin-destination trips

Figure 103 provides an overview of the PHT on public transport for the top ten origin-destination pairs in the Adelaide GCCSA in 2010-11.

Figure 103 **Public transport – top ten origin-destination pairs – utilisation 2011 – Adelaide GCCSA**



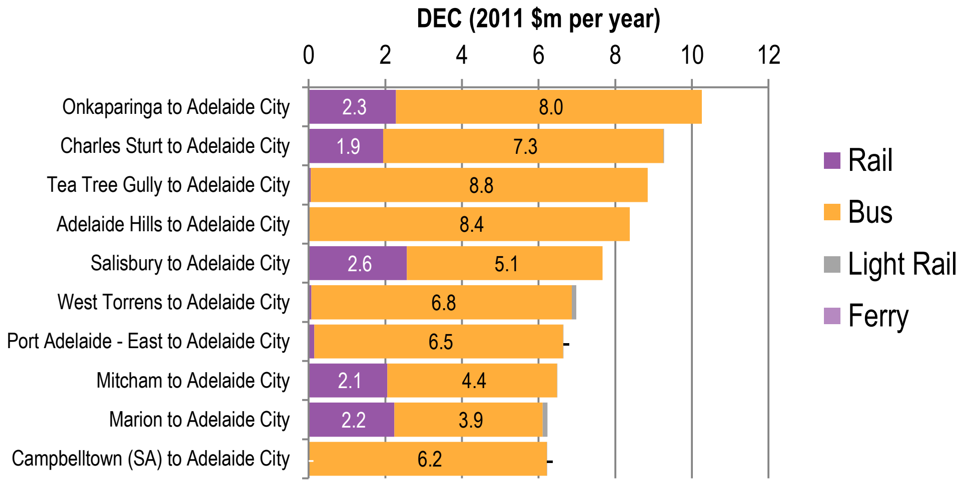
Source: ACIL Allen Consulting, 2014

The top ten origin-destination pairs all have the ‘Adelaide City’ as destination. Trips from the ‘Onkaparinga’ SA3 have the highest utilisation which is due to ‘Onkaparinga’ SA3 being the largest SA3 in this region.

DEC for top 10 origin-destination trips

Figure 104 shows the ten origin-destination pairs which in 2011 had the highest DEC in the Adelaide GCCSA.

Figure 104 **Public transport – top ten origin-destination pairs – DEC 2011 – Adelaide GCCSA**



Source: ACIL Allen Consulting, 2014

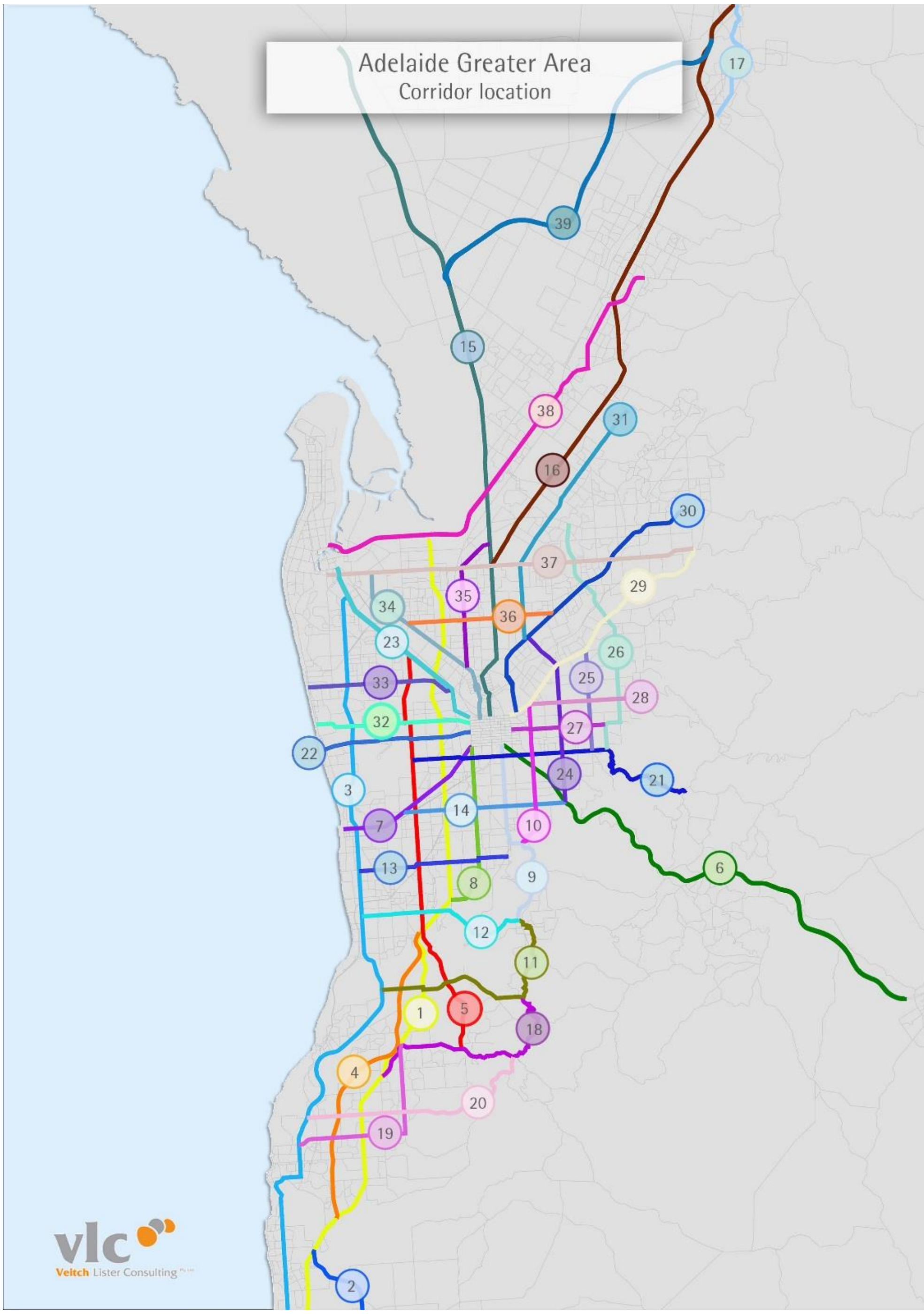
The DEC of public transport for the top ten origin-destination pairs in the Adelaide GCCSA is dominated by bus transport. Trips from the ‘Salisbury’ SA3 have the highest rail transport DEC of the top ten origin-destination pairs.

8.6 Corridor analysis

The analysis of key transport corridors in the Adelaide-Yorketown region provides more detailed insights than the analysis of origin-destination pairs. Corridors are defined to reflect some of the most commonly travelled journeys in the Adelaide-Yorketown area. Corridors can include multiple parallel routes reflecting different choices for motorists to travel between certain destinations. The analysis of corridors is limited to the urban road network.

Figure 105 provides an overview of the major transport corridors that are assessed in the Adelaide-Yorketown area.

Figure 105 Adelaide-Yorketown **urban transport corridors**



Source: VLC, 2014

Table 104 Adelaide-Yorketown **corridors**

Corridor	Description	Corridor	Description
1	South Rd/Main South Rd Corridor	21	Richmond Rd/Greenhill Rd Corridor
2	Victor Harbor Rd Corridor	22	Sir Donald Bradman Dve Corridor
3	Tapleys Hill/Brighton/Lonsdale/Dyson/Commercial Rd Corridor	23	Port Road Corridor
4	Southern Expressway Corridor	24	Portrush Road Corridor
5	Marion Rd Corridor	25	Glynburn Road Corridor
6	Princess Hwy (M1)/Glen Osmond Rd Corridor	26	Outer Eastern Arterial Bypass Corridor
7	Anzac Hwy Corridor	27	Kensington Road Corridor
8	Goodwood Rd Corridor	28	Magill Road Corridor
9	Unley Rd/Belair Rd Corridor	29	Lower North East Rd/Payneham Rd Corridor
10	Fullarton Rd Corridor	30	North East Road Corridor
11	Majors/Black/Main Rd Corridor	31	Bridge Road/Hampstead Rd Corridor
12	Sturt/Shepherds Hill Rd Corridor	32	Henley Beach Road Corridor
13	Oaklands/Daws/Springbank Rd Corridor	33	Grange Road Corridor
14	Cross Rd Corridor	34	Torrens Road Corridor
15	Port Wakefield Rd/Main North Rd Corridor	35	Churchill Road Corridor
16	Outer Main North Rd Corridor	36	Regency Road Corridor
17	Gawler Township Corridor	37	Grand Junction Road Corridor
18	Kenihans Rd/Chandlers Hill Rd/Main Rd Corridor	38	Salisbury Hwy/Philip Hwy Corridor
19	Flaxmill/Wheatsheaf/Panalatinga Rd Corridor	39	Northern Expressway Corridor
20	O'Sullivan Beach/Bains/Piggott Range Rd Corridor		

Source: ACIL Allen Consulting, 2014

8.6.1 DEC of corridors

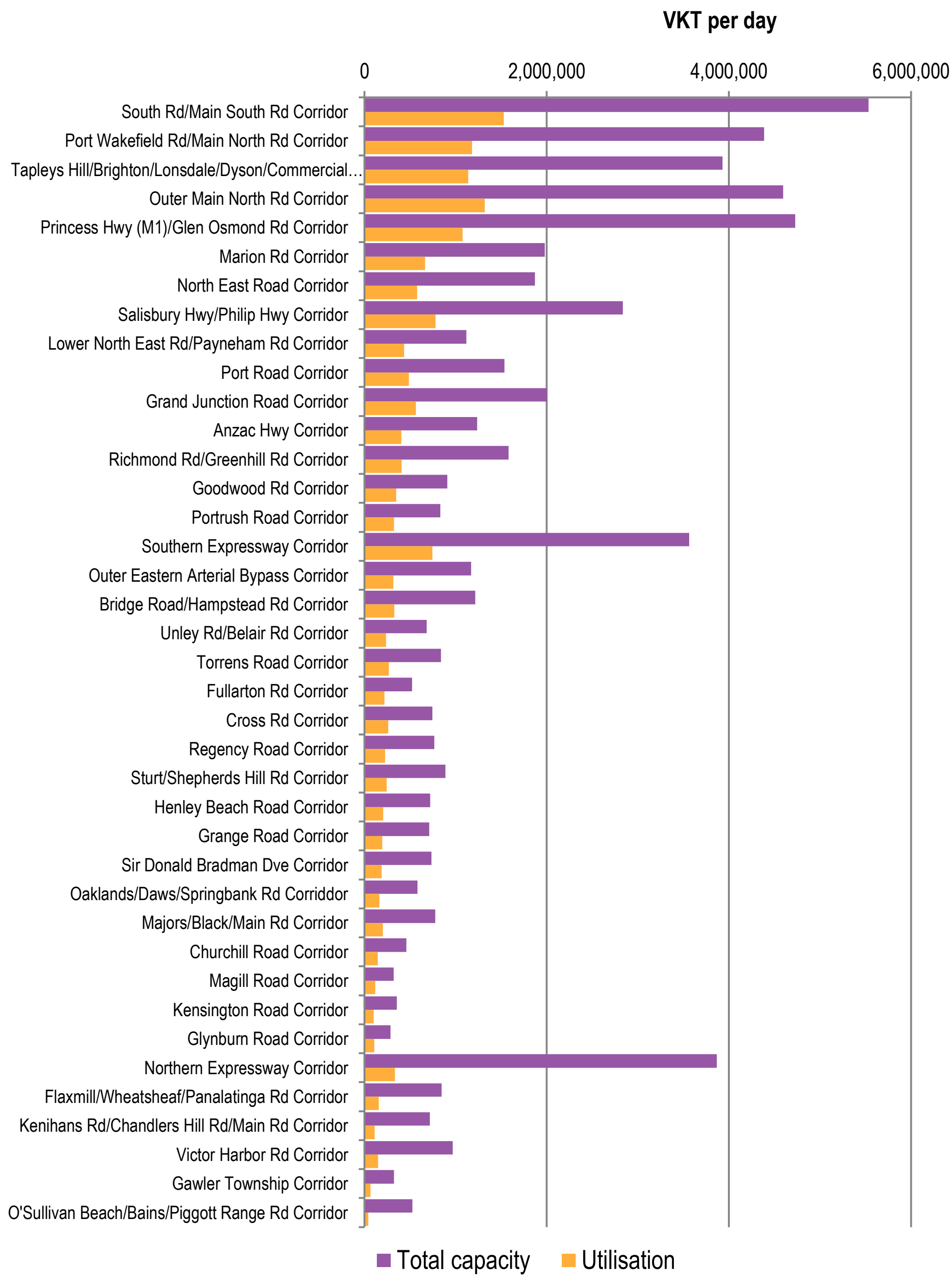
Corridor capacity and utilisation

The capacity of the selected corridors depends on the length of the corridor, the speed limits and the number of parallel routes that the corridor is made up of.

Figure 106 shows the capacity and utilisation of road corridors in the Adelaide-Yorketown area in 2010-11. The graph shows the following:

- the capacity of the road corridors in VKT per day (purple bars);
- the utilisation on a typical day (yellow bars); and
- the utilisation during the morning peak (percentage figures).

Figure 106 **Transport corridors – Capacity and utilisation 2011 –** Adelaide-Yorketown



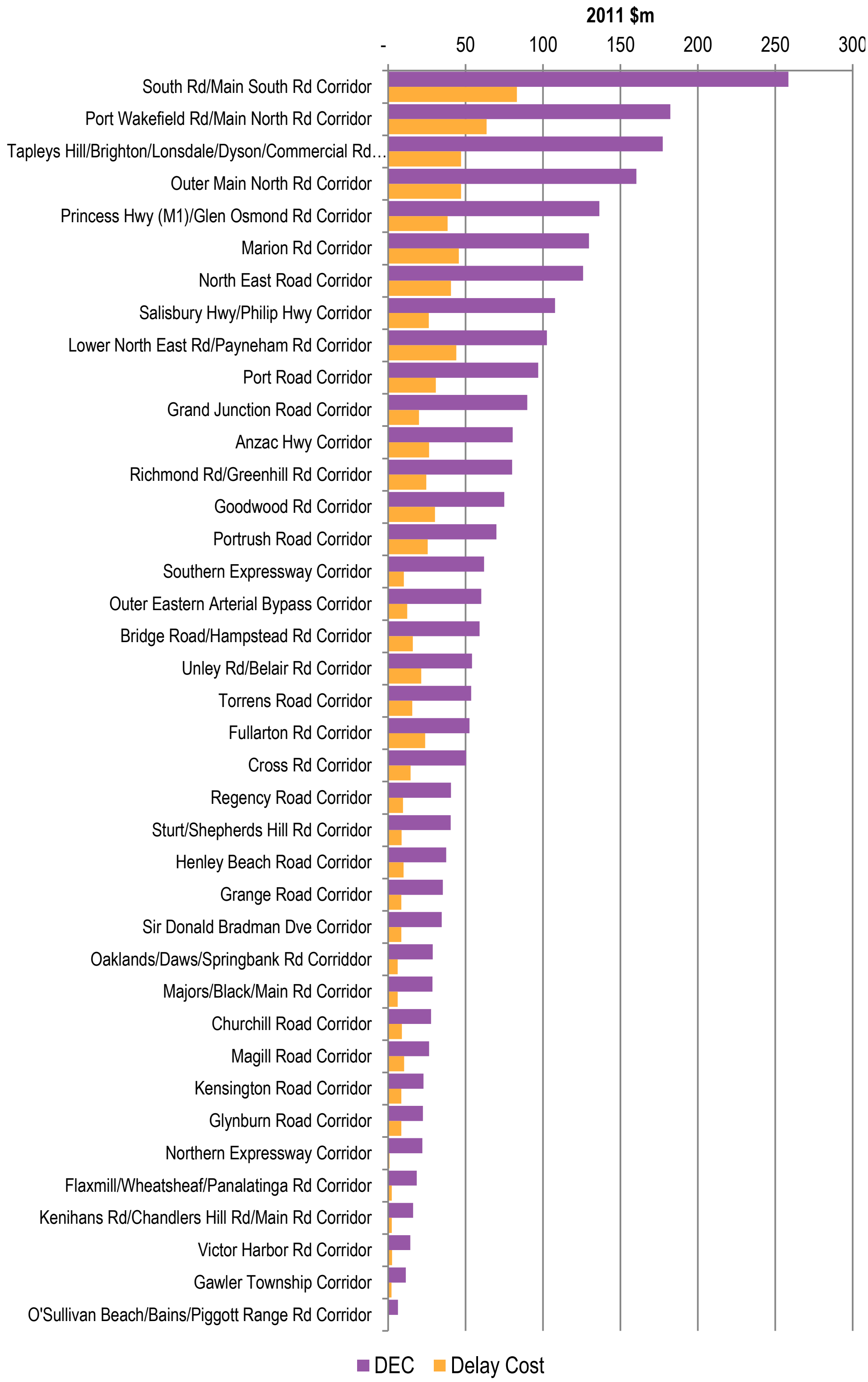
Source: ACIL Allen Consulting, 2014

The South Rd/Main South Rd Corridor has the highest capacity of the selected corridors and also a relatively high utilisation. In 2010-11 the three corridors with the highest utilisation in the Adelaide region were the ' Fullarton Rd Corridor', the 'Portrush Road Corridor' and the 'Glynburn Road Corridor'.

Corridor DEC and delay costs

Figure 107 shows the DEC and utilisation of major transport corridors in the Adelaide-Yorketown area.

Figure 107 **Transport corridors – DEC and delay cost 2010-11 –** Adelaide-Yorketown



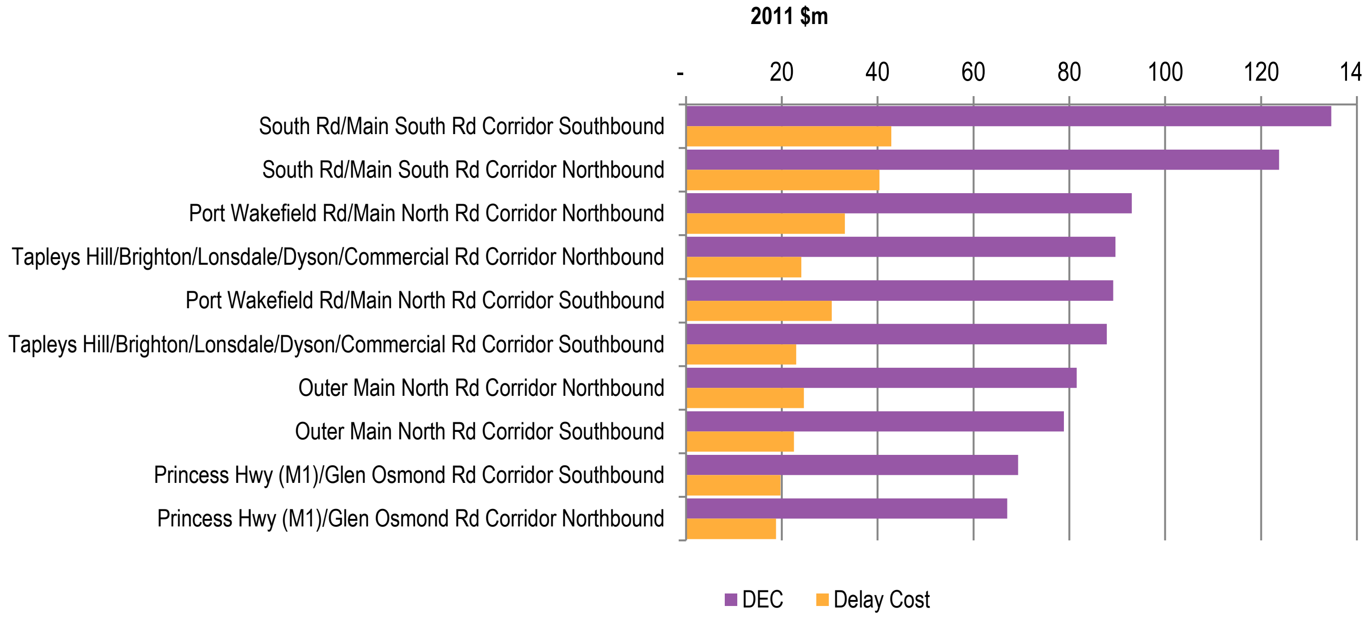
Source: ACIL Allen Consulting, 2014

The ‘South Rd/Main South Rd Corridor’ and ‘Port Wakefield Rd/Main North Rd Corridor’ were the corridors with the highest delay cost in 2010-11. We note that these are not necessarily the corridors with the highest volume over capacity ratio. Larger corridors with a moderate utilisation will have larger delay costs than very small corridors with high utilisation.

8.6.2 Analysis of routes within major corridors

Figure 108 shows the DEC and delay costs of routes within the five highest-DEC corridors in the Adelaide-Yorketown area.

Figure 108 **Transport corridors – DEC and delay cost of routes within major corridors –** Adelaide-Yorketown



Note: Shown are routes within the five corridors with the highest DEC.
Source: ACIL Allen Consulting, 2014

The DEC and delay cost is relatively evenly split between the north bound and south bound routes within the major corridors. Together the routes within the five major corridors in 2010-11 had a delay cost of $280 million.

8.7 Projections for 2031

8.7.1 Demand drivers for urban transport

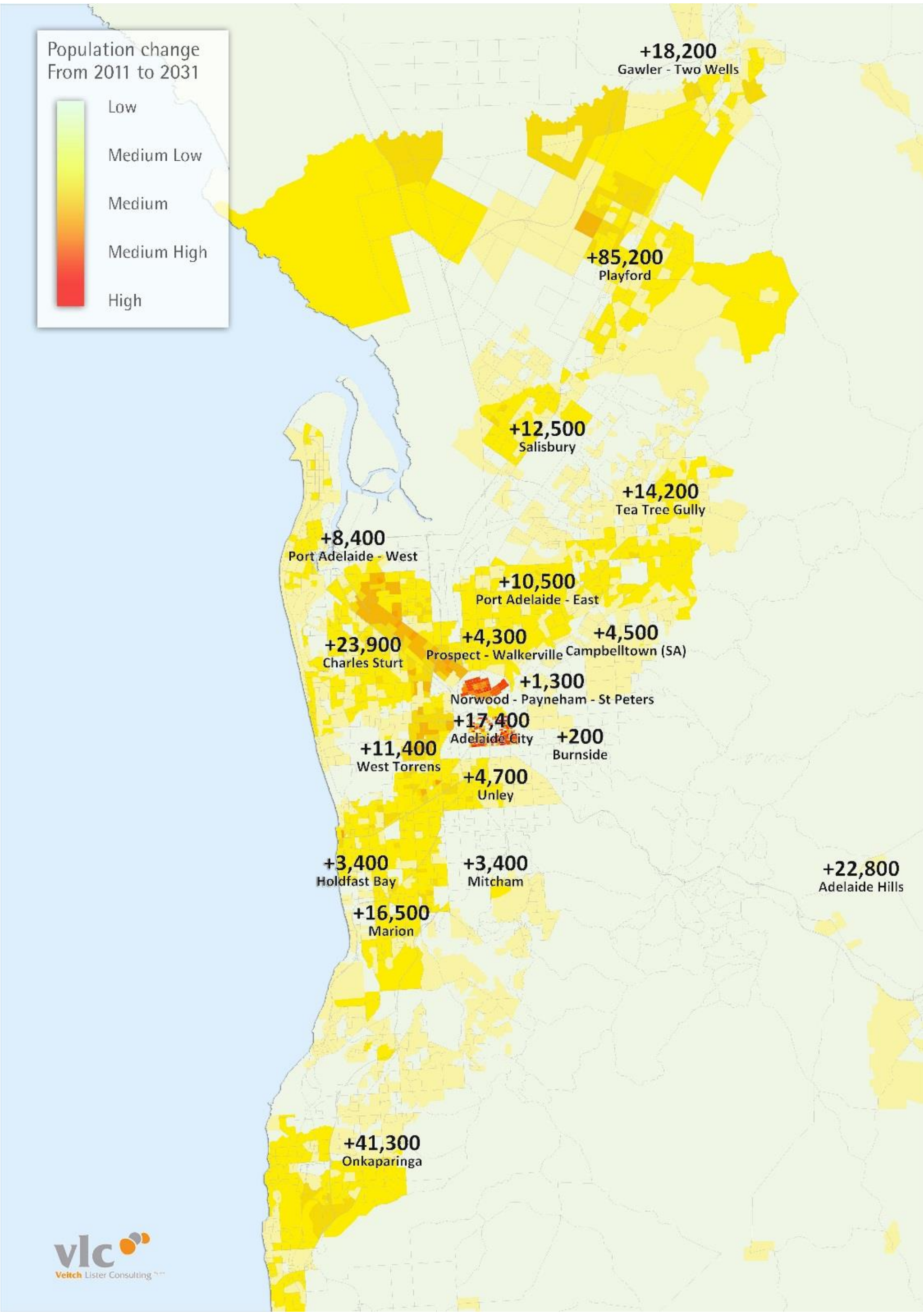
The main drivers of demand for transport are population growth and growth in employment. Growth in these variables is reflected in the use of the main transport corridors and as such they are strong predictors of urban transport needs.

Projected population growth

Figure 109 shows projected changes in population for Adelaide-Yorketown area by transport zone.

Figure 109 **Projected population growth 2010-11 to 2030-31 –** Adelaide-Yorketown

3



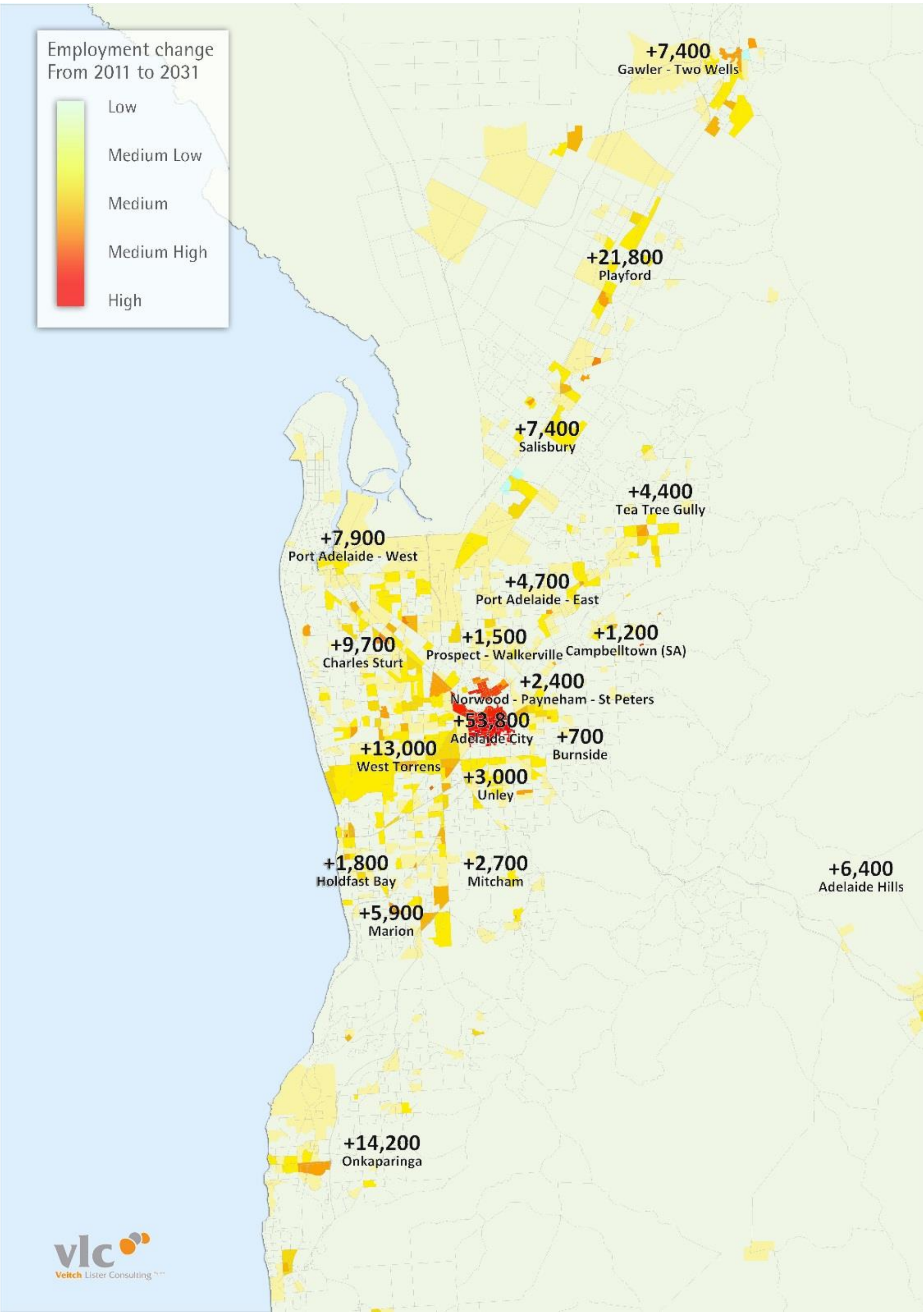
Source: (VLC, 2014)

There is concentrated population growth in the centre of Adelaide GCCSA, however nowhere else shows more than 'medium' level growth. There is relatively uniform projected growth in Adelaide's surrounding urban areas.

Projected employment growth

Figure 110 shows projected employment growth in the Adelaide-Yorketown area.

Figure 110 **Projected employment growth 2010-11 to 2030-31 –** Adelaide-Yorketown



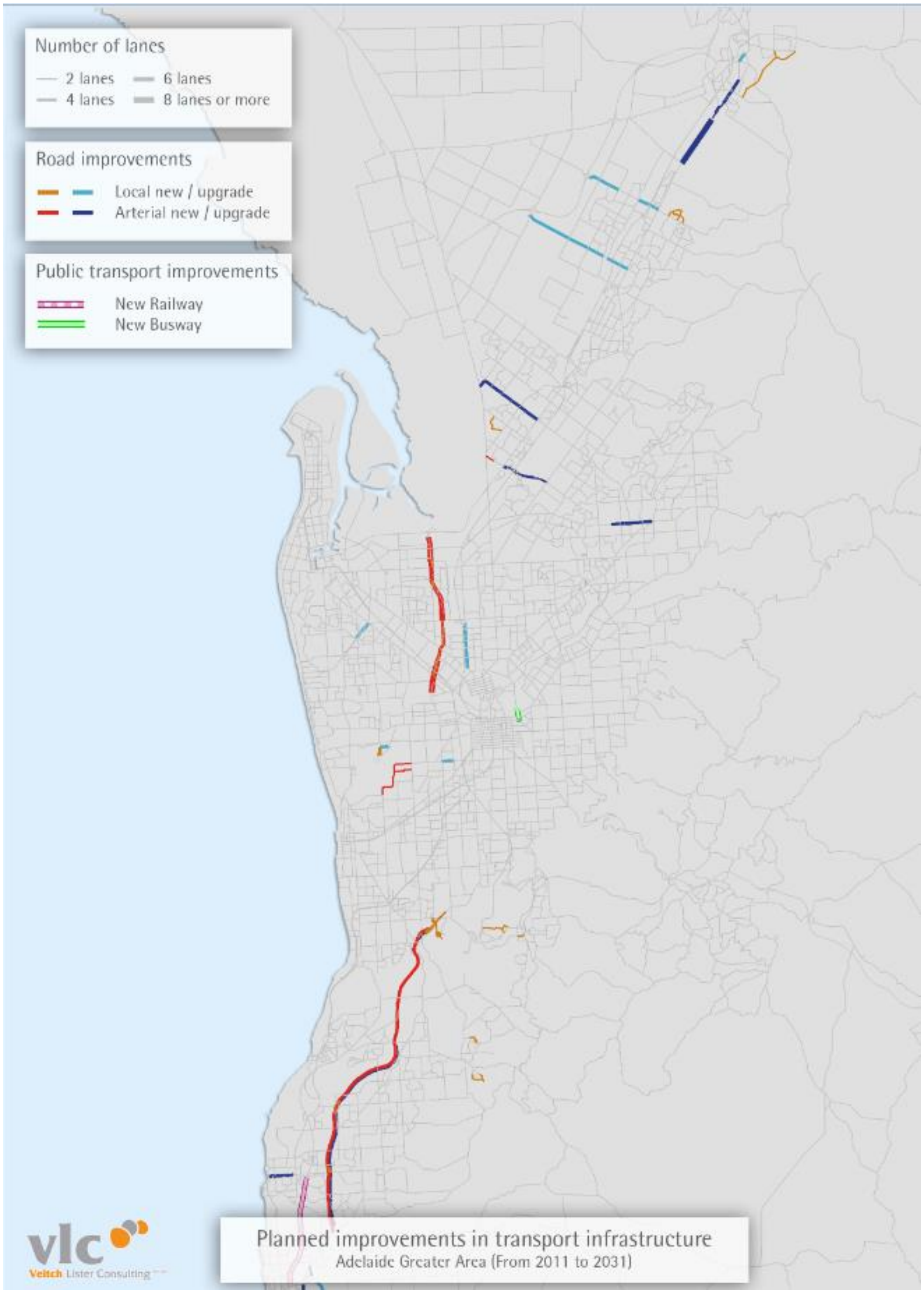
Source: (VLC, 2014)

Compared to population growth, there is a much more definite concentration of employment growth in the city centre. As with other major centres, there is concentrated growth in specific parts of the surrounding urban areas, however this is much less distinct in the Adelaide-Yorketown regions compared to the Melbourne-Geelong region, the Sydney-Newcastle-Wollongong region or the Canberra-Goulburn-Yass region.

8.7.2 Planned expansion of urban transport infrastructure

Figure 111 gives an overview of assumed changes in rail and road infrastructure between 2010-11 and 2030-31.

Figure 111 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 –** Adelaide-Yorketown



Source: VLC, 2014

Table 105 provides an overview of the key additions to the transport system in the Adelaide-Yorketown region that are assumed to go ahead between 2010-11 and 2030-31. A significant proportion of the planned additions are road networks. The planned increases are in line with a low investment scenario which only includes projects that are already committed or have significant political momentum.

Table 105 **Major additions to transport infrastructure between 2010-11 and 2030-31 assumed in transport modelling**

Project	Description
McLaren Vale Overpass	Grade separation of the Victor Harbor Road/Main Road junction
South Road Superway	Elevated road over existing arterial, with upgrades to southern section of south road (not-elevated)
Southern Expressway Duplication	Construction of additional lanes to the west of the existing road, with two lanes from Old Narolunga to Reynella and four lanes from Reynella to Bedford Park in the northbound direction and three lanes from Bedford Park to Reynella and two lanes from Reynella to Old Noarlunga in the southbound direction
Marino Rocks Greenway	A new shared pedestrian and bicycle path that generally follows the Seaford railway line from West Terrace in the CBD to Marino Rocks railway station
Grange Greenway	A new shared pedestrian and bicycle path connecting Seaton Park railway station with Outer Harbor Greenway at Woodville in a 3 kilometre route
Wayville Railway	New Railway Station at Wayville
Gawler East local link road	Local link road between Potts Road and land owned by Lend Lease bordering Calton Road, Gawler East
Minor New Infrastructure	Construction of various local roads to accommodate additional PT network in 2013
South Road Upgrade: Torrens to Torrens	Reduction in capacity of existing South Road surface road, construction of a new underpass enabling continuous traffic flow
Darlington Transport Study	Rail duplication and extension and associated road infrastructure
Main North Road / Tiver Road / Gordon Road Intersection Upgrade	Lower Speed limit of 80kph on Main North Road through intersection
South Road Upgrade: Regency Road to Torrens Road	Grade separation of South Road from Regency Road to Torrens Road
Victor Harbor Road Duplication Stage 1	From Old Noarlunga to McLaren Vale
Victor Harbor Road Duplication Stage 2	MacLaren Vale to Mount Compass
Adelaide Airport Western Link Road	Construction of a new road connecting Any Thomas Circuit with James Schofield Drive, upgrades to James Schofield Drive to two lanes per direction
Adelaide Airport Access Improvements	Targeted intersection upgrades to Sir Donald Bradman Drive, and access to Adelaide Airport for taxis, commercial vehicles and buses along Richmond Road
Duplication of Main South Road (Seaford to Aldinga)	Upgraded from one to two lanes in both directions
Duplication of Beach Road (Noarlunga)	Upgraded from one to two lanes in both directions
Duplication of Dyson Road (Noarlunga)	Assuming South of Beach Rd to Murray Rd
Duplication of Richmond Road (Keswick)	Upgraded from one to two lanes in both directions
Duplication of West Lakes Boulevard	Upgraded from one to two lanes from Port Rd to Clark Terrace in both directions
Duplication of Churchill Road	Upgraded from one to two lanes in both directions from Torrens Road to Redin Street
Duplication of Montague Road (Modbury)	Upgraded from one to two lanes in both directions from Charmaine Ave to North East Rd
Duplication of Elder Smith Road	Upgraded from one to two lanes in both directions from Main North Road to Princes Highway, includes extension to Port Wakefield Road
Duplication of Kings Road	Upgraded from one to two lanes in both directions from Salisbury Highway to Port Wakefield Road, includes duplication of Bolivar Road
Duplication of Womma Road	Upgraded from one to two lanes in both directions from Main North Road to Heaslip Road
Duplication of Curtis Road (Munno Para West)	Upgraded from one to two lanes in both directions from Main North Road to Northern Expressway
Duplication of Adelaide Rd/Main North Rd (Evanston Park)	From Sturt Highway to Seventh Street
New Interchange on the South Eastern Freeway	At Bald Hills Road (Part of Mount Barker growth area infrastructure improvements)
New connector roads in Happy Valley	Construction of local roads to accommodate additional PT network in 2014
New connector roads in Parafield Gardens	Construction of local roads to accommodate additional PT network in 2014
North East Road work	North East Road and Sudholz Road Redesign
Seaford Rail Extension	Two new stations at Seaford Meadows and Seaford
Darlington Transport Study	Rail duplication and extension and associated road infrastructure
O-Bahn tunnel	O-Bahn City Access project (Bus tunnel)

Source: Source: VLC, 2014

DEC in 2031

Table 106 shows the DEC of different transport modes within the urban transport sector of the Adelaide-Yorketown area.

Table 106 **Urban transport DEC by transport mode – 2030-31 –** Adelaide-Yorketown

Mode	DEC	DEC
	(2011) $m	(2031) $m
Car	5,830	10,763
LCV	194	345
HCV	383	722
Rail	42	118
Bus	254	418
Ferries	0	0
Light Rail	1	7
Total	**6,705**	**12,373**

Source: ACIL Allen Consulting, 2014

Between 2010-11 and 2030-31 the DEC of urban transport infrastructure in the Adelaide-Yorketown region is projected to grow by $5.7 billion. The increase in DEC is driven by a near doubling in the DEC of car transport. The DEC from light rail is projected to increase due to higher utilisation of the existing line. The DEC of heavy rail is also projected to increase markedly driven by the expansion of the rail network to Seaford and higher utilisation of the existing network.

8.7.3 Capacity, utilisation and congestion in 2031

Table 107 provides an overview of road network capacity in 2030-31 compared to 2010-11.

Table 107 **Road network capacity – 2010-11 and 2030-31 – Adelaide-Yorketown**

Road network	Capacity	Capacity
	VKT per day	kms of road
2011	169,385,298	7,016
2031	175,544,578	7,089

Source: ACIL Allen Consulting, 2014

Despite the assumption that a number of road projects will go ahead between 2010-11 and 2030-31, the capacity of the network is assumed to grow by 3.6 per cent.

The forecast growth in road network capacity stands in marked contrast to the forecast growth in road travel demand. Table 108 compares road network utilisation in the Adelaide-Yorketown area in 2030-31 with 2010-11.

Table 108 **Road network utilisation and congestion – 2010-11 and 2030-31 –** Adelaide-Yorketown

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
2011	28,225,360	40%	17%	24%	1,442
2031	36,820,591	50%	21%	34%	3,747

Source: ACIL Allen Consulting, 2014

The utilisation of the road network in Adelaide-Yorketown region is projected to increase by 30 per cent. Delay costs do not increase in line with projected utilisation. Delay costs increase steeply once a certain threshold of congestion is reached. As a result, an increase in utilisation results in a more than doubling of delay cost between 2010-11 and 2030-31.

Table 109 provides a comparison of the projected capacity of public transport in the Adelaide-Yorketown area in 2030-31 to the capacity in 2010-11.

Table 109 **Public transport network capacity – 2010-11 and 2030-31 –** Adelaide-Yorketown

Year	Public Transport Networks	Capacity	Capacity
		Passenger seat kms per day	Passenger crush kms per day
2011	Rail Network	2,565,689	4,205,226
2011	Bus Network	7,237,787	10,454,581
2011	Light rail Network	163,743	382,067
2031	Rail Network	3,002,197	5,637,279
2031	Bus Network	7,238,064	10,454,981
2031	Light rail Network	164,181	383,090

Source: ACIL Allen Consulting, 2014

The assumed expansion of the railway network to Seaford leads to the increase in railway capacity that can be observed in the table above. Under the low investment scenario the capacity other public transport networks in the Adelaide-Yorketown region is not assumed to grow substantially. Increases in capacity of the bus and light rail network are mainly due to assumed increases in the number of services run on the existing network.

Table 110 compares the utilisation of different public transport modes in 2010-11 and 2030-31.

Table 110 **Public transport network utilisation – 2010-11 and 2030-31 –** Adelaide-Yorketown

Year	Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
		Passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
2011	Rail Network	582,748	42%	26%	23%	14%
2011	Bus Network	1,141,167	26%	18%	16%	11%
2011	Ferry Network	-	0%	0%	0%	0%
2011	Light rail Network	24,613	33%	14%	15%	6%
2031	Rail Network	1,073,067	71%	38%	36%	19%
2031	Bus Network	1,407,936	32%	22%	19%	13%
2031	Ferry Network	-	0%	0%	0%	0%
2031	Light rail Network	35,181	45%	19%	21%	9%

Source: ACIL Allen Consulting, 2014

Overall utilisation of the public transport networks in the Adelaide-Yorketown region is projected to increase by 44 per cent across all transport modes.

The Adelaide rail system is projected to experience an increase of 84 per cent in terms of the number of passenger kilometres travelled. This will result in congestion (in terms of the utilised seating capacity) to increase to 71 per cent during the morning peak.

Analysis of key journeys

This section examines the changes in the DEC of origin-destination pairs for public transport and road transport between 2010-11 and 2030-31.

Table 111 provides an overview of the ten origin-destination pairs with the highest projected change in the DEC of road transport between 2010-11 and 2030-31.

Table 111 **Roads – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Adelaide GCCSA**

From	To	∆ DEC ($m)
Salisbury	Playford	125.0
Playford	Gawler - Two Wells	56.7
West Torrens	Adelaide City	50.9
Playford	Adelaide City	44.3
Tea Tree Gully	Playford	43.4
Charles Sturt	Adelaide City	43.0
West Torrens	Charles Sturt	39.8
Onkaparinga	Marion	38.2
Port Adelaide - West	Playford	33.3
Adelaide Hills	Adelaide City	31.4

Source: ACIL Allen Consulting, 2014

The DEC of trips between Salisbury and the growth area of Playford is projected to see the most substantial increase of all origin-destination pairs in the Adelaide region.

The projected population growth of the Playford SA3 results in this SA3 featuring prominently within the top ten origin-destination pairs. The change in road DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C9 in Appendix C.

Table 112 shows the ten origin-destination pairs with the highest projected change in public transport DEC between 2010-11 and 2030-31.

Table 112 **Public transport – Top ten origin-destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Adelaide GCCSA**

From	To	∆ DEC ($m)
Onkaparinga	Adelaide City	9.0
Charles Sturt	Adelaide City	8.0
Adelaide Hills	Adelaide City	7.6
Playford	Adelaide City	7.3
West Torrens	Adelaide City	6.6
Salisbury	Adelaide City	6.6
Tea Tree Gully	Adelaide City	5.9
Marion	Adelaide City	5.8
Port Adelaide - East	Adelaide City	5.2
Campbelltown (SA)	Adelaide City	4.5

Source: ACIL Allen Consulting, 2014

The DEC of public transport trips from the Onkaparinga SA3 to the inner city are projected to see the highest increase. This is a result of the railway extension to Seaford and the overall size of this SA3.

As in the other cities analysed for this report, the public transport system in the Adelaide GCCSA is caters mostly for trips from the suburbs to the centre of the city. As a result, the ten public transport origin-destination pairs with the highest increase in DEC all have the ‘Adelaide

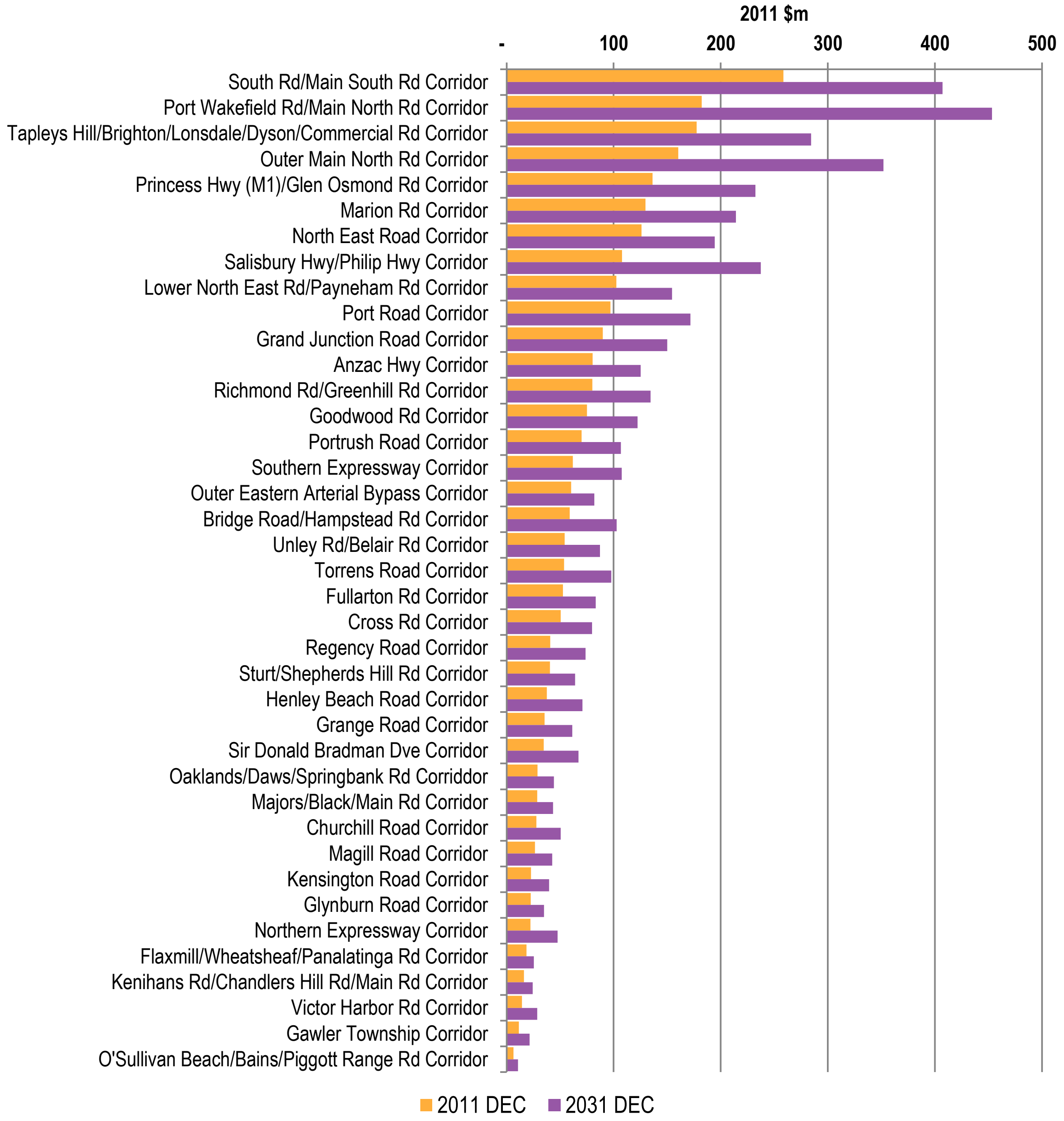
City' SA3 as the destination. The change in public transport DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C10 in Appendix C.

Analysis of corridors

This section examines the changes in the DEC of key road corridors in the Adelaide-Yorketown area between 2010-11 and 2030-31.

Figure 112 compares the projected DEC of major transport corridors in the Adelaide-Yorketown area in 2030-11 to the DEC of these corridors in 2010-11.

Figure 112 **Transport corridors – DEC 2010-11 and 2030-31 –** Adelaide-Yorketown

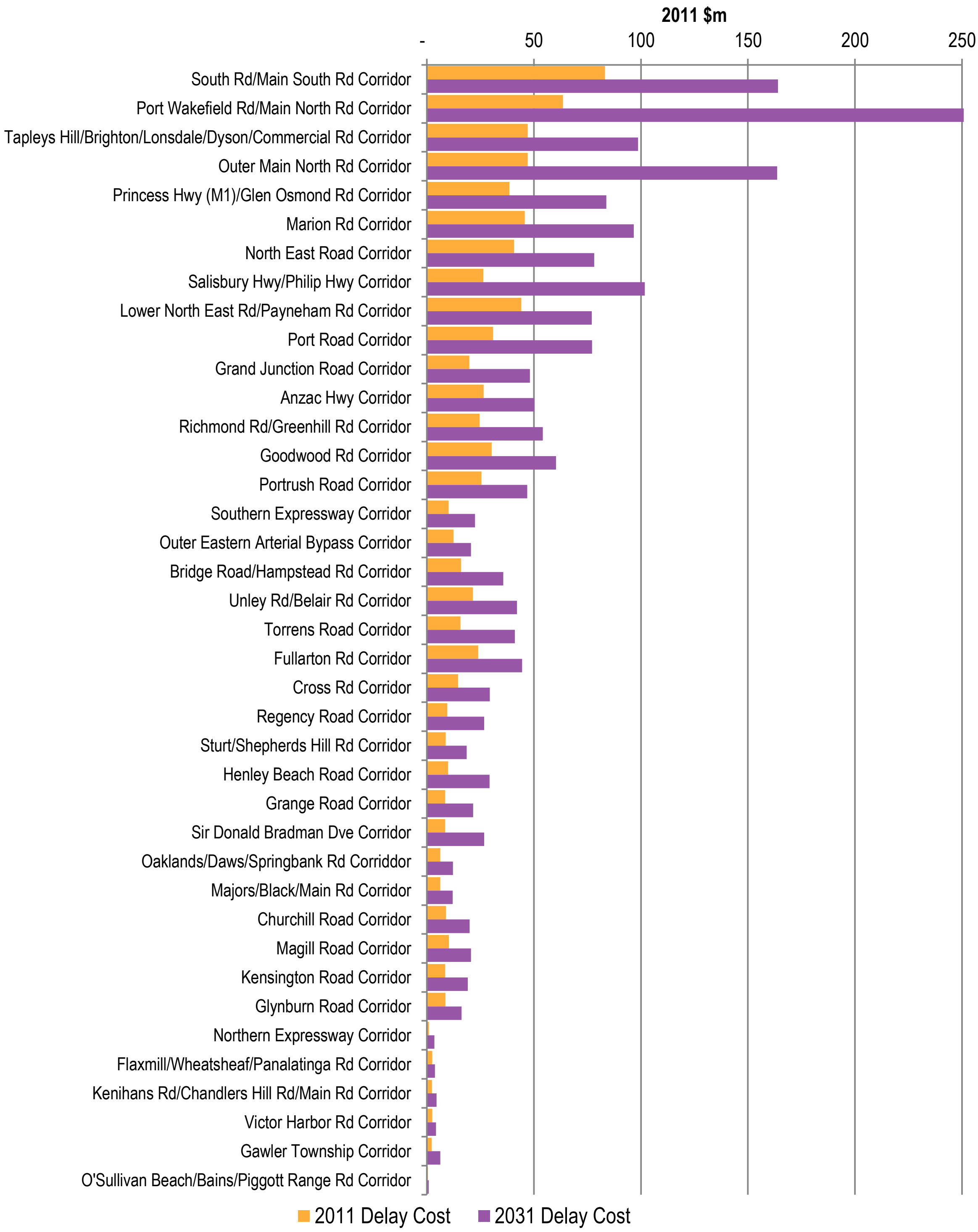


Source: ACIL Allen Consulting, 2014

Between 2010-11 and 2030-31 the DEC of the major road corridors in the Adelaide-Yorketown region is projected to increase by 75 per cent. As a result of strong projected population growth in Adelaide's north the 'Port Wakefield Rd/Main North Rd Corridor' is projected to be the corridor with the highest DEC in 2030-31.

Figure 113 compares the projected delay costs on major transport corridors in 2030-31 to the delay cost on these corridors in 2010-11.

Figure 113 **Transport corridors – delay cost 2010-11 and 2030-31 –** Adelaide-Yorketown

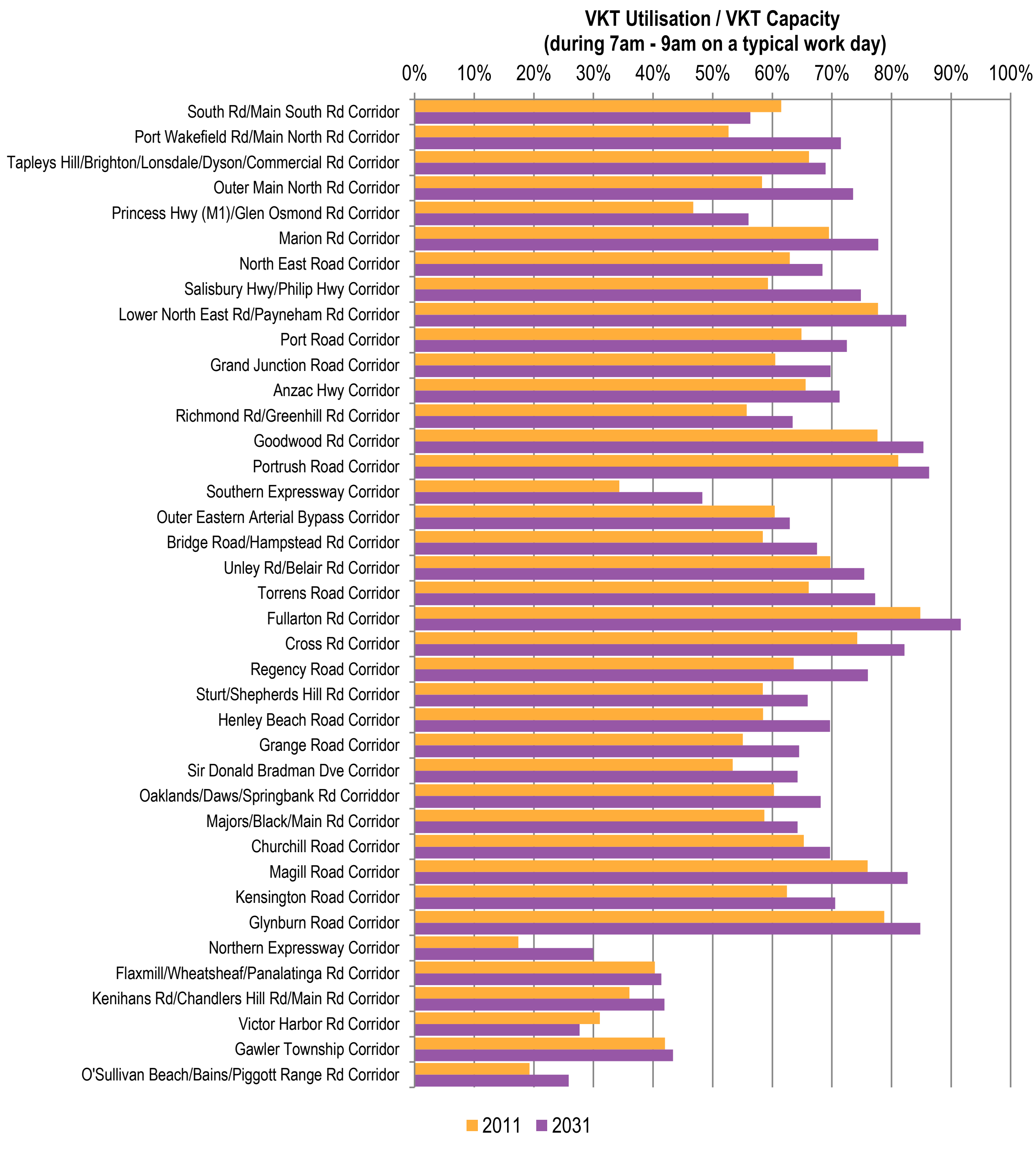


Source: ACIL Allen Consulting, 2014

Delay costs on the 'Port Wakefield Rd/Main North Rd Corridor' are projected to amount to $255 million or triple that corridor's DEC by 2030-31. Across the corridors in the Adelaide-Yorketown, region delay costs are projected to more than double between 2010-11 and 2030-3; an increase of approximately $1.1 billion.

Figure 114 provides a comparison of projected congestion on major transport corridors during the morning peak in 2030-31 to congestion on these corridors in 2010-11. The figure shows the ratio VKT to the VKT capacity of the corridors.

Figure 114 **Transport corridors – change in congestion 2010-11 and 2030-31 – Adelaide-Yorketown**



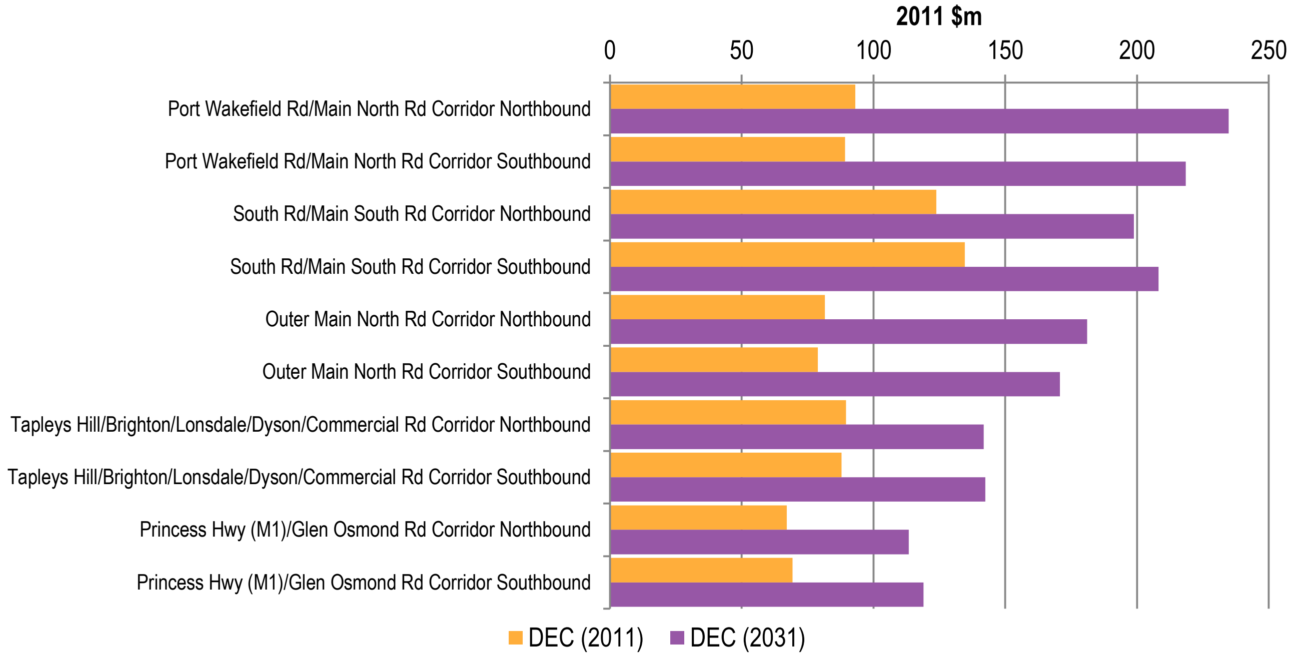
Source: ACIL Allen Consulting, 2014

Utilisation during the AM peak is projected to increase to levels above 85 per cent on the 'Portrush Road Corridor' and the 'Fullarton Rd Corridor'.

Analysis of key routes

Figure 115 compares the DEC and delay costs of routes within the two corridors with the highest DEC in the Adelaide-Yorketown area in 2010-11 and 2030-31.

Figure 115 **Key routes– DEC 2010-11 and 2030-31 – Adelaide-Yorketown**

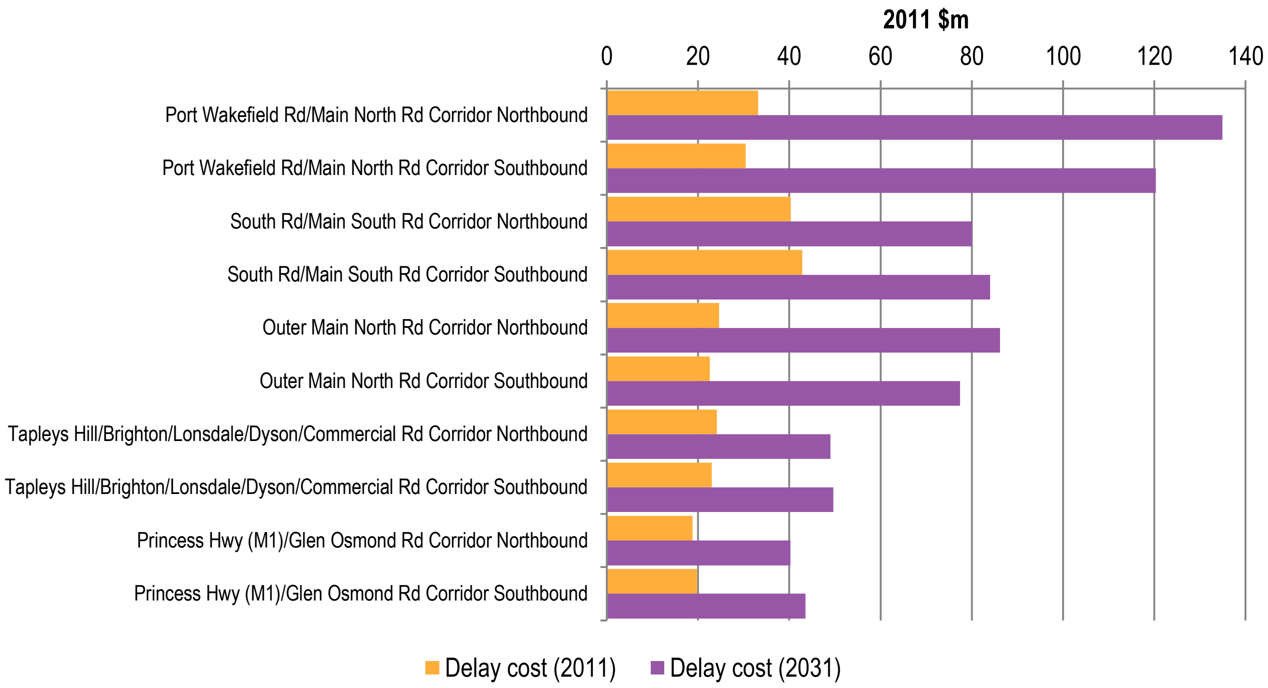


Source: ACIL Allen Consulting, 2014

The DEC of routes within the top five corridors is projected to increase by approximately $814 million between 2010-11 and 2030-31.

More than half of the increase in DEC of the key routes in the Adelaide-Yorketown area comes from an increase in delay cost. Figure 116 shows a comparison of delay cost on routes within the five corridors with the highest DEC in the Adelaide-Yorketown area between 2010-11 and 2030-31.

Figure 116 **Key routes– change in delay cost 2010-11 and 2030-31 – Adelaide-Yorketown**

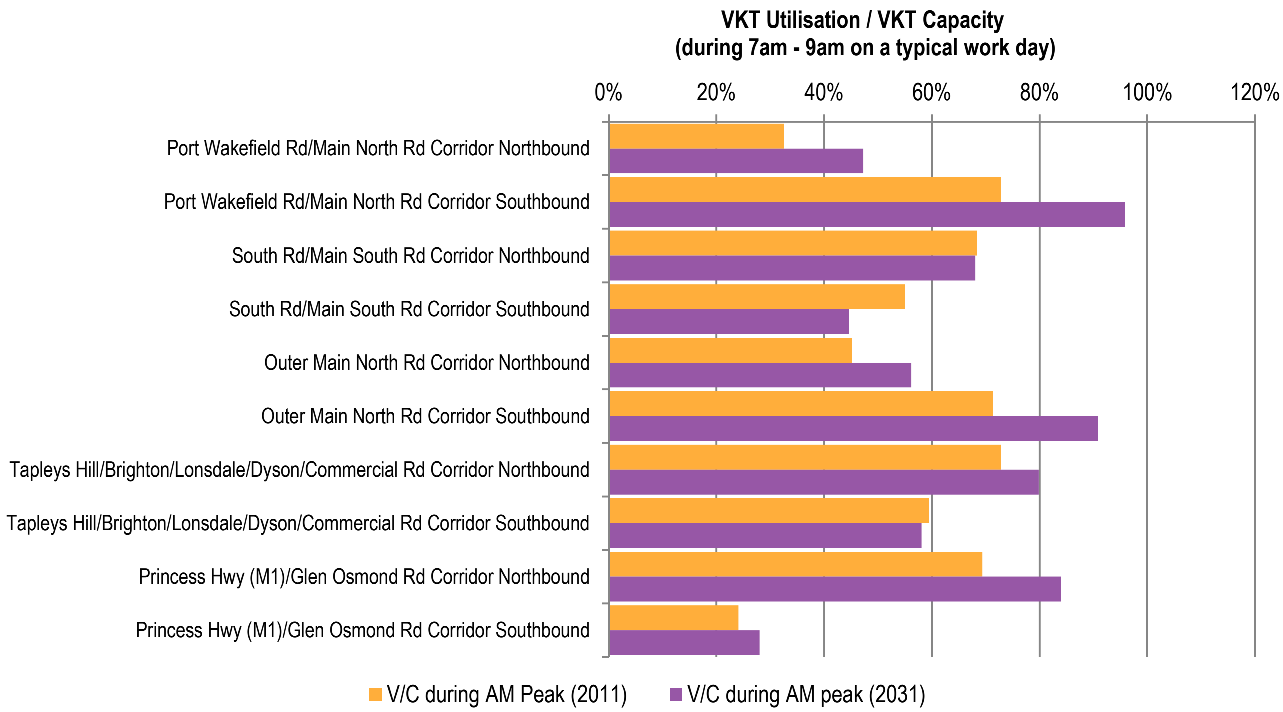


Source: ACIL Allen Consulting, 2014

Between 2010-11 and 2030-31 the delay cost on routes within the major transport corridors is projected to increase by $480 million.

Figure 117 compares congestion on key routes in the Adelaide-Yorketown area between 2010-11 and 2030-31.

Figure 117 **Key routes– change in congestion 2010-11 and 2030-31 – Adelaide-Yorketown**



Source: ACIL Allen Consulting, 2014

Utilisation in terms of volume over capacity during the AM peak is projected to increase to levels above 90 per cent for the southbound section of the 'Port Wakefield Rd/Main North Rd Corridor' and the South bound section of the 'Outer Main North Rd Corridor'.

8.7.4 Reconciliation with macro-economic data

Table 113 provides a comparison between the estimates of DEC based on transport activity modelling i.e. a bottom-up analysis and DEC estimates based on analysis of national statistics i.e. a top-down analysis.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014) using SDs as basic units rather than GCCSA (details of this is provided in the earlier section of this chapter). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements. The bottom-up projections of the DEC of urban transport infrastructure are based on transport activity projections from VLC's Zenith model. The top-down, projections of DEC are based on national statistics. Household expenditure on personal transport is based on data from the household expenditure survey and scaled to the number of households in each region. Household expenditure is assumed to grow in line with income growth as a proxy for expenditure growth. Income growth projections are obtained from ACIL Allen's Tasman Global modelling for the Baseline Scenario of the broader AIA. DEC from road and rail freight is projected to grow in line with projections of gross value add for rail and road transport which is also obtained from the Tasman Global model projections.

Table 113 **Macro-reconciliation – DEC of urban transport infrastructure 2030-31 – Adelaide- Yorketown area**

DEC (Based on transport simulation modelling)		DEC (Based on national statistics)	
Car/PMV	10,763	Household private vehicle expenditure	8,268
LCV	345	Road transport (freight)	1,831
HCV	722	Rail transport (freight)	334
Rail	118	Rail (household expenditure)	30
Bus	418	Bus/tram/light rail (household expenditure)	149
Ferry	-	Ferry (household expenditure)	21
Light Rail	7		
Total Transport	**12,373**	**Total Transport**	**10,632**
Growth factor (2011-31)	**1.85**	**Growth factor (2011-31)**	**1.92**

Source: ACIL Allen Consulting, 2014

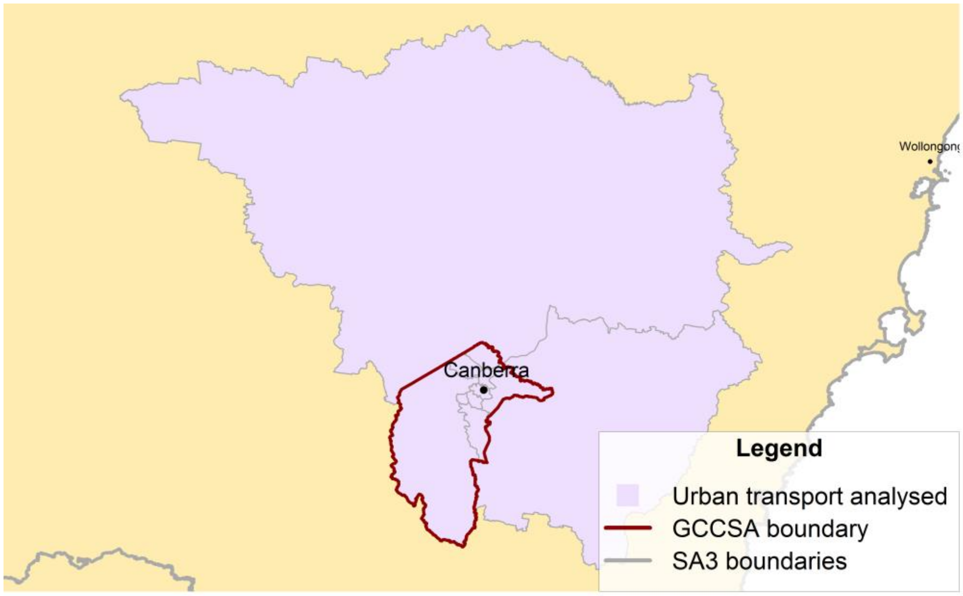
9 Canberra-Goulburn-Yass

Canberra is connected by a number of motorways and public buses operate within the city.

Canberra has intercity rail connections to Melbourne and to Sydney via Goulburn and but currently has no inner city rail network. A light rail line between the city and Gungahlin is currently under construction with further expansions under consideration. Canberra's bus network operates 88 routes including a route to the Airport.

The Federal Highway to Canberra branches of the Hume Highway to the west of Goulburn and enters Canberra from the north east. The Barton Highway connects Canberra to the regional town of Yass and the Hume Highway in the north west. The Monaro Highway connects Canberra to Cooma in the south while the Kings Highway in the east leads to Batemans Bay and the coast.

Figure 118 **Map of Canberra-Goulburn-Yass region**



Source: ACIL Allen Consulting, 2014

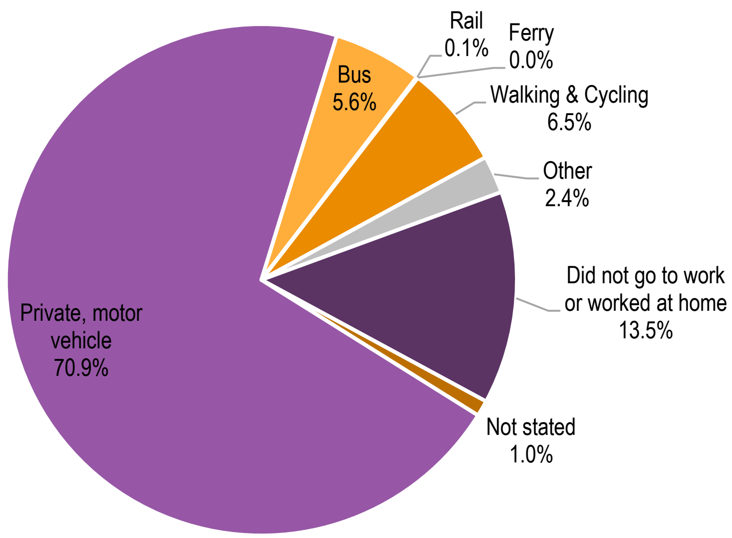
We note that the area covered by the urban transport analysis covers some non-urban areas. The boundaries of the urban transport analysis were chosen to ensure that the entire conurbation of a city is included in the analysis. This is to ensure that the transport system of the city is captured as accurately as possible.

9.1 Key issues and challenges

Canberra was designed to have self-contained suburbs to minimise the need for travel. As a result of this salient design feature congestion in Canberra is low when compared to other Australian cities. In 2009 around motor vehicles travelled an estimated 10 million kilometres on Canberra's roads (BITRE, 2011). Canberra's ACTION bus network had 17,764,803 passenger boardings in 2013-14.

ACT residents exhibit the highest reliance on private motor vehicles for their work commute amongst the cities studied for this report. Figure 119 provides an overview of the method by which people in the ACT get to work.

Figure 119 **Method of travel to work Australian Capital Territory - 2011**



Note: Transport methods have been grouped e.g. ‘private motor vehicle’ include trucks and motorbikes, ‘other’ includes multimodal public and private transport, does not include: Unemployed persons looking for either part-time or full-time work, Persons not in the labour force, Persons with Labour Force Status (LFSP) not stated, Persons aged under 15 years

Source: (ABS, 2011)

The ACT government is aiming to increase the share of workers who travel to work using public transport to support population growth, respond to climate change and address issues of accessibility of the city centre by an ageing population (ACT Government, 2012).

While the Canberra-Goulburn-Yass region currently enjoys a state of very little congestion future population and employment growth is expected to cause congestion on a number of roads. The ACT government is seeking to encourage the use of public and active transport to counteract road congestion.

9.2 Regulation, policy and governance context

In distinction to other cities considered in this report, Canberra does not have an urban train or light rail system – its urban transport systems are focussed on road networks and its public transport is focussed on bus services. Canberra does have one train station which is a terminus station of the inter-state rail network connecting the ACT with NSW and Victoria.

In September 2014, the ACT Government announced that it had decided to proceed with building light rail in Canberra, with a line to be built from Gungahlin in the northern suburbs to the city (Civic). The Government announced that a private consortium would be appointed to build, own and operate the light rail for at least 20 years.

Also in distinction to cities in other jurisdictions, there are no local councils in the ACT, and urban transport is fully the responsibility of the ACT Government (subject to the National Capital Authority’s planning powers).

9.2.1 Planning

Urban transport planning in the ACT is undertaken by the ACT Government subject to the powers of the National Capital Authority (NCA).

The NCA is responsible for preparing and administering the National Capital Plan (NCP), a planning instrument the authority of which supersedes than that of ACT Government planning instruments.

All planning in the ACT, including urban transport planning, is subject to the NCP. The NCP can include policies relating to planning national and arterial road systems – it currently includes design principles for the Federal Highway (National Capital Authority, 2014).

Transport for Canberra, part of the Environment and Planning Directorate of the ACT Government, is responsible for urban transport planning. The 2012 *Transport for Canberra* policy is the foundation for transport planning in the ACT out to 2031.

Transport for Canberra is also responsible for planning public transport. The Capital Metro Agency, a Directorate within the ACT Government, is responsible for planning and designing of the ACT light rail project.

9.2.2 Regulation

Maximum public transport bus service and taxi fares are determined by the Minister through disallowable instruments. The Territory and Municipal Services Directorate has verbally advised ACIL Allen that bus fares were historical set; changes to the bus fares are based on seeking to meet both a passenger target and a fare box recovery target.

ACTION monitors bus public transport services in the ACT as well as delivering them.

9.2.3 Funding

Urban transport in the ACT is funded by federal and territory government funding and user charges.

In relation to ACT public transport, of the total revenues in 2013-14 of $125 million for ACTION, user charges (comprised of fares, advertising and charter revenues) accounted for $22 million and ACT Government contributions accounted for $103 million. In 2013-14, 15.2 per cent of the ACTION network operating costs was recovered by fare box revenue (ACT Territory and Municipal Services, 2014).

9.2.4 Service delivery

Roads ACT, part of the Territory and Municipal Services Directorate, is responsible for delivering and maintaining road networks in the territory.

ACTION, a branch of the Roads and Public Transport Division of the Territory and Municipal Services Directorate, is responsible for delivering bus public transport services.

The Capital Metro Agency is responsible for delivering the ACT light rail project. The ACT Government has indicated that it will seek to deliver the project through a PPP arrangement.

9.3 Current network capacity, utilisation and congestion

9.3.1 Capacity

Table 114 provides an overview of the road network capacity in the Canberra-Goulburn-Yass area.

Table 114 **Road network capacity – 2010-11 –** Canberra-Goulburn-Yass

Road network	Capacity	Capacity
	VKT per day	kms of road
Road network	84,218,393	4,491

Source: VLC, 2014

Table 115 shows the network capacity for the public transport network in the Canberra-Goulburn-Yass area.

Table 115 **Public transport network capacity – 2010-11 –** Canberra-Goulburn-Yass

Public Transport Networks	Capacity	Capacity
	Passenger seat kms per day	Passenger crush kms per day
Bus Network	3,414,642	5,016,248

Source: VLC, 2014

Public transport in Canberra is limited to a bus network which, in relation to the road network, is relatively small. There are no rail or ferry urban transport networks in Canberra-Goulburn-Yass.

9.3.2 Utilisation and congestion

Table 116 provides an overview of utilisation and congestion in the road network of the Canberra-Goulburn-Yass area.

Table 116 **Road network utilisation and congestion** Canberra-Goulburn-Yass

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
	9,906,834	29%	12%	12%	208

Source: VLC, 2014

The delays experienced by residents of Canberra-Goulburn-Yass are lower than those of other major centres, but are still significant when looked at in proportion to the size of the economy. In 2010-11 the cost of delays across roads in the Canberra region was $208 million.

Table 117 shows the overall utilisation of public transport networks in the Canberra-Goulburn-Yass area.

Table 117 **Public transport network utilisation and congestion** Canberra-Goulburn-Yass

Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
	passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
Bus network	652,146	28%	19%	19%	13%

Source: VLC, 2014

The capacity of Canberra's bus network is used to a lesser extent than that of other capital cities. During the morning peak less than 20 per cent of the crush capacity of Canberra's bus network is used.

9.4 Current network Direct Economic Contribution

9.4.1 Aggregate DEC

Total DEC from Urban transport in the Canberra region in 2011 was $1,824 million in 2010-11. This can be broken down into four sectors as shown in Table 118 where it can be seen that bus transport makes up only a fraction of the total contribution.

9.4.2 DEC by mode

Table 118 provides an overview of the DEC by transport for the Canberra area.

Table 118 **Urban transport DEC by transport mode – 2010-11 –** Canberra-Goulburn-Yass

Mode	DEC
	$m
Car	1,502
LCV	51
HCV	175
Rail	-
Bus	95
Total	**1,824**

Source: ACIL Allen Consulting, 2014

The major source of transport in Canberra-Goulburn-Yass is car transport and this reflects the intentions of the city's original urban planners. The road network is obviously also amenable to bus transport and there is significant scope for expansion of the bus network.

9.4.3 Reconciliation with macro-economic data

Table 119 provides a comparison of estimates of DEC of urban transport infrastructure in the Canberra-Goulburn-Yass area using a bottom-up and using a top-down approach. The columns to the right of Table 119show estimates of the DEC of urban transport infrastructure based on household expenditure and national accounts statistics i.e. the top-down estimates. The columns to the left of Table 119 show estimates of DEC from urban transport infrastructure based on modelled transport activity data i.e. the bottom-up estimates.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014).

The macro reconciliation is aiming to provide a broad indication as to whether the results of the bottom-up modelling reconcile with macro-economic data. National account statistics available at the time of writing this report were available on the basis of statistical divisions

(SD's). SDs were used as a basic geographical unit for understanding and interpreting the geographical context of statistics published by the ABS before 2011. Generally SDs are broadly consistent with the GCCSA; detailed mapping of the SDs and their consistency with the GCCSAs can be found on the ABS website[20]. To reduce the potential mismatch between the national account statistics provided on a SD basis and the bottom-up modelling results the macro data has been scaled to the population of the relevant bottom-up modelling areas.

Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements.

Table 119 **Macro-reconciliation – DEC of urban transport infrastructure 2010-11 –** Canberra-Goulburn-Yass **area**

DEC (Based on transport simulation modelling)		DEC (Based on national statistics)	
Car/PMV	1,502	Household private vehicle expenditure	1,560
LCV	51	Road transport (freight)	213
HCV	175	Rail transport (freight)	6
Rail	-	Rail (household expenditure)	3
Bus	95	Bus/tram/light rail (household expenditure)	28
Ferry	-	Ferry (household expenditure)	-
Light Rail	-		
Total Transport	**1,824**	**Total Transport**	**1,810**

Source: ACIL Allen Consulting, 2014

The overall estimates of DEC of urban transport infrastructure in the Canberra-Goulburn-Yass area are relatively close.

The biggest difference between the top-down and bottom-up estimates of the DEC of urban transport infrastructure lie in the estimates of the DEC of freight services. The bottom-up estimates of the DEC of freight services do not include rail freight. In the bottom-up model the DEC from road freight is based on estimated freight movements on the roads within the study area. In the top-down model the DEC of freight services is calculated based on the gross value added of freight services from national account statistics. The national account statistics account for freight services at the point where contracts for freight movements are struck. As such contracts tend to be struck in the city and since the study area covers a largely urban area the top-down DEC estimates of road freight transport tend to be higher in the top-down model than in the bottom-up model.

The DEC estimates of public transport infrastructure in the top-down model are based on household expenditure survey data in which households report expenditure on public transport fares. The bottom-up model of the DEC from public transport accounts for the fares spend on public transport as well as the value of time spent travelling. As a result the estimates of DEC from public transport tend to be higher in the bottom-up model than in the top-down.

[20] http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1216.0July%202011?OpenDocument

9.5 Demand analysis by origin/destination

9.5.1 Overview of demand analysis

The demand analysis assesses the value (measured as DEC) of journeys from combinations of origins and destinations. The demand analysis is distinguished from other levels of analysis as it shows the demand for mobility (the value that is placed on trips that transport people or goods from one SA3 to another) as opposed to the value that is being derived from use of a physical network or infrastructure component.

A significant proportion of this demand (23.1% of road journeys and 34.2% of public transport journeys in the Canberra GCCSA) is within each SA3 (i.e. where the SA3 is both the origin and destination). The focus of this demand analysis however, is on infrastructure connecting separate origins and destinations. Specifically, the DEC of road journeys and public transport for combinations of different SA3 origins and destinations, for the GCCSA area, is shown in the form of 'heat-map' matrices.

9.5.2 Roads

Overview of DEC for all origin-destination pairs

Figure 120 shows the DEC for all origin-destination pairs in 2010-11 in the Canberra GCCSA. Each cell represents the DEC of road journeys from an origin (rows of the matrix) to a destination (column of the matrix). For example, the first row shows the DEC of journeys originating in the SA3 'North Canberra' whereas the first column shows the DEC of trips ending in the SA3 'North Canberra'. The DEC is colour coded from green to red where green indicates a low DEC and red indicates a high DEC. The right hand side of the figure provides an overview range of the DEC values across the matrix. The figure does not show the DEC of travel within SA3s i.e. the DEC of trips that originate and end in the same SA3.

Figure 120 **Roads – origin destination pairs – DEC 2011 – Canberra GCCSA**

SA3 Origin / Destination	North Canberra	South Canberra	Belconnen	Gungahlin	Woden	Weston Creek	Tuggeranong	Cotter - Namadgi	Fyshwick - Pialligo - Hume
North Canberra		25.3	28.8	40.1	7.5	3.4	11.6	36.9	10.8
South Canberra	26.7		11.7	12.5	7.5	2.8	9.3	17.8	9.5
Belconnen	33.0	13.0		27.2	4.2	2.0	4.2	37.4	7.2
Gungahlin	70.0	13.7	27.6		6.0	2.4	6.8	15.2	11.0
Woden	7.6	7.4	3.7	5.6		1.2	4.5	10.9	3.4
Weston Creek	3.6	2.9	1.8	2.3	1.3		1.2	5.9	0.8
Tuggeranong	12.9	9.9	4.5	6.6	4.9	1.4		10.9	3.8
Cotter - Namadgi	40.2	19.3	40.3	15.1	11.6	6.3	11.1		9.3
Fyshwick - Pialligo - Hume	10.9	9.6	6.5	10.3	3.4	0.7	3.6	8.8	

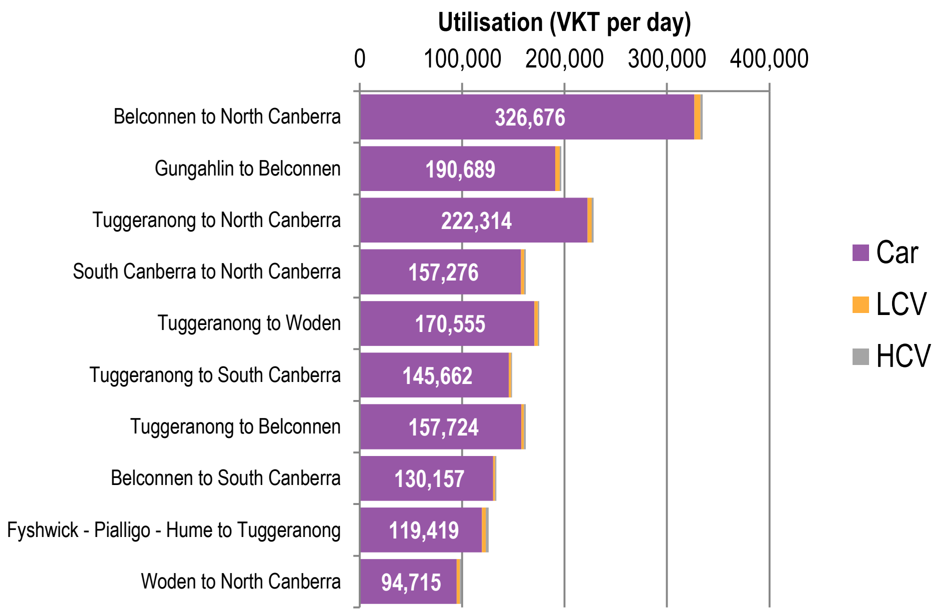
Source: ACIL Allen Consulting, 2014

Hots spots in Canberra's urban are trips to and from 'Canberra North' and 'Queanbeyan'.

Utilisation for top 10 origin-destination trips

Figure 121 provides an overview of the ten origin-destination pairs with the greatest utilisation of the road network in the Canberra GCCSA in 2010-11.

Figure 121 **Roads – top ten origin destination pairs – utilisation 2010-11 – Canberra GCCSA**



Source: VLC, 2014

Trips from Belconnen to North Canberra have the highest utilisation of origin-destination pairs in the Canberra region.

DEC for top 10 origin-destination trips

Table 120 provides an overview of the ten origin-destination pairs with the greatest DEC in the Canberra GCCSA in 2011.

Table 120 **Roads – top ten origin destination pairs – DEC 2011 – Canberra**

From	To	DEC
		$m
Belconnen	North Canberra	46.4
Gungahlin	Belconnen	27.0
Tuggeranong	North Canberra	26.4
South Canberra	North Canberra	25.3
Tuggeranong	Woden	23.8
Tuggeranong	South Canberra	18.1
Tuggeranong	Belconnen	17.1
Belconnen	South Canberra	17.1
Fyshwick - Pialligo - Hume	Tuggeranong	13.6
Woden	North Canberra	13.2

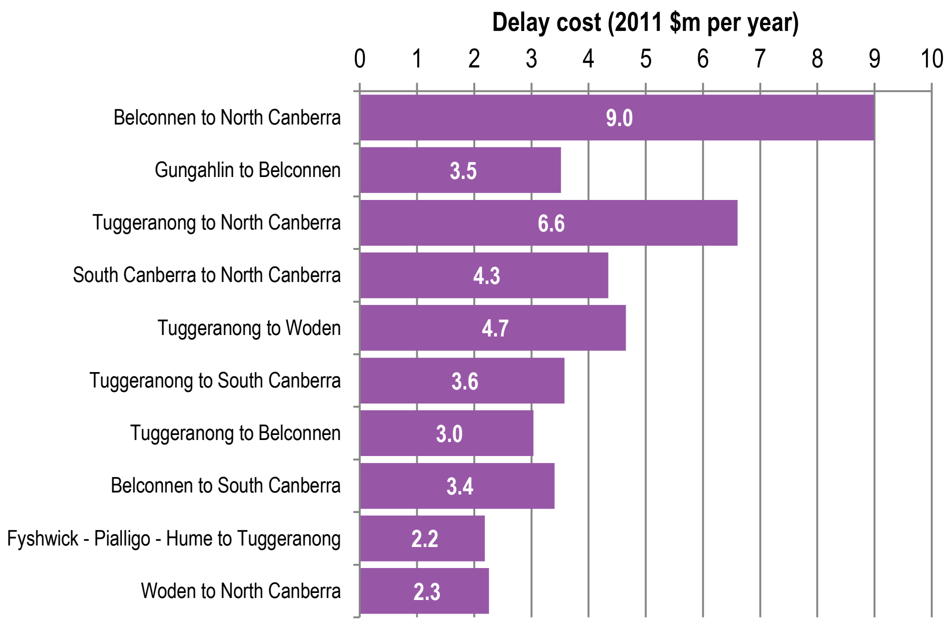
Source: ACIL Allen Consulting, 2014

Trips between the 'Belconnen' and 'North Canberra' SA3 have the highest DEC of all origin destination pairs in the Canberra GCCSA.

Delay costs for top 10 origin-destination trips

Figure 122 shows the ten origin-destination pairs with the greatest delay cost in the Canberra GCCSA in 2011.

Figure 122 **Roads – top ten origin destination pairs – delay cost 2011 – Canberra GCCSA**



Source: ACIL Allen Consulting, 2014

Delay costs are highest for trips between 'Belconnen' and 'North Canberra' SA3. Delay costs for the top ten origin-destination pairs in the Canberra region were $42.6 million in 2010-11.

DEC by cluster

Trips to the inner city areas make up a large proportion of the DEC of road travel in the Canberra-Goulburn-Yass region. To provide high level insights into car travel patterns for trips to the inner city regions within the Canberra-Goulburn-Yass area were grouped into clusters. SA3s within the Canberra-Goulburn-Yass area were grouped into clusters of areas with similar demographics and travel demand characteristics. Table 121 provides the clusters that were defined in the Canberra area.

Table 121 **Definition of clusters –** Canberra-Goulburn-Yass

Cluster	Regions
Central	North Canberra South Canberra
East	Fyshwick - Pialligo - Hume
North	Belconnen Gungahlin
Outer	Goulburn - Yass Queanbeyan
South	Woden Weston Creek Tuggeranong
West	Cotter – Namadgi

Source: ACIL Allen Consulting, 2014

Table 122 provides an overview of the delay costs incurred by car transport in 2010-11 in the Canberra-Goulburn-Yass area for trips from the defined clusters to the central cluster.

Table 122 **Car delay cost and DEC – 2010-11 –** Canberra-Goulburn-Yass

Cluster	Car delay cost	Car DEC	Car delay cost
	($m)	($m)	% of DEC
Central	10.91	75.68	14%
North	14.43	44.13	33%
South	10.21	45.79	22%
West	0.11	1.36	8%
East	1.67	10.86	15%
Outer	8.07	50.02	16%

Source: ACIL Allen Consulting, 2014

Delay costs as a percentage of DEC were highest for trips from the North cluster to the Central cluster.

9.5.3 Public transport

Overview of DEC for all origin-destination pairs

Figure 123 provides an overview of the DEC of public transport for all SA3 Origin destination pairs in the Canberra GCCSA.

Figure 123 **Public transport – all origin destination pairs – DEC 2011 – Canberra GCCSA**

SA3 Origin / Destination	North Canberra	South Canberra	Belconnen	Gungahlin	Woden	Weston Creek	Tuggeranong	Cotter - Namadgi	Fyshwick - Pialligo - Hume
North Canberra		4.6	14.3	30.2	2.5	0.6	3.5	9.1	0.4
South Canberra	4.8		1.9	3.6	0.8	0.1	1.2	1.5	0.4
Belconnen	14.1	1.9		13.7	1.5	0.2	0.2	5.9	0.6
Gungahlin	31.0	3.7	13.4		1.2	0.0	1.0	0.4	1.3
Woden	2.4	0.8	1.4	1.1		0.1	0.7	1.2	0.1
Weston Creek	0.7	0.2	0.2	0.0	0.1		0.1	1.0	0.1
Tuggeranong	3.3	1.3	0.3	0.9	0.7	0.0		0.4	0.1
Cotter - Namadgi	9.1	1.4	6.2	0.4	1.2	1.0	0.4		0.2
Fyshwick - Pialligo - Hume	0.4	0.3	0.5	1.3	0.1	0.1	0.1	0.2	

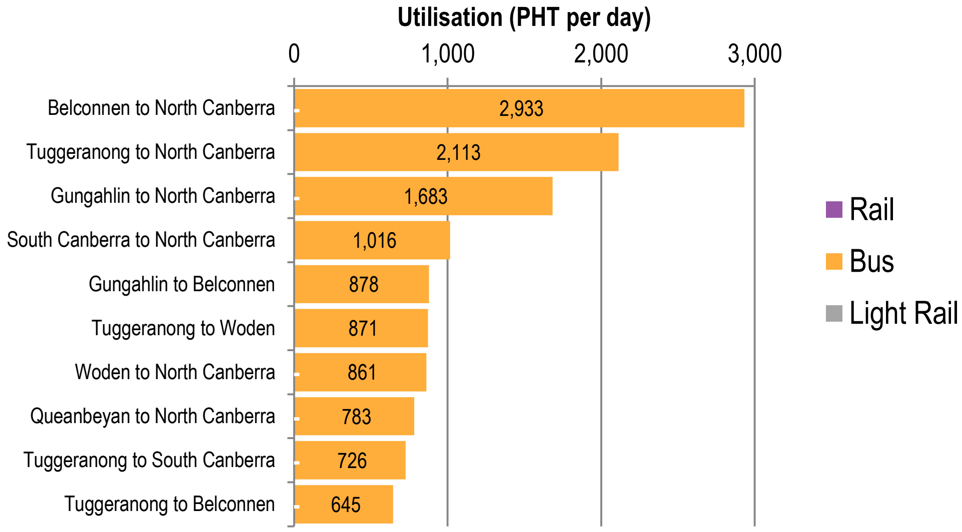
Source: ACIL Allen Consulting, 2014

Hot spots in public transport in the Canberra region are trips to and from North Canberra especially trips between North Canberra and Belconnen.

Utilisation for top 10 origin-destination trips

Figure 124 provides an overview of the PHT on public transport for the top ten origin-destination pairs in the Canberra area in 2010-11.

Figure 124 **Public transport – top ten origin destination pairs – utilisation 2011 – Canberra**



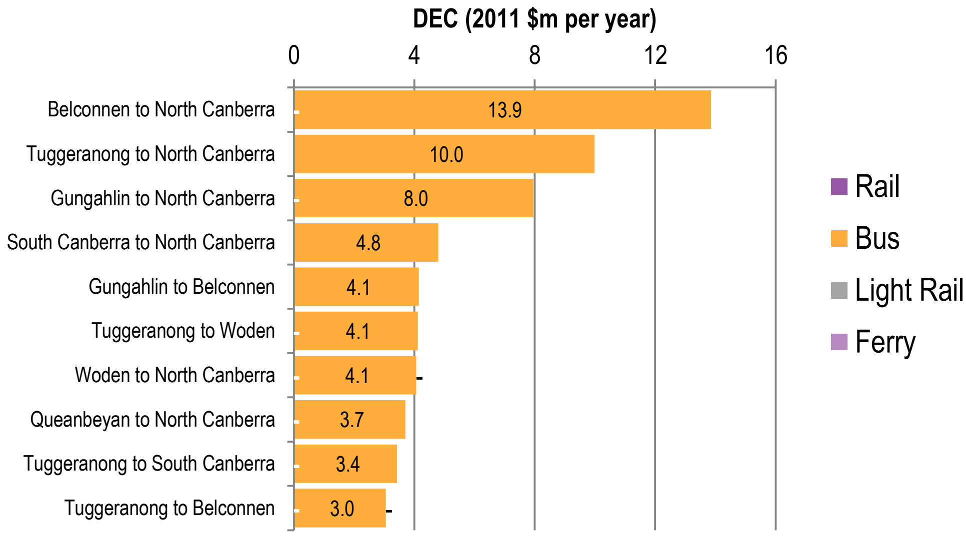
Source: VLC, 2014

Trips from Belconnen to North Canberra had the highest utilisation of all origin destination pairs in the Canberra GCCSA.

DEC for top 10 origin-destination trips

Figure 125 shows the ten origin destination pairs which in 2011 had the highest DEC in the Canberra GCCSA.

Figure 125 **Public transport – top ten origin destination pairs – DEC 2011 – Canberra GCCSA**



Source: ACIL Allen Consulting, 2014

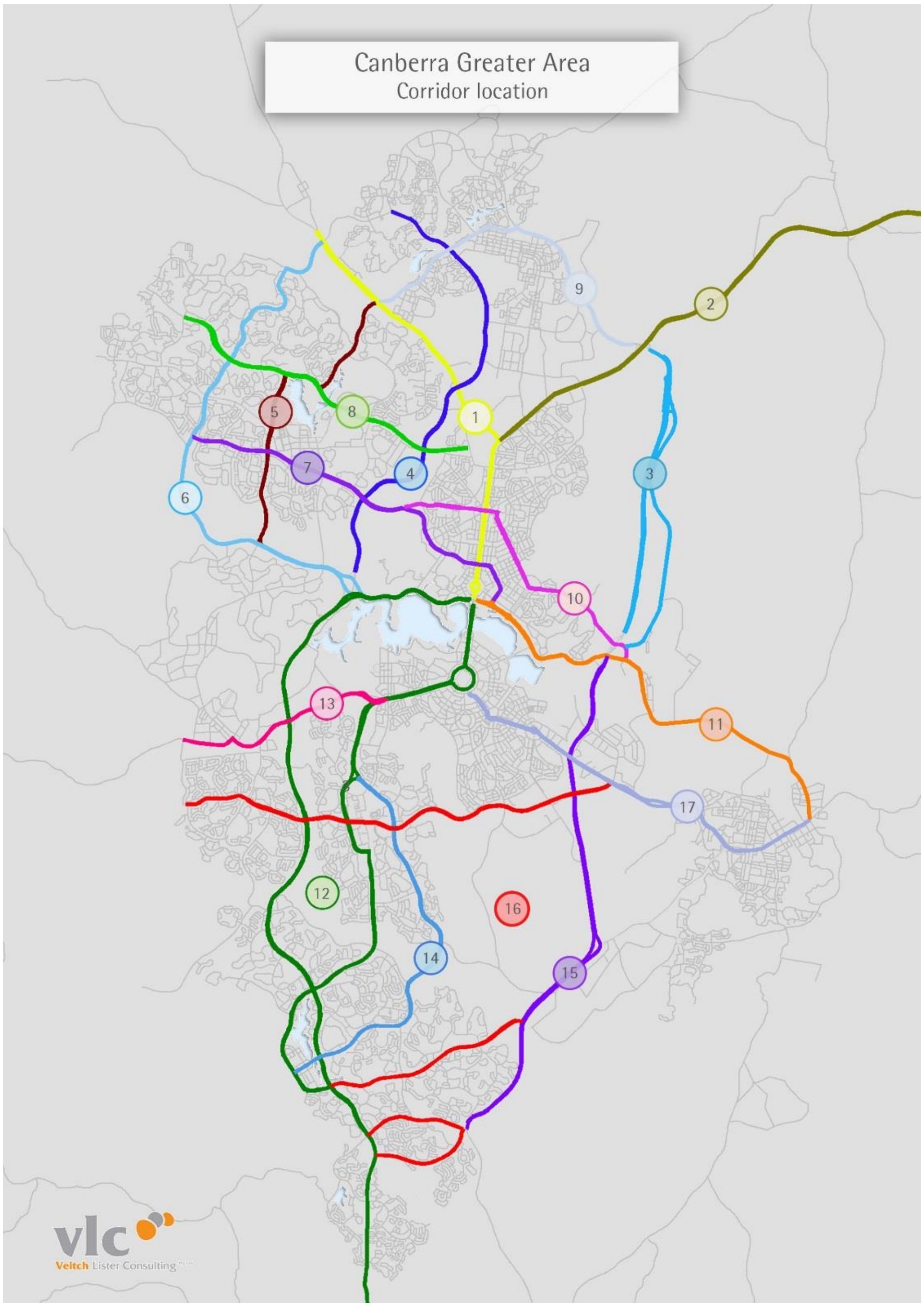
The high utilisation of trips from Belconnen to North Canberra results in a high DEC for public transport trips between these destinations.

9.6 Corridor analysis

The analysis of key transport corridors in the Canberra-Goulburn-Yass region provides more detailed insights than the analysis of origin-destination pairs. Corridors are defined to reflect some of the most commonly travelled journeys in the Canberra-Goulburn-Yass area. Corridors can include multiple routes travelling in parallel reflecting different choices for motorists to travel between certain destinations. The analysis of corridors is limited to the urban road network and includes public transport.

Figure 126 provides an overview of the 27 major transport corridors that are assessed in the Canberra-Goulburn-Yass area.

Figure 126 Canberra-Goulburn-Yass **urban transport corridors**



Source: VLC, 2014

Table 123 **Canberra-Goulburn-Yass corridors**

Corridor	Description	Corridor	Description
1	Barton Hwy/Northbourne Ave Corridor	10	Macarthur Av/Limestone Ave/Fairbairn Ave Corridor
2	Federal Hwy Corridor	11	Canberra Airport to Civic Corridor
3	Majura Road Corridor	12	Drakeford Dve/Tuggeranong Pky/Parkes Way Corridor
4	Gungahlin Dve Corridor	13	Cotter Road Corridor
5	William Slim Dve/Coulter Dve Corridor	14	Erindale Dve/Yamba Dve Corridor
6	Kingsford Smith Dve/William Hovell Dve Corridor	15	Monaro Hwy Corridor
7	Belconnen Way/Barry Dve Corridor	16	East-West Corridors
8	Ginninderra Dve Corridor	17	Canberra Avenue Corridor
9	Gundaroo Dve/Horse Park Dve Corridor		

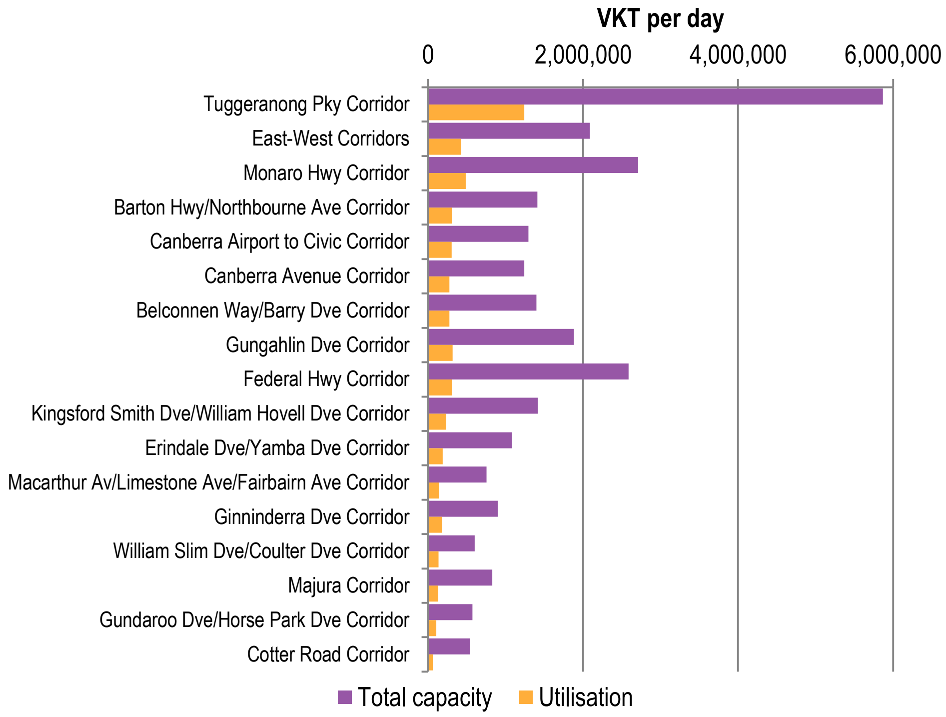
Source: VLC, 2014

9.6.1 DEC of corridors

Corridor capacity and utilisation

The capacity of the selected corridors depends on the length of the corridor, the speed limits and the number of parallel routes that the corridor is made up by. Figure 127 shows the capacity and utilisation of road corridors in the Canberra-Goulburn-Yass area in 2010-11. The graph shows the capacity of the road corridors in VKT per day with purple bars, the utilisation on a typical day is indicated with a yellow bar and the utilisation during the morning peak is shown through percentage figures.

Figure 127 **Transport corridors – Capacity and utilisation 2011 –** Canberra-Goulburn-Yass



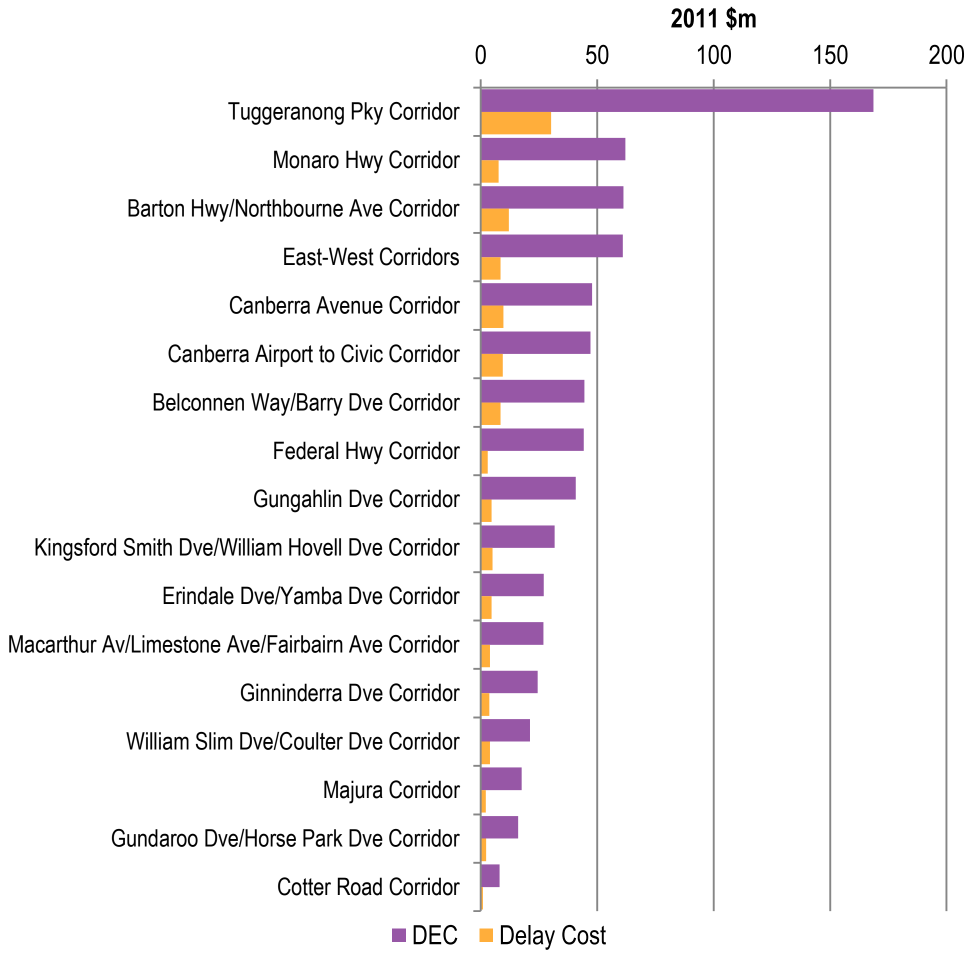
Source: VLC, 2014

The 'Tuggeranong Pky Corridor' has the highest capacity of corridors in the Canberra region.

Corridor DEC and delay costs

Figure 128 shows the DEC and utilisation of major transport corridors in the Canberra-Goulburn-Yass area.

Figure 128 **Transport corridors – DEC and delay cost 2010-11 –** Canberra-Goulburn-Yass



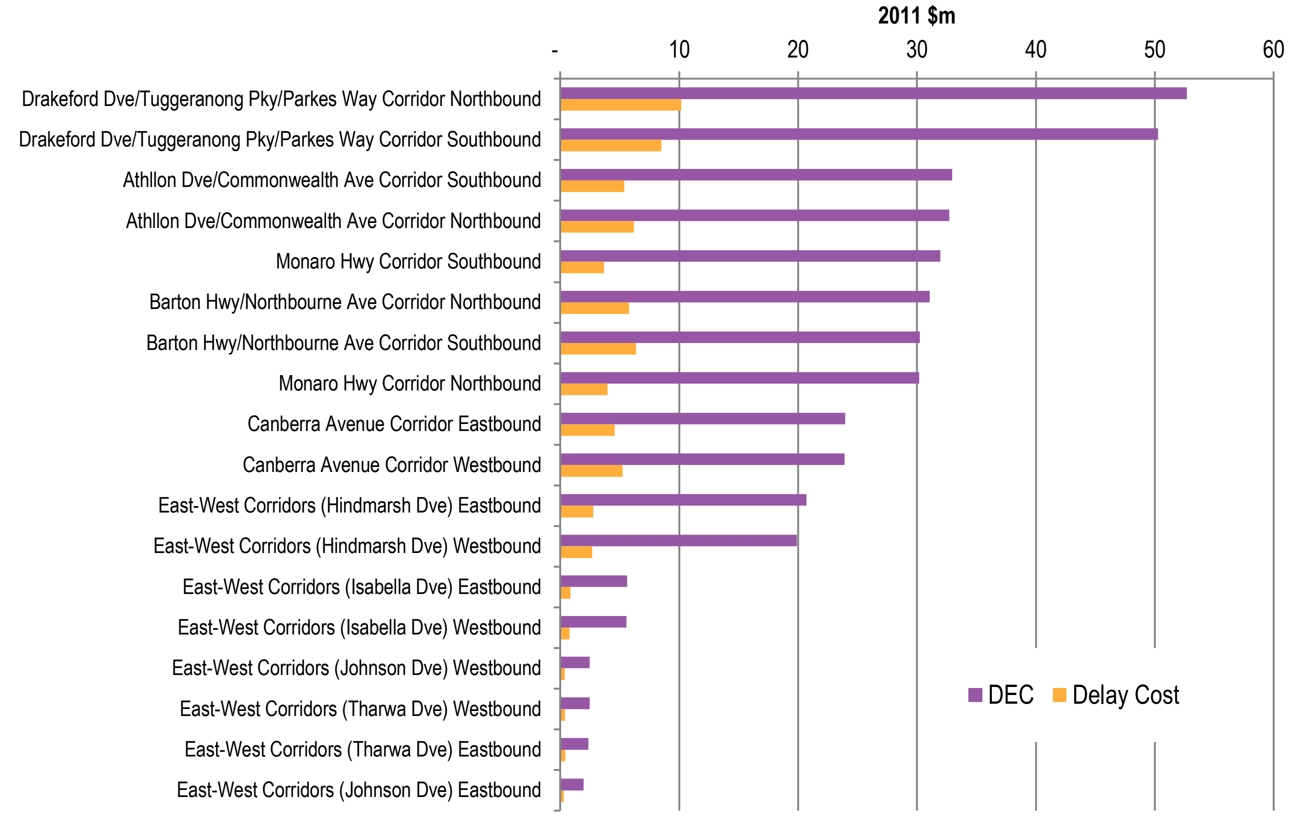
Source: ACIL Allen Consulting, 2014

As a result of its high capacity and utilisation the ‘Tuggeranong Pky Corridor’ has by far the greatest DEC in the Canberra region. In 2010-11 the DEC of the major corridors in the Canberra region was $751 million of which $121 million were absorbed in congestion cost.

9.6.2 Analysis of routes within major corridors

Figure 129 shows the DEC and delay costs of routes within the five corridors with the highest DEC in the Canberra-Goulburn-Yass area.

Figure 129 **Transport corridors – DEC and delay cost of routes within major corridors –** Canberra-Goulburn-Yass



Note: Shown are routes within the five corridors with the highest DEC.
Source: ACIL Allen Consulting, 2014

The DEC of routes within major transport corridors is relatively evenly split between the different directions in which the corridors are traversable. The 'Drakeford Dve/Tuggeranong Pky/Parkes Way' route within the 'Tuggeranong Pky Corridor' had the highest DEC of routes within the major corridors.

9.7 Projections for 2031

The requirements for urban transport growth are driven by the fundamental factors of expected population growth and employment growth.

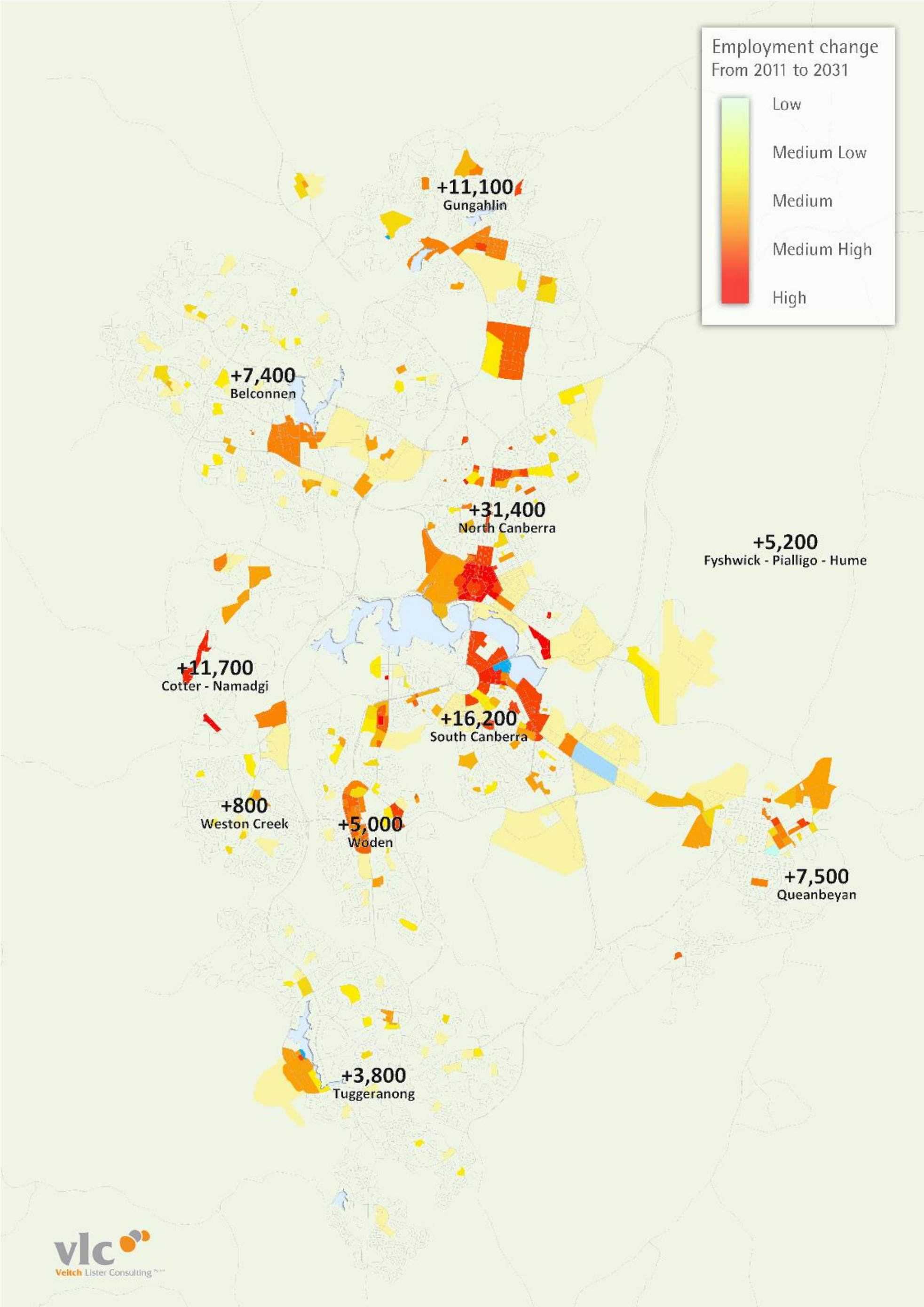
9.7.1 Demand drivers for urban transport

Predictions of population growth, as with the other regions covered within this report, are aligned with ABS Series B population predictions. VLC modelling has produced projections for the ACT region at a high level of spatial resolution suitable for detailed transport activity modelling.

Projected population growth

Figure 130 shows projected changes in population for the Canberra-Goulburn-Yass area. Canberra-Goulburn-Yass's planned structure means that population increases are concentrated in the urban centres, or 'hubs' surrounding the city centre. Red areas in the map below indicate areas of higher growth and the figure clearly illustrates the large differences between regions.

Figure 130 **Projected population growth 2010-11 to 2030-31 –** Canberra-Goulburn-Yass



Source: (VLC, 2014)

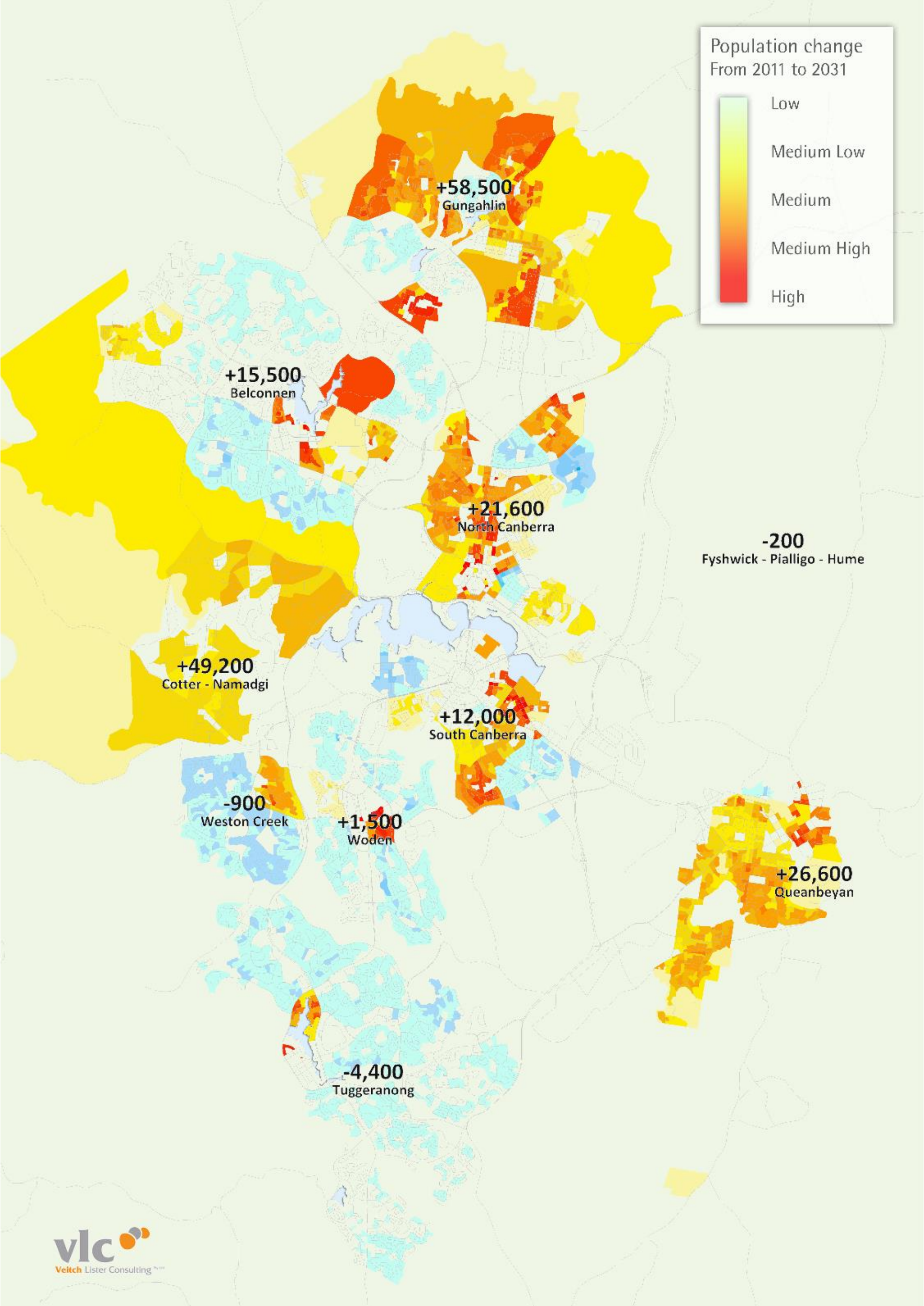
The largest increases in population in percentage terms occur in the SA3s of Gungahlin, and North and South Canberra. Overall population in the ACT is forecast to grow by 42 per cent. Goulburn-Yass and Queanbeyan are also expected to grow significantly over this period (41 and 51 per cent growth respectively).

Projected employment growth

Figure 131 shows projected employment growth in the Canberra-Goulburn-Yass area.

Unlike other major urban centres, employment in the ACT is closely linked to population growth. Only the SA3s of Woden and Weston Creek are forecast to see much greater employment growth as compared to population growth. The number of jobs in the ACT is expected to rise by some 182 thousand jobs between 2010-11 and 2030-31, an increase of 43 per cent.

Figure 131 **Projected employment growth 2010-11 to 2030-31 –** Canberra-Goulburn-Yass

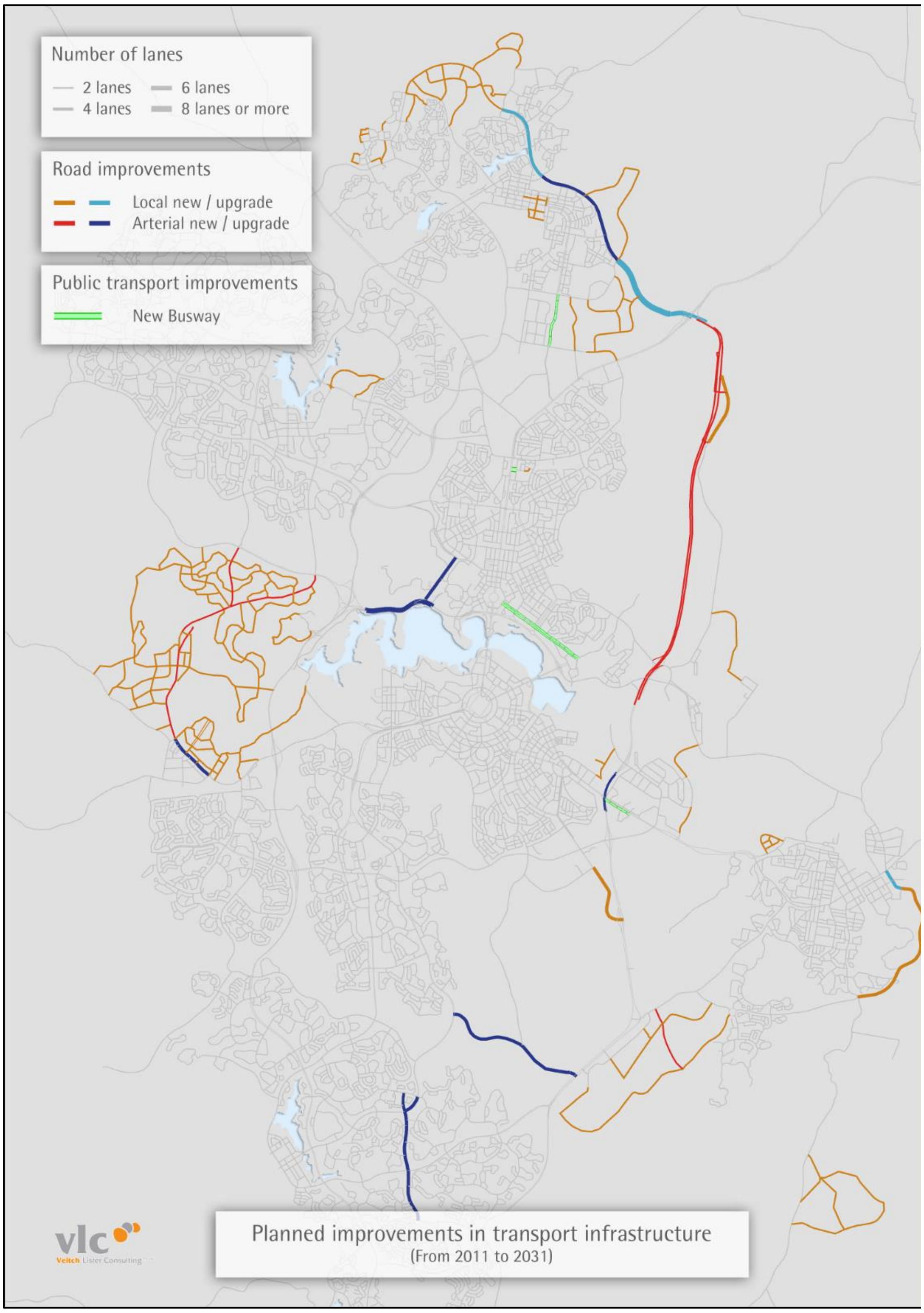


Source: (VLC, 2014)

9.7.2 Planned expansion of urban transport infrastructure

Figure 132 gives an overview of assumed changes in rail and road infrastructure between 2010-11 and 2030-31. The projected scenario represents the lowest expected investment based on current political capital tied up in various projects as well as committed spending levels.

Figure 132 **Projected changes in road and rail infrastructure 2010-11 to 2030-31 – Canberra-Goulburn-Yass**



Source: (VLC, 2014)

Table 124 provides an overview of the key additions to the transport system in the Canberra-Goulburn-Yass region that are assumed to go ahead between 2010-11 and 2030-31.

Table 124 **Major additions to transport infrastructure between 2010-11 and 2030-31 assumed in transport modelling**

Item	Description
1	Majura Pwy
2	Constitution Avenue
3	Horse Park Dr extension
4	Civic to Gungahlin Corridor Improvements
5	Molonglo Infrastructure Investment
6	Link Rd construction btn Majura Pwy and Majura Rd
7	Ashley Dr – Stage 1 - Duplication Erindale Dr btn Ashley Dr and Sternberg Cr

Source: (VLC, 2014)

We note that the planned introduction of light rail in Canberra is not included in assumed expansions of the urban transport network of the Canberra region.

9.7.3 DEC in 2031

Table 125 shows the DEC of different transport modes within the urban transport sector of the Canberra-Goulburn-Yass area.

Table 125 **Urban transport DEC by transport mode – 2030-31 –** Canberra-Goulburn-Yass

Mode	DEC	DEC
	(2011) $m	(2031) $m
Car	1,502	2,956
LCV	51	101
HCV	175	308
Bus	95	212
Total	**1,824**	**3,577**

Source: ACIL Allen Consulting, 2014

The growth in the economic contribution of bus transport is higher than all other forms of transport, however in absolute terms the growth in DEC of car transport is orders of magnitude higher. Overall the DEC of urban transport infrastructure in the Canberra-Goulburn-Yass region is projected to increase by $1.8 billion to $3.6 billion in 2030-31.

9.7.4 Capacity, utilisation and congestion in 2031

Table 126 provides an overview of the road network capacity in 2030-31 compared to the capacity in 2010-11.

Table 126 **Road network capacity – 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

Road network	Capacity	Capacity
	VKT per day	kms of road
2011	84,218,393	4,491
2031	91,517,327	4,759

Source: VLC, 2014

In the low investment scenario, assumed for this report, the capacity of the road network is assumed to only grow at a rate of 9 per cent between 2010-11 and 2030-31. This is similar to the growth in capacity seen in other major centres such as the Melbourne-Geelong region.

Table 127 compares road network utilisation in the Canberra-Goulburn-Yass area in 2030-31 with 2010-11.

Table 127 **Road network utilisation and congestion – 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

Road network	Utilisation	Congestion	Congestion	Congestion	Congestion
	VKT per day	V/C at AM Peak	V/C during typical day	delay as a % of travel time (daily)	Cost of delay ($m per year)
2011	9,906,834	29%	12%	12%	208
2031	13,593,001	37%	15%	22%	703

Source: VLC, 2014

While capacity of the network is predicted to growth by 9 per cent, utilisation of the network will grow by 37 per cent. As a result congestion is likely to increase in Canberra-Goulburn-Yass. This is reflected in the increase daily delay times and the increased costs of delay to the Canberra economy.

Table 128 provides a comparison of the projected capacity of public transport in the Canberra-Goulburn-Yass area in 2030-31 to the capacity in 2010-11. For the low investment scenario adopted for this report VLC's modelling does not assume any additions to Canberra-Goulburn-Yass's public transport networks. The table illustrates that there is essentially no planned capacity increases for the bus network.

Table 128 **Public transport network capacity – 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

Year	Public Transport Networks	Capacity	Capacity
		Passenger seat kms per day	Passenger crush kms per day
2011	Bus Network	3,414,642	5,016,248
2031	Bus Network	3,414,642	5,053,620

Source: VLC, 2014

Table 129 compares the utilisation of the bus network in Canberra-Goulburn-Yass between 2010-11 and 2030-31.

Table 129 **Public transport network utilisation – 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

Year	Public Transport Networks	Utilisation	Congestion	Congestion	Congestion	Congestion
		Passenger kms per day	V/Seat Capacity at AM Peak	V/Crush Capacity at AM Peak	V/Seat Capacity during typical day	V/Crush Capacity during typical day
2011	Bus Network	652,146	28%	19%	19%	13%
2031	Bus Network	1,066,222	46%	31%	31%	21%

Source: VLC, 2014

As a result of projected population growth and no assumed changes in bus network capacity, the modelling indicates a significant change in forecast utilisation of the bus network.

Analysis of key journeys

This section examines the changes in the DEC of origin destination pairs for public transport and road transport between 2010-11 and 2030-31.

Table 130 provides an overview of the ten origin-destination pairs with the highest projected change in DEC between 2010-11 and 2030-31.

Table 130 **Roads – Top ten origin destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Canberra GCCSA**

From	To	∆ DEC ($m)
Gungahlin	North Canberra	70.0
Cotter - Namadgi	Belconnen	40.3
Cotter - Namadgi	North Canberra	40.2
Belconnen	North Canberra	33.0
Gungahlin	Belconnen	27.6
South Canberra	North Canberra	26.7
Cotter - Namadgi	South Canberra	19.3
Cotter - Namadgi	Gungahlin	15.1
Gungahlin	South Canberra	13.7
Belconnen	South Canberra	13.0

Source: ACIL Allen Consulting, 2014

Driven by large population increases in the area trips from the ‘Gungahlin’ SA3 to ‘North Canberra’ have the highest projected change in DEC between 2010-11 and 2030-31. The change in road DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C11 in Appendix C.

Table 131 shows the ten origin destination pairs with the highest projected change in public transport DEC between 2010-11 and 2030-31.

Table 131 **Public transport – Top ten origin destination pairs with greatest increase in DEC – 2010-11 to 2030-31 – Canberra GCCSA**

From	To	∆ DEC ($m)
Gungahlin	North Canberra	31.0
Belconnen	North Canberra	14.1
Gungahlin	Belconnen	13.4
Cotter - Namadgi	North Canberra	9.1
Cotter - Namadgi	Belconnen	6.2
South Canberra	North Canberra	4.8
Gungahlin	South Canberra	3.7
Tuggeranong	North Canberra	3.3
Queanbeyan	North Canberra	2.5
Woden	North Canberra	2.4

Source: ACIL Allen Consulting, 2014

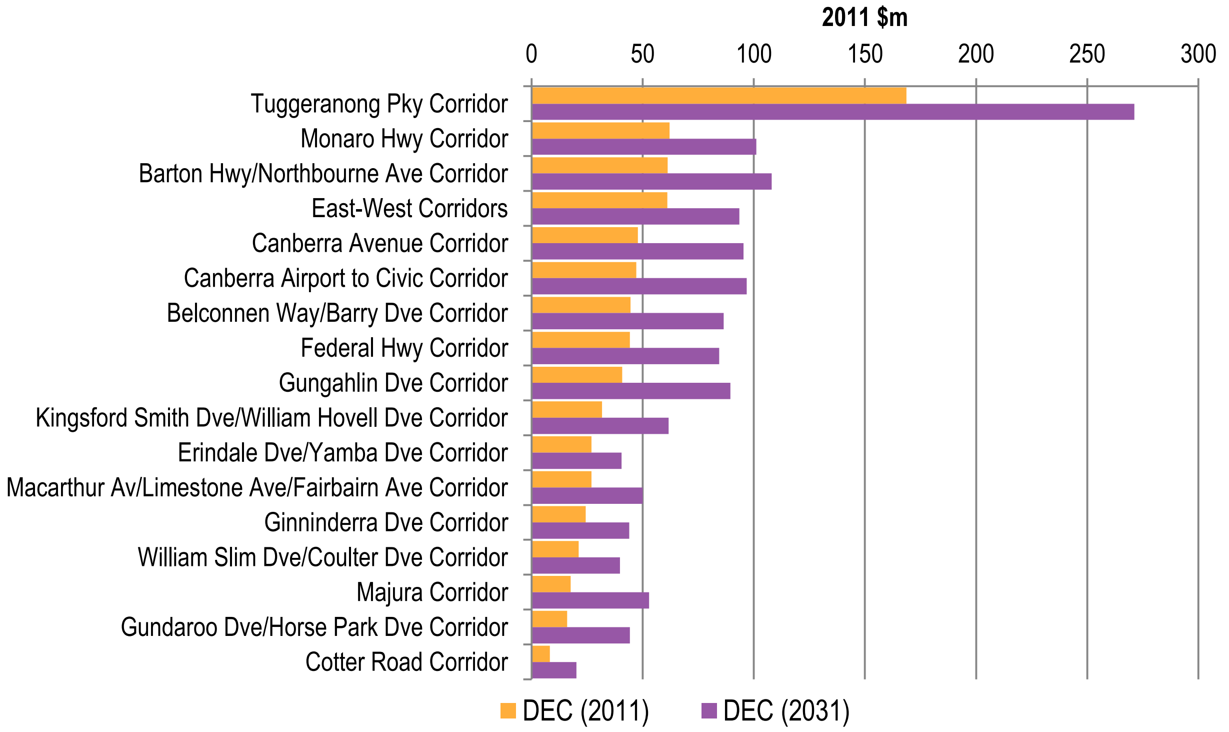
The projected large increase in the population of ‘Gungahlin’ results in a high change in DEC for trips from ‘Gungahlin’ to ‘North Canberra’. The change in public transport DEC from 2010-11 to 2030-31 by SA3 pairs is shown in the heat map in Table C12 in Appendix C.

Analysis of corridors

This section examines the changes in the DEC of key road corridors in the Canberra-Goulburn-Yass area between 2010-11 and 2030-31.

Figure 133 compares the projected DEC of major transport corridors in the Canberra-Goulburn-Yass area in 2030-11 to the DEC of these corridors in 2010-11.

Figure 133 **Transport corridors – DEC 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

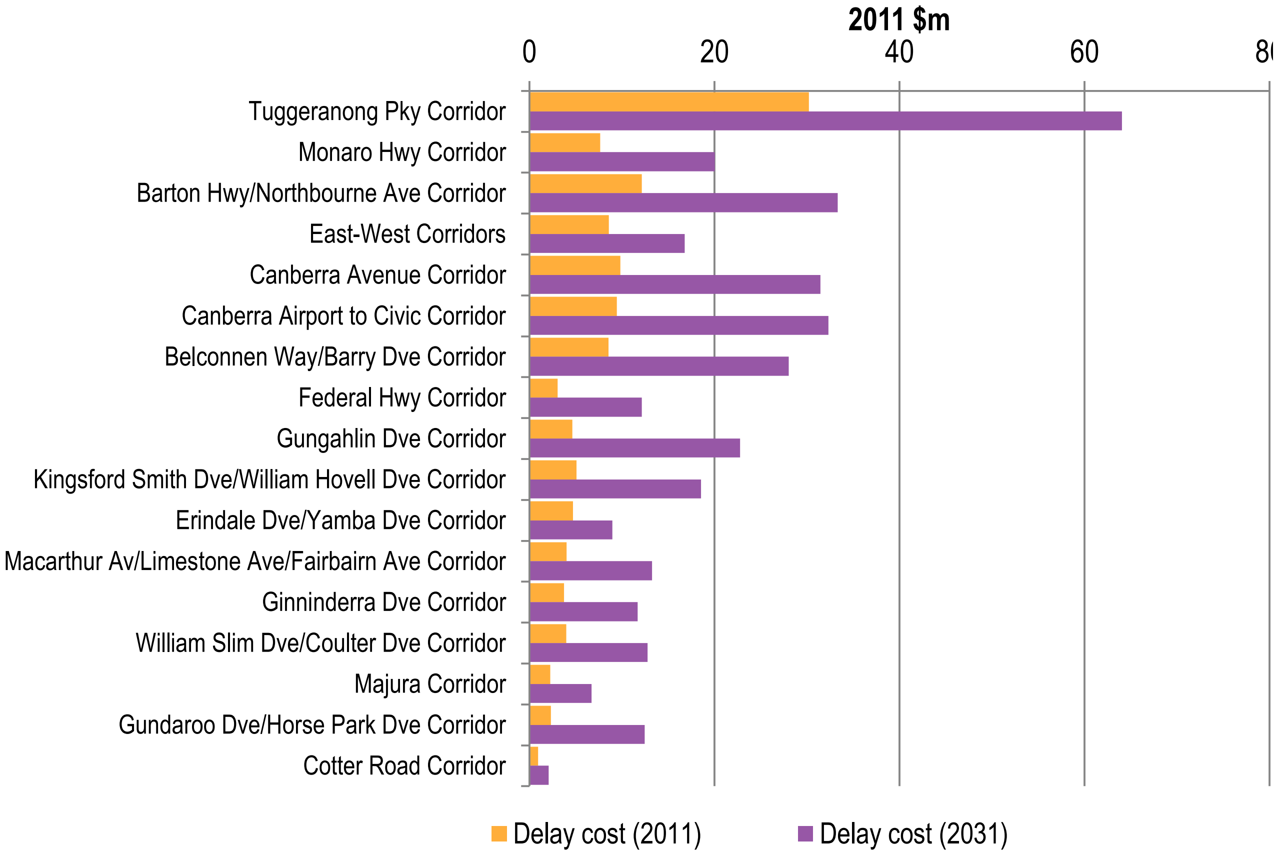


Source: ACIL Allen Consulting, 2014

The DEC of the major transport corridors in the Canberra region is projected to reach more than $1.3 billion by 2030-31. The DEC of the ‘Gungahlin Dve Corridor’ is projected more than double between 2010-11 and 2030-31.

Figure 134 compares the projected delay costs on major transport corridors in 2030-31 to the delay cost on these corridors in 2010-11.

Figure 134 **Transport corridors – delay cost 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

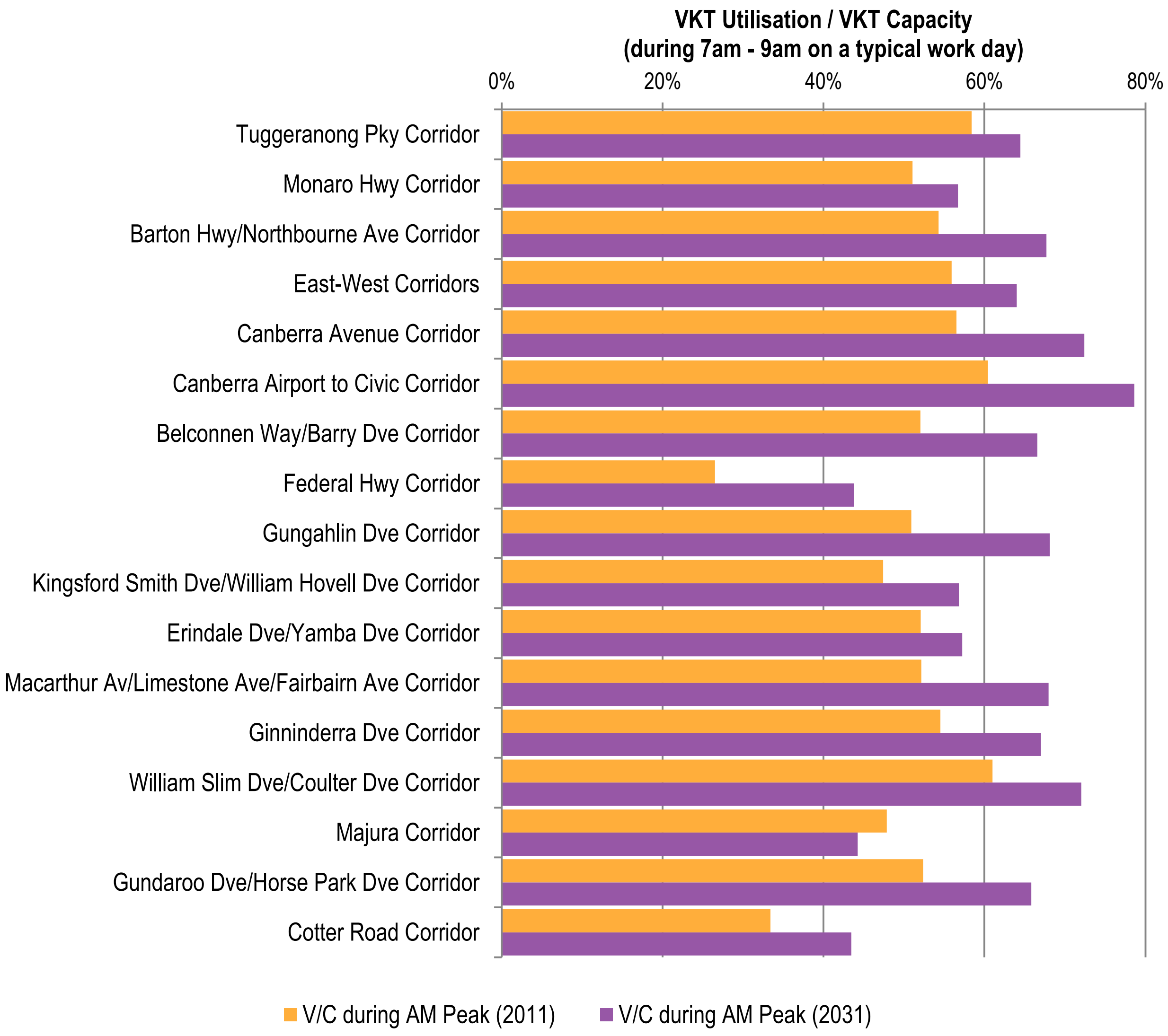


Source: ACIL Allen Consulting, 2014

Delay costs across the major transport corridors in the Canberra region are projected to increase by $227 million between 2010-11 and 2030-31, representing a near tripling in the cost of delay for these corridors.

Figure 135 provides a comparison of projected congestion on major transport corridors during the morning peak in 2030-31 to congestion on these corridors in 2010-11. The figure shows the ratio VKT to the VKT capacity of the corridors.

Figure 135 **Transport corridors – change in congestion 2010-11 and 2030-31 –** Canberra-Goulburn-Yass



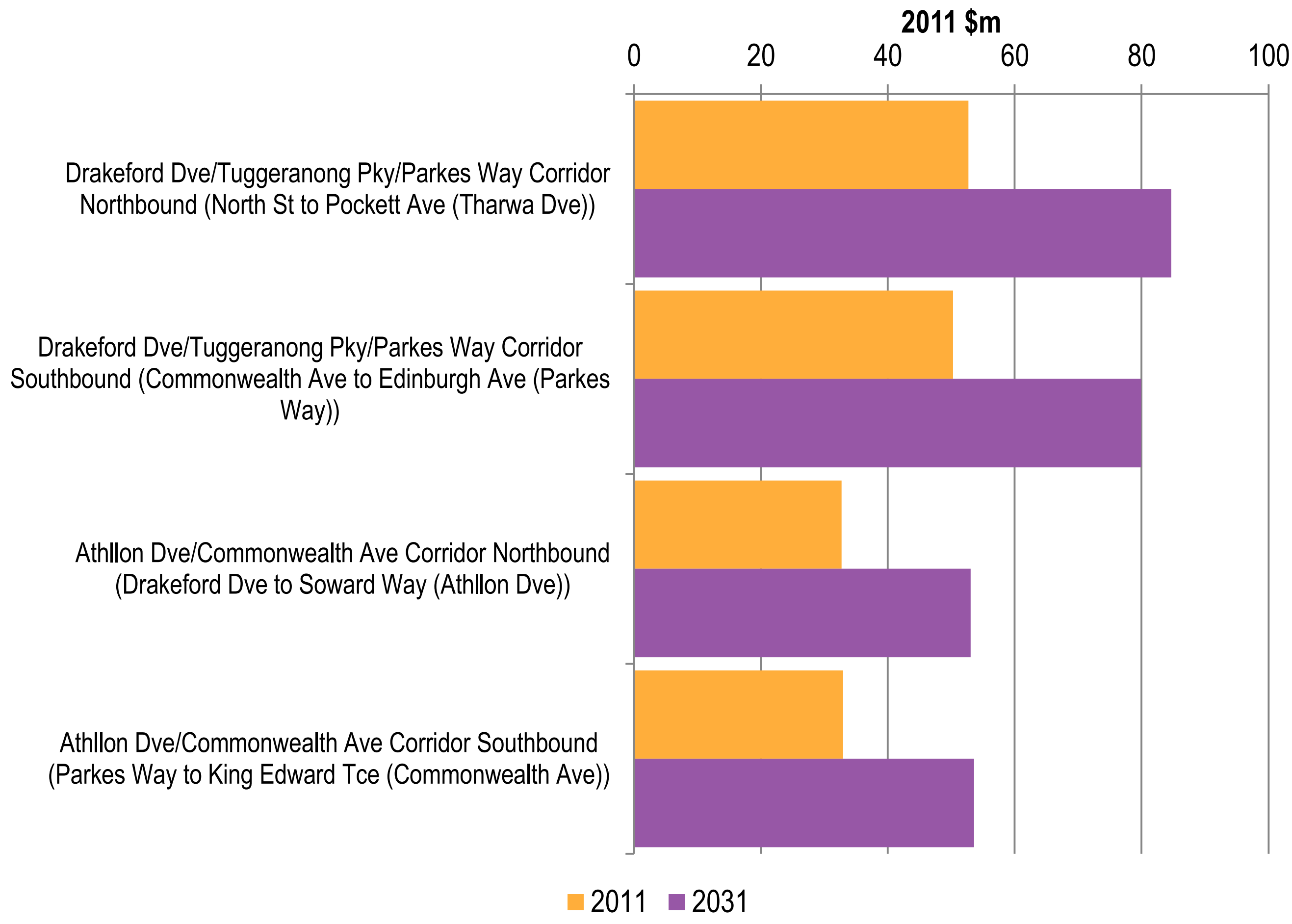
Source: VLC, 2014

Unlike corridors in other cities analysed for this study none of the corridors in the Canberra-Goulburn-Yass region are projected to reach utilisation of above than 80 per cent by 2030-31.

Analysis of key routes

Figure 136 compares the DEC and delay costs of routes within the two corridors with the highest DEC in the Canberra-Goulburn-Yass area in 2010-11 and 2030-31.

Figure 136 **Key routes– DEC 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

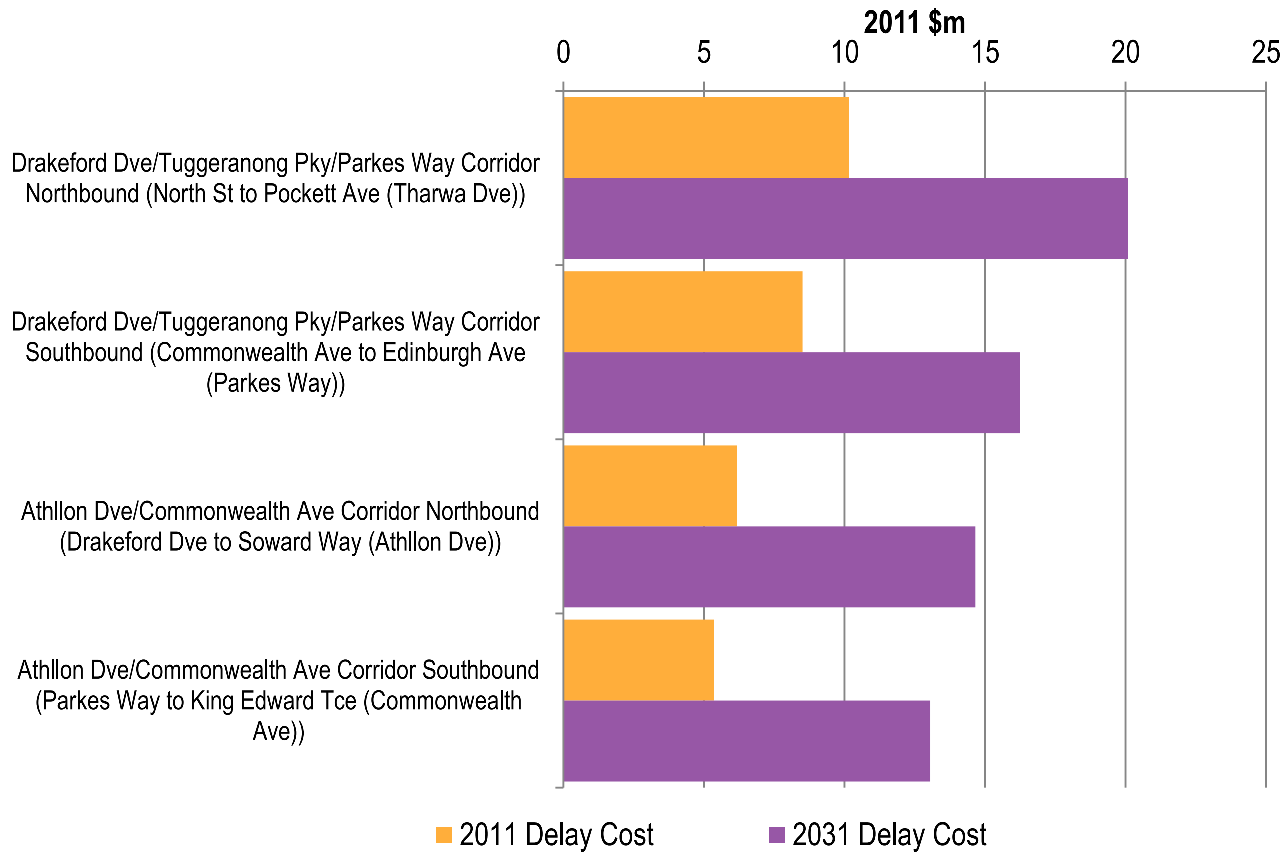


Source: ACIL Allen Consulting, 2014

Between 2010-11 and 2030-31 the DEC of the key routes within the top two corridors is projected to increase by $102 million.

Figure 137 shows a comparison of delay cost on routes within the two corridors with the highest DEC in the Canberra-Goulburn-Yass area between 2010-11 and 2030-31.

Figure 137 **Key routes– change in delay cost 2010-11 and 2030-31 –** Canberra-Goulburn-Yass

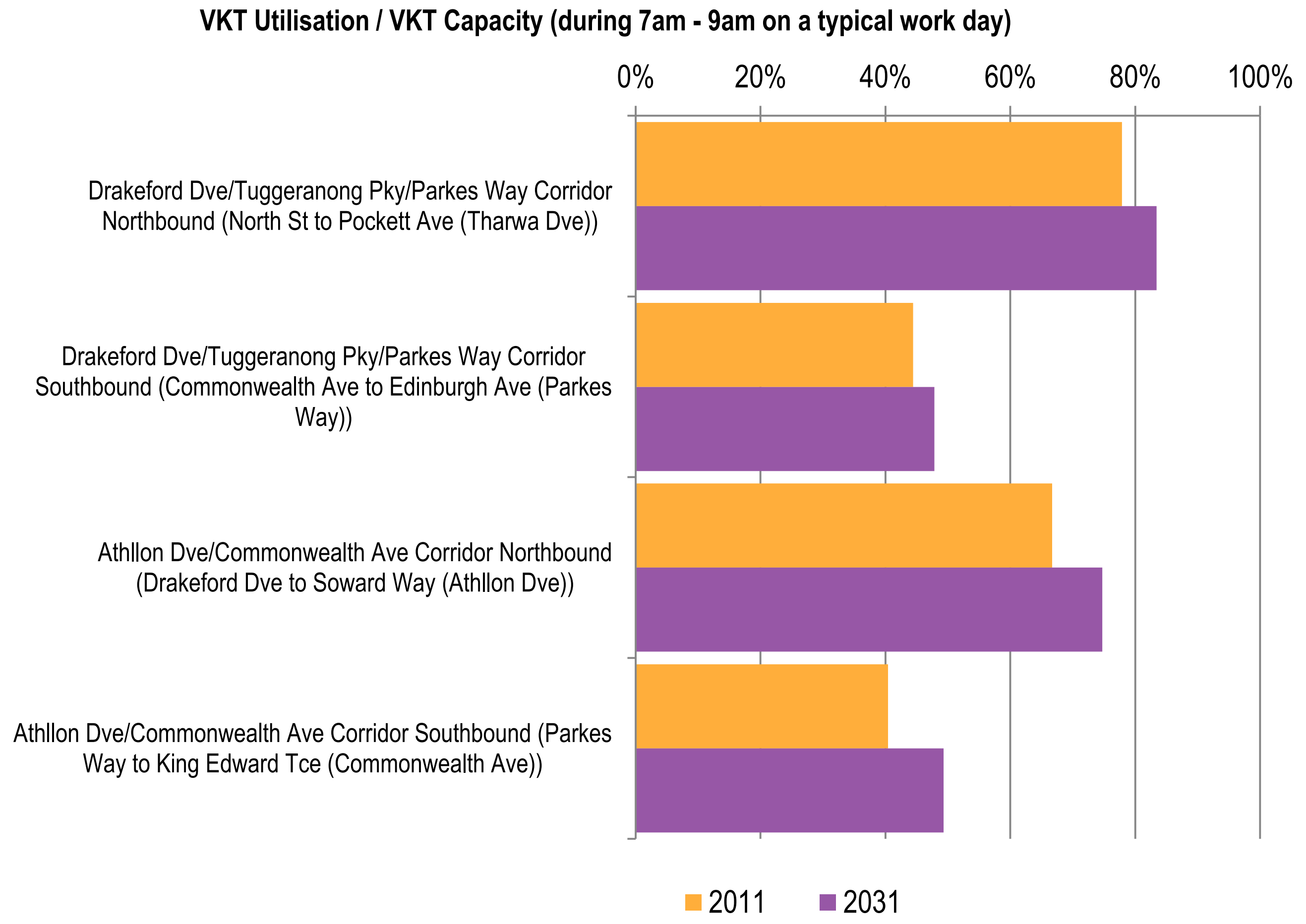


Source: ACIL Allen Consulting, 2014

Delay costs for the key routes in the top two corridors in the Canberra-Goulburn-Yass region are projected to increase by $34 million between 2010-11 and 2030-31.

Figure 138 compares congestion on key routes in the Canberra-Goulburn-Yass area between 2010-11 and 2030-31.

Figure 138 **Key routes– change in congestion 2010-11 and 2030-31 –** Canberra-Goulburn-Yass



Source: ACIL Allen Consulting, 2014

Congestion the 'Drakeford Dve/Tuggeranong Pky/Parkes Way Corridor Northbound (North St to Pockett Ave (Tharwa Dve))' is projected to reach more than 80 per cent by 2030-31.

9.7.5 Reconciliation with macro-economic data

Table 132 provides a comparison between the estimates of DEC based on transport activity modelling i.e. a bottom-up analysis and DEC estimates based on analysis of national statistics i.e. a top-down analysis.

The top down analysis is based on data sourced from the 2009 household expenditure survey (ABS, 2011) and national accounts data (ABS, 2014) using SDs as basic units rather than GCCSAs (details of this is provided in the earlier section of this chapter). Household expenditure data was used to estimate expenditure on private and public transport on a per capita basis. Data from the national accounts was used to estimate the DEC of freight movements. The bottom-up projections of the DEC of urban transport infrastructure are based on transport activity projections from VLC's Zenith model. The top-down, projections of DEC are based on national statistics. Household expenditure on personal transport is based on data from the household expenditure survey and scaled to the number of households in each region. Household expenditure is assumed to grow in line with income growth as a proxy for expenditure growth. Income growth projections are obtained from ACIL Allen's Tasman Global modelling for the Baseline Scenario of the broader AIA. DEC from road and rail freight is projected to grow in line with projections of gross value add for rail and road transport which is also obtained from the Tasman Global model projections.

Table 132 **Macro-reconciliation – DEC of urban transport infrastructure 2030-31 –** Canberra-Goulburn-Yass **area**

DEC (Based on transport simulation modelling)		DEC (Based on national statistics)	
Car/PMV	2,956	Household private vehicle expenditure	3,762
LCV	101	Road transport (freight)	377
HCV	308	Rail transport (freight)	5
Rail	-	Rail (household expenditure)	8
Bus	212	Bus/tram/light rail (household expenditure)	69
Ferry	-	Ferry (household expenditure)	1
Light Rail	-		
Total Transport	**3,577**	**Total Transport**	**4,222**
Growth factor (2011-31)	**1.96**	**Growth factor (2011-31)**	**2.33**

Source: ACIL Allen Consulting, 2014

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Appendix A Assumed network expansion

Table A1 **Assumed network expansions – Sydney-Newcastle-Wollongong region**

Description
Improved exit ramp to Campbelltown Road
F5 Freeway - Stage 3 - Widen to 3 lanes in each direction between Raby Road and Narellan Road, completed in March 2012
Pedestrian and bike bridge between Claymore and Woodbine
Permanent closure of Jones Street to Broadway
The Ponds supporting infrastructure (including The Ponds Boulevard)
Boundary Street upgrade – April 2012, replaced rail bridge over Boundary Road
Great Western Hwy - Station Rd to Tableland Rd (Wentworth)
Camden Valley Way upgrade between Cobbitty Road and Narellan Road
South West Growth Centre - Oran Park 2012
Camden Valley Way upgrade
Wallarah Creek, Pacific Highway Upgrade
Hoxton Park Rd
F5 Freeway Widening - Stage 2
M2 Upgrade Project - Windsor Rd west facing ramps and Herring Road west bound off ramp
M2 Upgrade Project - Christie Rd east facing ramp
Cumberland Highway and M4 intersection. Lane number edits
Eagle Vale Road Upgrade
Improving traffic flow on Marsden Road, Eastwood
The Ponds - Greenview Parade
Extra minor Roads for 2013 PT network
South West Growth Centre - Oran Park 2013
South West Growth Centre - Turner Rd 2013
Upgrade of central coast highway between carlton road and matcham rd
Pedestrian underpass across central coast hwy, kariong
The Ponds - Ridgeline Drive
Powers Road extra lane
Reconciliation Road, Pemulwuy
The Northern Road, Cranebrook
Taren Point Rd sth to hold & nrth to toorak- increasing length of slip turning lanes by 110m.
South West Growth Centre - Oran Park 2014
Erskine Park Link Road
M2 Upgrade Project
Upgrade of central coast highway between matcham rd and ocean view drive
Princes Highway Upgrade - South Nowra. 2 to 4 lanes
The Hunter Expressway - new 40km highway
Great Western Hwy Upgrade at Bullaburra
M2 Upgrade Project - Lane Cove Road East-bound on-Ramp and Lane widening
Richmond Road Upgrade - Stage 1
Schofields Road Corridor Upgrade - Stage 1
Brisbane Water Drive and Manns Road at West Gosford Intersection upgrade
Nelson Bay Road Upgrade, Bob's Farm to Annay Bay
M5 West Widening
Richmond Road Upgrade - Stage 2

Description
Western Sydney Employment Area - Old Wallgrove Road upgrade
Fullers Road, Chatswood
Boundary Street Upgrade, Roseville
North West Growth Centre - Alex Avenue Precinct
North West Growth Centre - Marsden Park Precinct
North West Growth Centre - Colebee
Spring Farm Road Infrastructure Stage 1
Elderslie Road Infrastructure
South West Growth Centre - Oran Park 2016
South West Growth Centre - Turner Rd 2016
Eagle Vale Road Upgrade
South West Growth Centre - Edmondson Park 2016
Camden Valley Way upgrade between Oran Park Drive, Harrington Park and Bringelly Road, Leppington - upgrade from 2 to 4 lanes with 80km/hr speed limit
Schofields Road Upgrade and Extension - Stage 2
Werrington Arterial Road - Stage 1, Claremont Meadows
Showground Road Upgrade, Castle Hill
South West Growth Centre - Oran Park 2018
M2 to F3 Corridor
Prospect Highway upgrade
North West Growth Centre - Schofields Precinct
Western Sydney Employment Area - Southern Link Road
Schofields Rd Upgrade and Extension - Stage 3
Narellan Road Upgrade
Mona Vale Road Upgrade
Alford's Point Road Southern Approach
North West Growth Centre - Area 20 Precinct
North West Growth Centre - Riverstone Precinct
North West Growth Centre - Riverstone West Precinct
North West Growth Centre - Box Hill Precinct
North West Growth Centre - North Kellyville Precinct
North West Growth Centre - Riverstone East Precinct
Spring Farm Road Infrastructure Stage 2
South West Growth Centre - Catherine Fields (Part) 2021
South West Growth Centre - Turner Rd 2021
South West Growth Centre - Austral & Leppington 2021
South West Growth Centre - Edmondson Park 2021
South West Growth Centre - Marylands - 2021
South West Growth Centre - East Leppington - 2021
M4 widening
Upgrade of Campbelltown Road
South West Growth Centre - Leppington - 2026
South West Growth Centre - Marylands - 2026
Upgrade of Denham Court Rd
Archbold Road
Western Sydney Employment Area - Long-term Improvements
Richmond Road Upgrade - Stage 3
Bringelly Road Upgrade
The Northern Road upgrade, Bringelly

Description
North West Growth Centre - Schofields West Precinct
North West Growth Centre - Vineyard
South West Growth Centre - Catherine Fields North - 2031
South West Growth Centre - Catherine Fields - 2031

Source: VLC, 2014

Table A2 **Assumed network expansions –Melbourne-Geelong**

Description
M1 - WGB widening Managed motorway
Central Arterial - (Waterview Bvd to) Aitken Bvd to Windrock Av (2x1 lane divided)
Hallam Rd - Pound Rd to Ormond Rd => 4 lane Divided
Plenty Rd - Gordons Rd to Hawkstowe Pde => 4 lane Divided
Plummer St Extension (widening included in Project 002)
Windrock Av - Central Arterial to Craigieburn Rd
Tullamarine Airport Access Upgrades
Grand Bvd - Mt Ridley Rd to Winrock Ave => 4 lane Collector
Nagambie Bypass - Mitchellstown Road and Moss Road
Princes Highway Duplication - Reid Drive, Wurruk and Reeve Street, Sale
Mitcham Road level crossing grade separation
Bass Hwy Duplication - Lang to Anderson
Western hwy duplication - Beaufort to Ballarat
Bush Bvd in Mill Park between Plenty Rd and McDonalds Rd - New Road
Breakwater Road realignment - Tucker Road to Barwon Heads Road
O'Herns Rd - Edgars Rd to Epping Rd => 4 Lanes Divided
Sayers Rd - Derrimut Rd to Tarneit Rd => 4 lane Divided
Shearwater Dr - Cardinia Rd to Princes Hwy
Dingley Arterial East - Springvale Rd to Perry Rd
Frankston Bypass - EastLink to Dandenong-Frankston Rd => 6 lane Freeway
M80 Upgrade Calder Fwy to Sydney Rd
M80 Upgrade Western Hwy to Sunshine Ave
M80 Upgrade Edgars Rd to Plenty Rd
M80 Upgrade Princes Hwy to Western Hwy
M80 Upgrade Sunshine Ave to Calder Fwy
M80 Upgrade Sydney Rd to Edgars Rd
M80 Upgrade Plenty Rd to Greensborough Hwy
Cardinia Rd - Princes Hwy to Pakenham Bypass => 4lanes
Clyde Rd - Kangan Dr to Princes Hwy => 4 Lanes Divided
Cooper St - Hume Fwy to Edgars Rd - 4 lanes => 6lanes Divided
Derrimut Rd - Sayers Rd to Leakes Rd => 4 lane Divided (see also 013)
Dohertys Rd - Hume Rd to Grieve Pde => 4 lanes Divided, but Undivided on Fwy Overpass
E14 (Aitken Bvd) - Craigieburn Rd to Mt Ridley Rd - 2 lanes undivided.
E14 (Aitken Bvd) - Somerton Rd to Craigieburn Rd - 2 lanes undivided
Grices Rd - Berwick-Cranbourne Rd to Soldiers Rd - 2 lane undivided - Sealed
Hallam Rd - Princes Hwy to Pound Rd => 4 lane Divided
Hallam Rd - Ormond Rd to South Gippsland Hwy => 4 lane Divided
Heaths Rd - Shaws Rd to Tarneit Rd => 4 Lanes Divided
Heaths Rd-Bolton Rd - Ballan Rd to Shaws Rd => 4 Lanes Divided - Incl Bridge widening.
High Street Rd - Stud Rd to Burwood Hwy =>
Koo Wee Rup Bypass - Manks Rd to South Gippsland Hwy - 2 lanes undivided
Linsell Bvd - Narre Warren-Cranbourne Rd to Berwick-Cranbourne Rd - 2 Lanes undivided

Description
Narre Warren-Cranbourne Rd - Pound Rd to Thompsons Rd => 4 lane divided
Palmers Road - Dunnings Rd to Sayers Rd => 4 lane Divided
Palmers Road - Sayers Rd to Dohertys rd => 4 lane Divided
Palmers/Robinsons Road - Dohertys Rd to South of Deer Park Bypass => 4 lane Divided
Plenty Road - McKimmies Rd to Centenary Dr 4 Lanes => na Lanes
Point Cook Road - Point Cook Homestead Rd to Dunnings Rd => 4 lanes Divided
Princes Freeway West - Interchange at Duncans Rd => Full Diamond
Somerton Rd - Mickleham Rd to Roxburgh Park Dr => 4 lanes Divided
Thompsons Rd - Western Port Hwy to South Gippsland Hwy =>4 lane Divided
Thompsons Rd - Dandenong Valley Hwy to Western Port Hwy =>4 lane Divided
Thompsons Rd, Templestowe - Manningham Rd to Foote St =>4 lane undivided
Boronia Rd - Mountain Rd to Stud Rd => 6 Lanes Divided
Geelong Ring Road Stages 4A, 4B & 4C
Princes Highway Duplication - Waurn Ponds to Winchelsea
Princes Freeway East - Melbourne to Sale
Calder Park Dr-Westwood Dr - Western Hwy to Taylors Rd =>Stage 1
Peninsula Link - Dandenong-Frankston Rd to Frankston-Flinders Rd
Peninsula Link - Frankston-Flinders Rd to Mornington Peninsular Fwy
Calder Fwy Interchanges: , Kings Rd (Diamond), Kings Rd=>4 Lanes
East West Link Stage 1
Dingley Arterial West - Springvale Bypass (Westall Rd) to Warrigal Rd => 4lane Divided
Kororoit Creek Rd - Grieve Pde to Millers Rd => 4 Lanes Divided + Grade Separation.
Sneydes Road full Interchange
Cardinia Rd, Shearwater Dr to Pakenham Bypass
Dandenong Valley Hwy (Stud Rd) - Boronia Rd to Mountain Hwy =>4 Lanes Divided
Regional Rail Link (Tarniet and Manor Lakes Stn)
Sunbury Electrification and Extension (Calder Park Stn) - Stage 1
South Morang Extension
Maryborough Line improvements (Talbot Stn)
New Stations to existing lines (Cardinia Rd, Lynbrook & Williams Landing)
Growth Area Bus Infrastructure
Maryborough Line improvements (Clunes Stn)
East West Link – Stage 1 – Eastern Section
Cranbourne-Pakenham Rail Corridor project
M80 Ring Rd upgrade (widening)
Western Hwy duplication – Ballarat to Stawell
Metro Level Crossing Blitz - Blackburn Rd | Burke Rd | North Rd
Metropolitan grade separations - Mitcham Rd & Rooks Rd | Springvale Rd
Princes Hwy duplication project – Winchelsea to Colac
Main Road Level Crossing Removal
Western Hwy realignment – Anthonys Cutting (Melton to Bacchus Marsh)
Goulburn Valley Nagambie Bypass
Princes Hwy East – Traralgon to Sale duplication
Princes Hwy West – stage 1 Waurn Ponds to Winchelsea
Dingley Bypass btn Warrigal Rd to Westall Rd
Geelong Ring Rd stage 4C – Geelong Ring Rd to Surf Coast Hwy
Calder Hwy interchange at Ravenswood
Koo Wee Rup Bypass
Breakwater Road – upgrade
Geelong Ring Rd Stage 4B – Anglesea Rd to Princes Hwy West

Description
Peninsula Link
Port-Rail shuttle (metropolitan intermodal system)
Clyde Rd duplication – High St to Kangan Dr (4L)
Narre Warren Cranbourne Rd duplication btn Pound Rd and Thompson Rd (4 & 6L)
South Gippsland Hwy upgrade – Sale to Longford
Bass Hwy duplication Stage 7 – Woolmer Rd to Phillip Island Rd

Source: VLC, 2014

Table A3 **Assumed network expansions – Brisbane South East Queensland**

Description
RCM CLEM7 - AL Connections (City Ramps)
Northern Busway: RBH to Kedron to Bracken Ridge - INB to Federation St
Airport Link Reference Design Sandgate Road interchange
Airport Link Ancillary Works - Northern Busway Staging : Interim - RCM NSBT
Airport Link Tunnels
Kingsford Smith Drive - Theodore St to French St => 6 lanes Divided
Beckett Rd - Rode Rd to Albany Creek Rd => 4 lane divided; signals except roundabout at Rode Rd.
Bridgeman Road - Albany Creek Rd to Millar Rd => 4 lane Divided, Speed Limit 70 kph.
Kerners Road Deviation - Warwick Rd to Kerners Rd. (Include reclassification of Kerners Rd-Deebing Creek Rd – Ash St to Pisale Dr as collector)
Third Avenue Extension - Bardon Rd - Wembley Rd. New 4 lane Road - Part 1
Eastern Busway: Buranda to Capalaba, Stage 1 - Buranda to Main Ave
Ipswich Motorway upgrade: Dinmore to Darra to Rocklea, Goodna to Dinmore_Part 1
Ipswich Motorway upgrade: Dinmore to Darra to Rocklea, Goodna to Dinmore_Part 2
Miscellaneous North Lakes Area Roads completed by July 2012.
Reclassify selected North Lakes Roads as collectors, including: Endeavour Bvd; Bounty Bvd (northern section); Discovery Dr (northern section); and Memorial Dr connection to Kinsellas Rd W.
Pimpama Area Roads as at end June 2012
Pacific Mwy Interchanges and added lanes, Nerang to Gooding Rd
Bundilla Area Roads Completed by 30/06/2012
Bruce Highway - Kidgell St to Oak St => 4 lane arterial (+ Hughes Tce Interchange at 2 lanes)
Noosa Junction Bus Station
Sumners Road - Spine St to Tomkins Rd => 4 lanes divided throughout.
Deebing Creek Connection Road - Kerners Rd to Lakeview Dr to Centenary Hwy. New 2 lane sub-arterial.
Francis Road - Rail overpass, Gympie Rd to Tarandi St as 2 lane divided + upgrade to collector to Ellis St.
Sippy Downs Drive - University Way to Dixon Rd Interchange => 4 lane collector + 2 lane connection to Power Rd.
Stringy Bark Road - Jorl Ct to Sippy Downs Dr => 2 lane collector.
Bruce Highway realignment between Sankeys Road (Cooran) to Traveston Road (Traveston)
Pacific Mwy Interchanges (Loganlea Rd and Paradise Rd)
Port of Brisbane Motorway - Gateway Mwy to Boat Passage => 4 lane divided (North of Pritchard St not grade sep)
Brisbane Urban Corridor - Mains Rd/Kessels Rd grade seperation
Removal of T2 lanes on Pacific Highway between Mt Gravatt and Eight Mile Plains (2 lanes + T2 lane => 4 lanes)
Mt gravatt Capalaba Rd (Broadwater Rd to Gardner Rd - 6L)
Gateway Mwy Southbound onramp extension to pacific Mwy

Description
Western Arterial Rd (Jindalee - Everton Park) - Wardell St / Samford Rd (Improve intersection)
Light Rail - Griffith University to Pacific Fair.
Northern Link - Western Freeway to ICB. New 4 lane tunnel.
Telegraph Rd 4L (from Linkfield Rd to Norris Rd)
Removal of Rail crossing at Robinson Road in Geebung - building a 4 lane bridge
Gateway Motorway Northbound - Sandgate Rd to depot Rd on Ramp => 6 lanes
Gateway Motorway - Nudgee Rd to Deagon Deveiation => 6 lane freeway.
Ipswich Motorway - Rocklea to Darra => 6 lane Freeway/Expressway. (Oxley to Granard)
Brisbane Valley Highway Interchange at Warrego Hwy and Wulkuraka Connection Rd. (include northern service road, as 2 lane collector, and Bayley Rd-Pine Mountain Rd link.)
SE Busway - Extension to Priesdale St
Mount Crosby Road - Warrego Hwy intersection (WB off-ramp to Mt Crosby Rd) - Construct auxiliary lanes
Springfield Rail - Richlands to Carole Park/Camira
Cunningham Highway - Ripley Rd to Ipswich Western Bypass => 4 lane Freeway. (Include 2 lane Western Bypass Connection to Ipswich-Rosewood Rd).
Centenary Highway - Logan Mwy to Augusta Pwy => 4 lane freeway.
Springfield Rail - Carole Park/Camira to Springfield
Mount Lindesay Arterial Rd (Nottingham Rd / Honeysuckle) - 2700cap
Sandgate Sub - Arterial Rd (Northumbria Rd / Garozzo Rd) - Improve intersection
Logan Sub - Arterial Road (Miles Platting Rd / Padstow / Logan
Capalaba - Victoria Point Rd (Vienna Rd - Redland Bay Rd) - Improve intersection
Capalaba - Cleveland Road (Abelia st - improve intersection)
Capalaba - Cleveland Road (Finucanne Road / Willard Road) - Improve intersection
Pacific Motorway - Gooding Rd to Varsity Lakes => 6 lane freeway.
Pacific Motorway - Varsity Lakes to Stewart Rd => 6 lane freeway.
Foxwell Road - Abraham Rd to Cunningham Dr South => 4 lanes Divided
Abraham Road - Days Rd to BP service road connection => 4 lane divided sub-arterial
Pacific Hwy (Fitzerald Avenue - Aranda st) - Construct additional lane
Brisbane - Beenleigh Rd (paradise rd) - Improve intersection
Brisbane - Beenleigh Rd (Muchow Road) - Improve intersection
Brisbane - Beenleigh Rd (Muchow road) - Improve intersection
Brisbane - Beenleigh Rd (Monash Road) - Improve intersection
Logan Motorway upgrade (Ipswich Mwy to Pacific Mwy) - Mt Lindsay to Gateway 8L, East of Gateway 4L
Gold Coast Hwy - Hope Island Road (improve intersection)
Labrador - Carrara Rd (Smith St / Olsen Avenue interchange) - from 4 to 6 lanes
Smith Street Eastbound - Pacific Mwy Ramp to Olsen Ave Ramp => 3 lanes.
IRTC - Foxwell Rd to Nerang-Broadbeach Rd. New 2 lane
Southport-Nerang Road - Minnie St to Queen St => 4 Lane divided arterial.
Stapylton-Jacobs Well Rd - Pacific Mwy to Quinns Hill Rd => 4 lane divided sub-arterial.
Redcliff rail extension
Interim future plan on Yarrabilba for 2021
Other Jimboomba/Greenbank Area Roads, including: Homestead Drive (LCC_050) - Teviot Rd to Rail Bridges => 4 lane sub-arterial; Pub Lane - Teviot Rd to Equestrian Dr => 4 lane collector; Fraser Road-Red Gum Road Connection as new 2 lane collector.
Teviot Road - Homestead Dr to Cusack Ln => 4 lane. Sub-arterial.
Homestead Drive - Railway Bridges (2) + extension to Flagstone West N-S Collector as 4 lane sub-arterial.
Flagstone Western Collector - Mountain Ridge Rd to Homestead Dr as new 2 lane sub-arterial.
Mountain Ridge Road - Teviot Rd to Flagstone Western Collector => 2 lane sub-arterial.
Silverwood Drive - Extesion to Paula Rd as 2 lane collector. (Flagstone East N-S Collector)
Teviot Road - Crowson lane extension to Mountain Ridge Rd (SIC) => 4 lane divided sub-arterial.

Description
Interim future plan on Flagstone for 2026
Mt Lindesay Highway - Rosia Rd to Chambers Flat Rd => 4 lane freeway (incl interchange at Chambers Flat Rd)
Crowson Lane - Teviot Rd to Mt Lindesay Hwy => 2 lane sub-arterial.
Crawson Lane - Teviot Rd to Mt Lindesay Hwy => 4 lane divided sub-arterial.
Pub Lane (Teviot Road - Equestrian Dr.) - 4L
New Beith Area Collectors - Boyd Rd-Equestrian Dr and Cunningham Dr-Portland Rd
Teviot Road - Pub Lane to Stoney Camp Rd => 4 lane divided sub-arterial.
Goodna Road - Teviot Rd to Springfield => 4 lane divided arterial
Springfield-Greenbank Arterial - Springfield Pwy to Springfield TC Distributor to Sinnathamby Bvd to Beaudesert Boundary => 4 lane divided arterial.
Other Springfield Area Roads as per QML Job.
Other Springfield Area Roads as per QML Job.
(UA1) Jedfire Street NS Extension - Park Ridge Rd to Green Rd as 2 lane collector.
(UA2) - Park Ridge Rd to Bumstead Rd as 2 lane collector.
Murphy Rd - Handford Rd - Lemke Rd Stage 1 (Ellison Road to Gympie Road) 4L divided
Maundrell Terrace-Appleby Road - Stafford Rd to Albany Creek Rd => 4 lane sub-arterial.
Rode Road - Glenrowan St to Hilltop Ave => 4 lane divided.
Rode Road - Old Northern Rd to Glenrowan St + Hilltop Ave to Gympie Rd=> 4 lane divided.
Ormskirk St extension (from Harmish St to Benhiam St) - 2L divided collector
Benhiam St (from Nottingham Rd to Formby St) - 4L collector
Benhiam St (from Formby st to Ormskirk St) - 4L collector
Benhiam St (Omskirk St to Benhiam rd extension) - 4L collector
Benhiam St (Benhiam Rd extension to Beaudesert Rd) - 4L collector
Benhiam St Extension (Benhiam St to Higland Dv) - 2L divided access street
Formby St (algester Rd to Benhiam St) - 2L arterial
Ormskirk St (Algester Rd to Benhiam St) - 4L divided collector
Crossacres (Blunder Rd to Rockfield Rd) - 4L divided
Crossacres St (joseph Banks Av to Rockfield Rd) - 2L divided
Wynnum Road (Inbound lane (3L) Scanlan St to Wellington Road)
Waterford Road (Considine St to Woogaroo St) -2L divided
Woogaroo St (Waterford Rd to Johnson Rd)-4L
Jesmond Road Extension (Gunning Road to Fig Tree Pocket Rd)-2L
Fig Tree Pocket Road (Kenmore Road to Gunnin Street)-4L divided
Murphy Rd/Handford Rd (Ellison Rd to Zilmere Rd) - 4L
Tilley Road Extension - Lytton Rd to Wondall Rd and Manly Rd to Old Cleveland Rd=> 2 lane sub-arterial.
Kingsford Smith Drive - Seymour Rd to Theodore St (to Links Ave) => 6 Lanes Divided
Stapylton Rd Stage 1 (Wadeville St to Logan Mwy) - 4L divided
Paradise Rd stage 1 (Adjacent Kulcha St to Radius Drive) - 4L collector
Manly Rd (Whites Rd to Preston Rd) - 4L
Rickertt Road - Green Camp Rd to Thorneside Rd => 4 lane arterial, 80 kph speed limit.
Pine Rd (form Garden Rd to Archerfield Rd - 4L
Ford Rd Extension (Gardner Rd to Rochedale Rd) - 2L collector
Gardner Road (Prebble St to Ford Rd Extension) - 2L undivided
Gardner Rd extension (Miles Platting Rd to Priesdale Rd) - 2L collector
Greenwoood Street-Prebble Street - Mt Gravatt-Capalaba Rd to Gardner Rd. 2 lane collectors
Wacol Station Rd (Wolston Ck Bridge to Sumners Rd) - sub-arterial 4L divided (1600cap)
Sumners Road - Spine St to Tomkins Rd => 4 lanes divided throughout.
Beenleigh Road (Boundary Road to Warrigal Rd Extension) - 6L
Kianawah (Wondall Rd to Wynnum Rd, bridge over Hemmants Drain at the end of Millennium place) - access St 2L

Description
Wondall Road - Manly Rd to Randall Rd => 4 lane divided sub-arterial
Bognor St (Wynnum Rd to Wondall Rd) - 2L divided collector
Kianawah Rd (Wondall Rd to Wynnum Rd) - New rd sub arterial 2L
Green Camp Road (Rickertt Rd to New Cleveland Road) - Upgrade to 4L divided.
Tilley rd upgrade (new Cleveland Rd to Green Camp rd) - 4L divided
Arenga St upgrade (Basella St to Manly Rd) - Collector 2lane divided
Basella St Upgrade (Caladium St to Dianthus St) - Collector 2L divided
Caladium St (Basella St to New Cleveland Rd) - Collector 2L divided
Boundary Road - Bukulla St to Kelliher Rd. New 2 lane through Wacol Army Barracks. Including Bridge
Wacol Station Rd Stage 1 (Interim upgrade) (Wolston Rd to Wolston Ck) - sub-arterial 4L divided (1600cap)
Wacol Station Road - Ipswich Mwy to Sumners Rd => 4 lane divided sub-arterial
Tile St (Boundary Rd to Clendon St) - collector 4L divided
Clendon St (Tile St to Considine St) - collector 4L divided
Boundary Rd (Tile St to Progress Rd) - 4 lane divided sub-arterial throughout.
Rogers St (Montague Rd to Riverside Dr) - new access st 2L
Filmer St (Beesley St to Filmer St end) - collector rd 2L divided
Beesley St (Montague Rd to Riverside Dr) -collector 2L divided
Pidgeon Close (Beesley St to Pigeon Close end) - collector 2L divided
Duncan Street (Duncan Street Extension 1 to Duncan Street Extension 2) - collector 2L divided
Buchanan Street (Jane Street to Donkin Street) - collector 2L divided
Ferry Road (Montague Road to Riverside Drive) - collector 2L divided
Musgrave Street (Montague Road to Buchanan Street) - collector 2L divided
Tondara Lane (Kurilpa Street to Rogers Street Extension) - collector 2L divided
Victoria St (Montague Rd to Duncan St Extension 1) - Collector 2L divided
Jane St (Montague Rd to Riverside Dr) - Collector2L divided
Anthony Street (Montague Road to Buchanan Street) - collector 2L divided
Donkin Street (Montague Road to Buchanan Street) - collector 2L divided
Kurilpa Street (Montague Road to Riverside Drive) - collector 2L divided
Filmer Street Extension (Filmer Street end to Victoria Street) - collector 2L divided
Duncan Street Extension 1 (Victoria Street to Duncan Street (north end) - collector 2L divided) - collector 2L divided
Duncan Street Extension 2 (Duncan Street (south end) - collector 2L divided to Ferry Road) - collector 2L divided
Tondara Lane Extension 1 (Victoria Street to Kurilpa Street) - collector 2L divided
Tondara Lane Extension 2 (Rogers Street Extension to Ferry Road) - collector 2L divided
Pandorea St (School Rd to Manettia St) - 2 lane divided (700cap)
Pandorea St (Manettia Rd to Wynnum Rd) - 2 lane divided (700cap)
Craword Rd (Kianawah Rd to School Rd) - 4L undivided
School Rd (New Lindum Rd to Ropley Rd) - 2L divided
Extension 2L from Bradman St/Learoyd Rd/McCotter St to Delathin Rd
Ermelo Road-Dairy Swamp Road - New Cleveland Rd to Belmont Rd => 4 lane divided sub-arterial
Linkfield Road 2L (from Gympie arterial Rd to Lacey Rd) -4L divided
Telegraph Rd 4L - From Quinlan st to Mustang St
Creek Rd 6L (Lytton Rd to Cavendish Rd)
Meadowlands Road - Belmont Rd to Preston Rd => 4 lanes throughout. Including bride widening
Stanley St - Cavendish Rd Stage 3 (Caswell St to Cavendish Rd)-6L
Inala Avenue - King Avenue - Learoyd Road Stage 2 (Blunder Rd to King Av) - 4L divided
Stanley St - Cavendish Rd Stage 2 (Wellington St to Caswell St) - 6L
New bridge. Telegraph Rd - Depot rd Corridor Stage4 (Lemke Rd Bridge at cabbage Tree Ck) - 4L divided

Description
Telegraph Rd (Norris Rd to Mustang St) - 4L
New Cleveland Road - Green Camp Rd to Old Cleveland Rd=> 4 lane divided sub-arterial.
New Cleveland Road - Manly Rd to Green Camp Rd => 4 lane divided sub-arterial.
Shafston Ave - Lytton Rd - Wynnum Rd stage : Balmoral St (from Hawthorne Rd to Riding Rd) - 6L
Wadeville Street - Stapylton Rd to Forest Lake Bvd => 4 lanes divided
South-western side of Finney Road/Woodville Street (Moggill Road to Woodville Street) - Collector 2L divided
Logan Rd (Cornwall St to Kessels Rd) - 6L
Toombul Road - Nudgee Rd to Melton Rd => 6 lane divided arterial.
Shafston Ave - Lytton Rd - Wynnum Rd stage 2 : Balmoral St (Overend St to Riding Rd) - 6L
Shafston Ave - Lytton Rd - Wynnum Rd stage4: Laidlaw Parade to Overend St - 6L
Boundary Road (Kelliher Road to Blunder Road) - 4L divided
Kinsford Smith Dve (Sugarmill Rd to Eagle Farm Rd) - 6Lanes divided
Progress Rd Stage 5 (Ipswich Mwy to Archerfield Rd) - 6L (2700cap)
Miles Platting Rd (School Rd to Gardner Rd) - 4L
Miles Platting Rd (Gardner Rd to Rochedale Rd) - 4L
School Road (Miles Platting Rd to Underwwod Rd)- 4L
School Road Extension (Miles Platting Road to Rochedale Road) - 2L undivided
Gardner Road (Ford Road Extension to Miles Platting Road) - 4L
Gardner Rd (southern boundary of landfill site to Prebble St) - 4L
Gardner Rd (Mount Gravatt Capalaba Rd to Southern Boundary of Landfill) - 4L
Grieve Rd (Mount Gravatt Capalaba Rd to Rochedale Rd) - 4L
Priestdale Rd (School Rd to Rochedale Rd) - 4L
Murphy Rd - Handford Rd - Lemke Rd Stage 2 (Taigum Place to Cabbage Tree Creek Bridge) - 4L
Wynnum Rd/Manly Rd Interim Upgrade (Wynnum Rd to New Cleveland Rd) - 6L
Newnham Road (Creek Road to Logan Road) - Upgrade to 4L divided
Tilley Road Extension (New Cleveland Road to Kianawah Road) - New 2 lane road
Green Camp Road Stage 1 (Manly Rd to Rickertt Rd) - 4L
Inala Av - King Av - Learoyd Rd stage 4 (Sherbrooke Rd to Watson Rd) - 4Lane divided. Including Bridge (Oxley Ck)
Inala Avenue-King Avenue-Learoyd Road - Inala Av to Sherbrooke Rd => 4 lane divided.
Lutwyche Road (Enoggera Ck to Gympie Rd) - 6L most of it (3300capacity)
Rode Road (Gympie Road to Bilsen Road) - 4L divided
Lindum Rd Open Level Crossing (Crawford Rd to Inghams Pl). Includes Lindum Rd Duplication and Rail Grade sep.
Kinawah Rd Extension Stage 3 (Crawford Rd to Wynnum Rd) - 2L divided
Beams Road - Handford rd to Sandgate Rd => 4 lane divided arterial.
Newbeith Road - Pub Lane to Goodna Rd (Springfield-Greenbank Arterial) => 2 lane sub-arterial.
Pub Lane - Equestrian Dr to Newbeith Rd => 4 lane collector.
FlagstoneWest NS Collector - Boyd Rd to Mountain Ridge Rd => 2 lane sub-arterial/collector.
Granger Road-Sungold Road - Chambers Flat Rd to Mt Lindesay Hwy=> 4 lane sub-arterial.
Chambers Flat Road - Kenny Rd to Mt Lindesay Hwy => 2 lane sub-arterial.
Other Logan projects for 2031
Beatty Road-Sherbrooke Road - Granard Rd to King Av = 4 lane divided sub-arterial.
Hoyland Street - Kluver St to Bracken Ridge Rd => 4 lane arterial
Mt Gravatt-Capalaba Road - Mt Cotton Rd to Old Cleveland Rd => 4 lane divided arterial.
Beams Rd Stage1 (from Gympie Rd to Balcara av) - 4L divided
Cavendish Rd (From Old Cleveland Rd to Creek Rd)-4L all way long
Nottingham Road - Algester Rd to Beaudesert Rd => 4 lane divided sub-arterial.
depot Road (Quinlan St to Braun St) - 4L divided
Shafston Av - Lytton Road - Wynnum Rd stage6 (Scanlan St to Laidlaw St) - 3L inbound

Description
Underwood Road - Warrigal Rd to Millers Rd => 4 lane divided sub-arterial.
Fairfield Road (Sheerwood Road to annerley Road)-3L all the way long. Include upgrade on Home St till Annerley Rd
Beams Road Stage 2 (Carselgrove Av to Handford Rd) 4L divided
Kingsford Smith Dr (Stage 3: Race Course Road to Cooksley Street) - 6L
Johnson Road - Southlink St to WoogarooRd => 4 lane divided arterial/sub-arterial
Settlement Road - Samford Rd to Waterworls Rd => 4 lane divided sub-arterial
Beenleigh Road - Warrigal Rd to Stiller Dr => 4 Lane Divided.
Freeman Road - Garden Rd to Blunder Rd => 4 lane Divided collector.
Archerfield Road - Ipswich Rd to Poinsettia St => 4 lane divided sub-arterial.
Seventeen Mile Rocks Road - Goggs Rd to Kingsgate St => 4 lane divided sub-arterial.
Hellawell Road - Beaudesert Rd to Gowan Rd =. 4 lane divided sub-arterial.
Belmont Road - Manly Rd to Meadowlands Rd => 4 lane divided collector.
Dianthus St upgrade (Basella St to New Cleveland Rd) - Collector 2L divided
Murphy Rd- Handford Rd -Lemke Rd Stage4 (Coxen st to Zillmere Rd) - 4L divided
Updated Ipswich Rd 3L all way long from O'Keefe St to Keats St
Beams Road - Bridgeman Rd to Gympie Rd => 4 lane divided arterial.
Stanley St - Cavendish Rd Stage 4 (Stanley St to Old Cleveland Rd)-6L
Stapylton Road - Logan Mwy to Johnson Rd => 4 lanes divided
Coonan St (Moggill Road to Westminster St) - Upgrade to 4L divided
Paradise Road (Johnson Rd to Radius Dve)
Oxley Road (Walter Taylor Bridge to Sherwood Rd) - 4 L divided arterial
Paradise Rd (south of Beaudesert Rd intersection to area adjacent to Kulcha St)
Prebble St Extension (Gardner Rd to Rochedale Rd)-2L
Rochedale Rd - Grieve Rd (Underwood Rd to Priestdale Rd)-4L undivided
Rochedale Rd - Grieve Rd (Priesdale Rd to School Rd extension)-4L divided
Rochedale Rd - Grieve Rd (Prebble St to School Rd extension)-4L undivided
Rochedale Rd - Grieve Rd (Grieve Rd to Prebble st extension)-4L undivided
Gardner Rd Extension (Priestdale Rd to School Rd)
Grieve Road (Extent of very low density (24m reserve) to Ford Road) - 4L undivided
Grieve Road (Rochdale Road to Extent of very low density (24m reserve))-4L undivided
Ford Road extension (Rochedale Road to Grieve Road)
Underwood Rd (School Rd to Rochedale Rd)
New Road (Ford Road Extension) (Miles Platting Road to School Road Extension)- 2L divided
RCM CLEM7 - AL Connections (City Ramps)
Northern Busway: RBH to Kedron to Bracken Ridge - INB to Federation St
Airport Link Reference Design Sandgate Road interchange
Airport Link Ancillary Works - Northern Busway Staging : Interim - RCM NSBT
Airport Link Tunnels
Kingsford Smith Drive - Theodore St to French St => 6 lanes Divided
Beckett Rd - Rode Rd to Albany Creek Rd => 4 lane divided; signals except roundabout at Rode Rd.
Bridgeman Road - Albany Creek Rd to Millar Rd => 4 lane Divided, Speed Limit 70 kph.
Kerners Road Deviation - Warwick Rd to Kerners Rd. (Include reclassification of Kerners Rd-Deebing Creek Rd - Ash St to Pisale Dr as collector)
Third Avenue Extension - Bardon Rd - Wembley Rd. New 4 lane Road - Part 1

Source: VLC, 2014

Table A4 **Assumed network expansions Canberra-Goulburn-Yass**

Description
New roadways providing access to residential developments in Eastlake
Construction of third lane from Glenloch Interchange to Edinburgh Avenue (both directions)
Duplication between Canberra Ave and Newcastle St
Duplication of road between Dunrossil Drive and Lady Denman Drive.
Connect Sandford (Morisset) Street from Flemington Road to the Antill Street Roundabout on the Federal Highway
Addition of one lane in each direction for Ashley Drive (between Sternberg Crescent & Isabella Drive)
11.5 km of dual carriageway linking Monaro Highway and the Federal Hwy
Extension of sections east and west of Moncrieff, complete missing section of Horse Park Drive
Connect Edwin Land Parkway to Yass Rd in Queanbeyan
New roadways providing access to residential developments
Shown in StreetPro 2013 and Google Maps
Shown in StreetPro 2013 and Google Maps
Roads for 2014 PT Stops
New roads as shown in Roads ACT 2031 layer
New roadways providing access to residential developments
New roadways providing access to residential developments
New roadways providing access to residential developments
New roadways providing access to residential developments
New roadways providing access to residential developments
Extension of Ruden Cutler Drive to Horse Park Drive
Internal roads for Coombs Estate
New roadways providing access to residential developments
Upgrading all Cotter Road to four-lanes
New roads based on Master Plan
Internal road for growth area and current zoning
Majura Pwy
Constitution Avenue
Horse Park Dr extension
Civic to Gungahlin Corridor Improvements
Molonglo Infrastructure Investment
Link Rd construction btn Majura Pwy and Majura Rd
Ashley Dr – Stage 1 - Duplication Erindale Dr btn Ashley Dr and Sternberg Cr

Source: VLC, 2014

Table A5 **Assumed network expansions Perth-Wheatbelt**

Description
Great Eastern Highway Upgrade - Kooyong Road to Tonkin Highway Widened from 2 to 3 lanes per direction, with central median for the full length of the upgrade
Spearwood Avenue Upgrade Upgrades to Spearwood Avenue from Barrington Street to Sundlow Road
Great Eastern Highway Upgrade - Great Eastern Highway to Roe Highway Interchange Upgrades to interchange at Great Eastern Highway and Roe Highway
Reid Highway/Mirrabooka Avenue Overpass Grade separation of two intersections between the existing traffic signals on Mirabooka Avenue, allowing higher vehicle capacity assumptions
Kwinana Freeway Widening between Leach and Roe Highways Widening and upgrades to a 4.5 kilometre section of the Kwinana Freeway, allowing higher vehicle capacity assumptions
Murdoch Activity Centre Roads Construction of several local roads in Murdoch as per Murdoch Activity Centre Structure Plan Murdoch Area Roads (University-Hospital-Industrial Area)
Albany Highway Upgrade - John Street to Leach Highway Widening to allow right turns at major intersections
GatewayWA - Roe Highway and Tonkin Highway interchange upgrade Grade separation of intersection at Roe Highway and Tonkin Highway
GatewayWA - Tonkin Highway and Kewdale Road interchange upgrade Grade separation of intersection at Tonkin Highway and Kewdale Road
GatewayWA - Leach Highway and Tonkin Highway interchange upgrade Grade separation of intersection at Tonkin Highway and Leach Highway
GatewayWA - Connection from Tonkin Highway to Perth Airport Construction of a connection from Tonkin Highway to Dunreath Drive, providing Highway access to Perth Airport
Roe Highway Extension Extension from Kartel Avenue to Bibra Drive
Roe Highway Extension Extension from Bibra Drive to North Lake Road
Roe Highway Extension Extension from North Lake Road to Stock Road
Tonkin Hwy on ramp from Abernethy Rd Construction of a new on ramp to the Tonkin Highway at Abernethy Road
Graham Farmer Freeway Tunnel Upgrade Additional lanes in the Graham Farmer Freeway tunnel between Fitzgerald Street and Lord Street
Mitchell Freeway Widening (Northbound) Hepburn Ave to Hodges Dr widened from 2 to 3 lanes (Northbound Direction Only)
Connolly Drive upgrade as part of Mitchell Freeway Widening Widened from Shenton Avenue to Neerabup Road from 1 to 2 lanes
Mitchell Freeway Widening (Southbound) Hepburn Ave to Hodges Dr widened from 2 to 3 lanes (Southbound Direction Only)
Great Eastern Highway localised improvements Localised improvements from Stoneville Road to Mann Street
Reid Highway Principal Shared Path Construction of a pedestrian/cyclist shared pathway from Mirrabooka Avenue to Camboon Road
Mitchell Freeway Widening (Northbound) Additional lane on Mitchell Freeway northbound from Graham Farmer Freeway to Hutton Street
Guildford Road Principal Shared Path Construction of a pedestrian/cyclist shared pathway from Tonkin Highway to Bassendean Station
Kwinana Freeway Northbound exit ramp realignment Realignment of northbound exit ramp to South Road
Various local roads Construction of various local roads to accommodate additional PT network in 2013
Perth Stadium to Swan River Pedestrian Bridge Construction of a pedestrian bridge connecting the Perth CBD with the new Perth Stadium
Hepburn Avenue Extension Extension to Marshall Road

Description
NorthLink WA Construction of a new freeway grade road from the Brand Highway to the Reid/Tonkin Highway interchange
East Wanneroo local access roads Construction of local roads propose in the East Wanneroo growth area
Leach Highway (High Street) Fremantle Project Upgrade the section of High Street between Carrington Street and Stirling Highway to a 4 lane dual carriageway standard; Realignment of the intersection of High Street and Stirling Highway, creating a continuous route at the eastern leg of the new Leach Highway and Stirling Highway; Upgraded pedestrian and cyclist access from Marmion Street to Carrington Street along the route and including at the major intersections.
Mitchell Freeway Extension - Burns Beach Road to Hester Avenue Extension of the Mitchell Freeway to Hester Avenue; Extension of Neerabup Road to Wanneroo Road; Upgrades to Hester Avenue from Wanneroo Road to Hidden Valley Retreat
Reid Highway Duplication Duplication of Reid Highway from Erindale Road to Duffy Road
Beaufort Street 2-way conversion Beaufort Street converted to 2-way operation from Roe Street to Newcastle Street
William Street 2-way conversion William Street converted to 2-way operation from Roe Street to Newcastle Street
Murray Street 2-way conversion stage 1 Murray Street converted to 2-way operation - Stage 1 from Barrack Street to Pier Street
Murray Street 2-way conversion stage 2 Murray Street converted to 2-way operation - Stage 2 from William Street to Elder Street
Murray Street 2-way conversion stage 3 Murray Street converted to 2-way operation - Stage 3 from Elder Street to Thomas Street
Mounts Bay Road 2-way conversion Mounts Bay Road converted to 2-way operation from Mill Street to William Street
Barrack St 2-way conversion Barrack St converted to 2-way operation from St Georges Terrace to Wellington Street
Roe Highway Extension Widening of the Kwinana Freeway in the southbound from Roe Highway to Armadale Road, part of the Roe Highway extension package
Reid Highway - Lord Street Intersection Upgrade
Greenslands Road Realignment Greenslands Road realigned to connect with new South Western Highway roundabout
GatewayWA - Roe Highway and Berkshire Road interchange upgrade Interchange at Berkshire and Roe Highway converted to a diamond interchange
Riverside Dr Closure Permanent closure of Riverside Dr between Barrack St and William St

Source: VLC, 2014

Table A6 **Assumed network expansions Adelaide-Yorketown**

Description
McLaren Vale Overpass Grade separation of the Victor Harbor Road/Main Road junction
South Road Superway Elevated road over existing arterial, with upgrades to southern section of south road (not-elevated)
Southern Expressway Duplication Construction of additional lanes to the west of the existing road, with two lanes from Old Narolunga to Reynella and four lanes from Reynella to Bedford Park in the northbound direction and three lanes from Bedford Park to Reynella and two lanes from Reynella to Old Noarlunga in the southbound direction
Marino Rocks Greenway A new shared pedestrian and bicycle path that generally follows the Seaford railway line from West Terrace in the CBD to Marino Rocks railway station
Grange Greenway A new shared pedestrian and bicycle path connecting Seaton Park railway station with Outer Harbor Greenway at Woodville in a 3 kilometre route
New Railway Station at Wayville
Gawler East local link road Local link road between Potts Road and land owned by Lend Lease bordering Calton Road, Gawler East
Minor New Infrastructure Construction of various local roads to accommodate additional PT network in 2013
South Road Upgrade: Torrens to Torrens Reduction in capacity of existing South Road surface road, construction of a new underpass enabling continuous traffic flow
Darlington Transport Study Rail duplication and extension and associated road infrastructure
Main North Road / Tiver Road / Gordon Road Intersection Upgrade Lower Speed limit of 80kph on Main North Road through intersection
South Road Upgrade: Regency Road to Torrens Road Grade separation of South Road from Regency Road to Torrens Road
Victor Harbor Road Duplication Stage 1 From Old Noarlunga to McLaren Vale
Victor Harbor Road Duplication Stage 2 MacLaren Vale to Mount Compass
Adelaide Airport Western Link Road Construction of a new road connecting Any Thomas Circuit with James Schofield Drive, upgrades to James Schofield Drive to two lanes per direction
Adelaide Airport Access Improvements Targeted intersection upgrades to Sir Donald Bradman Drive, and access to Adelaide Airport for taxis, commercial vehicles and buses along Richmond Road
Duplication of Main South Road (Seaford to Aldinga) Upgraded from one to two lanes in both directions
Duplication of Beach Road (Noarlunga) Upgraded from one to two lanes in both directions
Duplication of Dyson Road (Noarlunga) Assuming South of Beach Rd to Murray Rd
Duplication of Richmond Road (Keswick) Upgraded from one to two lanes in both directions
Duplication of West Lakes Boulevard Upgraded from one to two lanes from Port Rd to Clark Terrace in both directions
Duplication of Churchill Road Upgraded from one to two lanes in both directions from Torrens Road to Redin Street
Duplication of Montague Road (Modbury) Upgraded from one to two lanes in both directions from Charmaine Ave to North East Rd
Duplication of Elder Smith Road Upgraded from one to two lanes in both directions from Main North Road to Princes Highway, includes extension to Port Wakefield Road
Duplication of Kings Road Upgraded from one to two lanes in both directions from Salisbury Highway to Port Wakefield Road, includes duplication of Bolivar Road

Description
Duplication of Womma Road Upgraded from one to two lanes in both directions from Main North Road to Heaslip Road
Duplication of Curtis Road (Munno Para West) Upgraded from one to two lanes in both directions from Main North Road to Northern Expressway
Duplication of Adelaide Rd/Main North Rd (Evanston Park) From Sturt Highway to Seventh Street
New Interchange on the South Eastern Freeway At Bald Hills Road (Part of Mount Barker growth area infrastructure improvements)
New connector roads in Happy Valley Construction of local roads to accommodate additional PT network in 2014
New connector roads in Parafield Gardens Construction of local roads to accommodate additional PT network in 2014
North East Road and Sudholz Road Redesign
Seaford Rail Extension Two new stations at Seaford Meadows and Seaford
Darlington Transport Study Rail duplication and extension and associated road infrastructure
O-Bahn City Access project (Bus tunnel)

Source: VLC, 2014

Appendix B Economic parameters by region

Table B1 **Parameters used in the economic modelling of urban transport – Sydney-Newcastle-Wollongong**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per hour	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$1.77 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Rail	$3.19 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Light rail	$2.86 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' (based on rail fare for short trip)
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	$27.23 per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' LEK (2008) – Cost Review of CityRail's Regular Passenger Services
Bus input costs	Bus	$424m per year	iPart (2011) – CityRail and Metropolitan and Outer Metropolitan Bus Services: Prices and ServicesReport 2011 State Transit Authority (2011) – Annual report 2010/11
Ferry input costs	Ferry	$37.83 per vessel hour	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Sydney Ferries (2011) – Annual report 2010/11
Light rail input costs	Light rail	$864,015 per year (track and train) $12.71per train hour $7.05 per train km	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Email communication with RMS Transdev website (http://www.transdevsydney.com.au/)

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013) (IPART, 2011), (Sydney Ferries, 2011) (Transdev)

Table B2 **Parameters used in the economic modelling of urban transport – Melbourne-Geelong**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$2.04 per trip	Victorian fares & ticketing manual (P51, fare section)
Average fare	Ferry	$2.04 per trip	Victorian fares & ticketing manual (P51, fare section)
Average fare	Rail	$2.04 per trip	Victorian fares & ticketing manual (P51, fare section)
Average fare	Light rail	2.04 per trip	Victorian fares & ticketing manual (P51, fare section)
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	$26.64 per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' LEK (2008) – Cost Review of CityRail's Regular Passenger Services GHD (2009) - Report for QR Network Access Undertaking Assessment of Operating and Maintenance Costs for UT3
Bus input costs	Bus	$1.41 per vkt	BusVic (2011) The impact of change from local, and Metropolitan Route Bus Services: Public or Private Provision to non-local ownership RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives', and Wikipedia – Transdev Melbourne (http://en.wikipedia.org/wiki/Transdev_Melbourne)
Ferry input costs	Ferry	-	-
Light rail input costs	Light rail	$33,176,069 per year $11.65 $6.46	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Yarra Trams – Facts & Figures (http://www.yarratrams.com.au/about-us/who-we-are/facts-figures/) Melbourne Transport Strategy - Effective and Integrated Transport System (Trams (www.melbourne.vic.gov.au/.../Transport_Strategy_2012_07_Tram.pdf)

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013), (GHD, 2009), (Public Transport Victoria), (LEK, 2008), (Wikipedia – Transdev Melbourne), (Yarra Trams), (City of Melbourne, 2012), (BusVic, 2011)

Table B3 **Parameters used in the economic modelling of urban transport – Brisbane-South-East-Queensland**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$2.04 per trip	Translink – fare (http://translink.com.au/tickets-and-fares)
Average fare	Ferry	$2.04 per trip	Translink – fare (http://translink.com.au/tickets-and-fares)
Average fare	Rail	$2.04 per trip	Translink – fare (http://translink.com.au/tickets-and-fares)
Average fare	Light rail	2.04 per trip	Translink – fare (http://translink.com.au/tickets-and-fares)
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	$28.86 per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' LEK (2008) – Cost Review of CityRail's Regular Passenger Services GHD (2009) - Report for QR Network Access Undertaking Assessment of Operating and Maintenance Costs for UT3
Bus input costs	Bus	$0.98 per vkt	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Brisbane Transport - Buses (http://www.btbuses.info/?GoTo=AboutBT)
Ferry input costs	Ferry	$9 million per year	VLC Modelling of fares
Light rail input costs	Light rail	$781,281 per year (only made available since 2014 in Gold Coast) (track and train) $6.82	All abroad – GC light rail takes off (http://www.brisbanetimes.com.au/queensland/all-aboard--gc-light-rail-takes-off-20140720-zv1tz.html) RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013), (GHD, 2009), (LEK, 2008), (Translink), (Brisbane Transport), (Brisbane Times)

Table B4 **Parameters used in the economic modelling of urban transport – Perth-Wheatbelt**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$3.43 per trip	Transperth – Tickets and Fares (http://www.transperth.wa.gov.au/Tickets-Fares/Fares#stdfare)
Average fare	Ferry	$1.35 per trip	Transperth – Tickets and Fares (http://www.transperth.wa.gov.au/Tickets-Fares/Fares#stdfare)
Average fare	Rail	$3.43 per trip	Transperth – Tickets and Fares (http://www.transperth.wa.gov.au/Tickets-Fares/Fares#stdfare)
Average fare	Light rail	-	-
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	$10.05 per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives', and carriage per train info from VLC LEK (2008) – Cost Review of CityRail's Regular Passenger Services GHD (2009) - Report for QR Network Access Undertaking Assessment of Operating and Maintenance Costs for UT3
Bus input costs	Bus	$1.41 per vkt	BusVic (2011) The impact of change from local, and Metropolitan Route Bus Services: Public or Private Provision to non-local ownership Bus Contracts (www.busvic.asn.au/images/.../public/Public_or_Private_June_2011.pdf) Swan Transit -depot locations (http://www.transitsystems.com.au/swandepot)
Ferry input costs	Ferry	$0.4 million in 2011	Transperth 2012-13 annual report
Light rail input costs	Light rail	-	-

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013), (BusVic, 2011), (LEK, 2008), (GHD, 2009), (Transperth), (Swan Transit), (Transperth, 2013)

Table B5 **Parameters used in the economic modelling of urban transport – Adelaide-Yorketown**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$2.31 per trip	Adelaide Metro (http://www.adelaidemetro.com.au/Tickets/Fares#Regular_Fare)
Average fare	Ferry	-	-
Average fare	Rail	$2.31 per trip	Adelaide Metro (http://www.adelaidemetro.com.au/Tickets/Fares#Regular_Fare)
Average fare	Light rail	2.31 per trip	Adelaide Metro (http://www.adelaidemetro.com.au/Tickets/Fares#Regular_Fare)
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	$7.94 per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives', and carriage per train info from VLC LEK (2008) – Cost Review of CityRail's Regular Passenger Services GHD (2009) - Report for QR Network Access Undertaking Assessment of Operating and Maintenance Costs for UT3
Bus input costs	Bus	$0.98 per vkt	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Brisbane Transport Buses (http://www.btbuses.info/?GoTo=AboutBT)
Ferry input costs	Ferry	-	-
Light rail input costs	Light rail	783,238 per year $12.31 $6.82	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Wikipedia – Adelaide Metro (http://en.wikipedia.org/wiki/Adelaide_Metro#Light_rail)

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013), (LEK, 2008), (GHD, 2009), (Brisbane Transport), (Adelaide Metro), (Wikipedia – Adelaide Metro)

Table B6 **Parameters used in the economic modelling of urban transport – Canberra-Goulburn-Yass**

Parameter	Applying to	Value	Source(s)
VOTT (Value of travel time)	Cars	$26.81 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation' VLC Transport Model
VOTT (Value of travel time)	Light Commercial Vehicles	$31.01 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Heavy Commercial Vehicles	$52.54 per hour per vehicle	Austroads (2012) – 'Guide to project evaluation'
VOTT (Value of travel time)	Public Transport	$13.17 per trip	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Average fare	Bus	$2.06 per trip	ACT Government – fare (http://www.action.act.gov.au/fares)
Average fare	Ferry	-	-
Average fare	Rail	-	-
Average fare	Light rail	-	-
Road maintenance	Car	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Light Commercial Vehicle	1.69 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Road maintenance	Heavy Commercial Vehicle	6.65 cents per vehicle kilometre travelled (VKT)	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives'
Rail input costs	Rail	-	-
Bus input costs	Bus	$0.98 per vkt $12,770,000 for all bus depots	RMS (2013) – 'Principles and Guidelines for Economic Appraisal of Transport Investments and Initiatives' Wikipedia – ACTION (http://en.wikipedia.org/wiki/ACTION)
Ferry input costs	Ferry	-	-
Light rail input costs	Light rail	-	-

Source: ACIL Allen Consulting, 2014 (Austroads, 2012), (RMS, 2013), (ACT Government), (Wikipedia – ACTION)

Appendix C Heat maps for DEC increases from 2010-11 to 2030-31

Table C1 **Roads – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Sydney GCCSA**

SA3 Origin / Destination	Sydney Inner City	Eastern Suburbs - North	Marrickville - Sydenham - Petersham	Leichhardt	Strathfield - Burwood - Ashfield	Botany	Eastern Suburbs - South	Kogarah - Rockdale	Canterbury	Hurstville	Cronulla - Miranda - Caringbah	Sutherland - Menai - Heathcote	Liverpool	Campbelltown (NSW)	Bankstown	Merrylands - Guildford	Auburn	Fairfield	Bringelly - Green Valley	Penrith	Camden	Blue Mountains - South	Wollondilly	Canada Bay	Pennant Hills - Epping	Carlingford	Ryde - Hunters Hill	Parramatta	Blacktown	Richmond - Windsor	St Marys	Hawkesbury	Blue Mountains	Rouse Hill - McGraths Hill	Mount Druitt	Blacktown - North	North Sydney - Mosman	Chatswood - Lane Cove	Ku-ring-gai	Hornsby	Dural - Wisemans Ferry	Baulkham Hills	Manly	Warringah	Wyong	Pittwater	Gosford
Sydney Inner City		58.9	35.1	41.7	48.8	103.9	63.5	38.0	22.3	15.6	19.1	13.8	11.5	9.5	17.6	10.3	13.0	6.8	5.9	9.0	5.2	1.8	9.4	25.2	4.7	8.3	26.4	11.0	5.1	1.4	2.2	1.5	2.1	1.6	9.8	7.1	46.3	47.5	14.6	4.2	4.4	10.7	11.4	30.5	3.4	8.5	3.7
Eastern Suburbs - North	58.1		5.6	6.6	8.5	24.1	38.7	10.0	4.5	4.5	5.5	3.9	2.6	2.1	3.6	1.9	2.5	1.4	1.4	2.0	1.5	0.2	1.3	4.6	0.9	1.8	5.5	2.3	1.1	0.1	0.6	0.3	0.6	0.4	1.6	1.1	11.8	12.4	4.8	0.6	1.0	2.5	3.1	8.1	0.3	2.6	0.2
Marrickville - Sydenham - Petersham	32.2	5.5		7.6	13.5	14.7	7.4	13.3	8.4	5.0	4.5	3.3	2.8	2.1	4.3	1.7	2.4	1.2	1.3	1.0	1.3	0.3	1.1	4.6	0.5	1.1	3.8	1.7	0.8	0.2	0.3	0.2	0.2	0.2	0.9	0.6	4.0	4.4	1.7	0.5	0.5	1.4	1.0	2.9	0.2	1.0	0.3
Leichhardt	35.0	5.7	6.7		14.3	9.3	4.8	5.6	5.7	3.1	2.6	2.5	2.3	1.8	4.4	2.2	3.0	1.2	1.0	1.4	1.2	0.3	1.0	9.8	1.2	2.1	8.9	2.6	1.3	0.2	0.6	0.3	0.4	0.3	1.4	1.1	7.0	8.5	3.5	1.1	0.9	2.6	1.7	4.5	0.5	1.5	0.4
Strathfield - Burwood - Ashfield	47.3	8.4	15.6	16.1		22.1	9.2	20.1	30.9	14.3	8.6	9.1	10.5	6.6	27.4	11.3	23.2	6.8	4.3	4.2	3.9	1.0	3.5	29.9	3.8	6.9	20.2	11.7	4.3	0.7	1.8	0.8	1.3	0.9	4.6	2.6	8.0	13.1	8.4	3.1	2.4	7.9	2.2	7.5	0.8	3.0	0.8
Botany	101.5	24.4	15.3	14.3	22.5		34.0	29.1	13.7	13.7	18.6	15.9	15.4	16.1	16.1	15.3	13.2	14.8	9.5	11.8	9.5	0.8	6.8	11.0	3.7	8.7	17.3	20.0	12.5	3.2	4.6	2.6	5.2	2.8	15.8	6.4	17.6	20.3	11.0	5.5	3.5	14.3	6.1	19.6	8.9	8.3	7.5
Eastern Suburbs - South	61.8	39.8	7.4	6.1	8.8	33.8		15.8	5.9	6.4	7.8	5.7	3.5	2.7	4.5	1.9	2.3	1.7	1.7	1.9	1.8	0.2	1.5	3.5	0.8	1.3	4.5	2.0	0.9	0.2	0.5	0.3	0.3	0.2	1.1	0.9	8.8	9.1	3.4	0.6	0.9	2.1	2.4	6.0	0.4	1.8	0.2
Kogarah - Rockdale	35.7	9.8	13.1	7.0	19.6	29.3	15.8		24.2	29.0	27.3	18.5	7.9	5.8	13.6	4.3	5.0	3.8	3.7	1.9	3.3	0.3	2.8	5.9	0.7	1.9	3.9	3.6	1.4	0.4	0.5	0.4	0.5	0.4	1.5	0.9	4.4	5.0	2.1	0.4	0.6	1.6	1.4	3.8	0.3	1.2	0.4
Canterbury	20.7	4.4	9.2	6.4	31.4	13.4	6.3	24.3		22.4	9.00	9.6	9.8	6.1	27.6	6.6	8.8	5.6	4.1	2.2	3.3	0.4	2.3	8.5	1.3	2.6	6.4	4.8	2.1	0.4	0.8	0.3	0.5	0.5	1.9	1.1	3.2	4.5	2.8	1.1	0.8	3.2	0.9	2.7	0.5	1.2	0.3
Hurstville	14.4	4.3	5.3	3.7	14.2	13.9	6.8	29.9	22.7		17.3	16.3	9.5	5.7	24.1	5.5	6.5	4.3	3.8	1.8	2.8	0.3	1.8	4.4	0.7	1.9	3.7	4.2	1.5	0.2	0.5	0.3	0.3	0.3	1.3	0.6	2.1	2.6	1.6	0.6	0.5	2.0	0.6	2.0	0.2	0.6	0.4
Cronulla - Miranda - Caringbah	17.8	5.3	4.8	3.7	8.5	19.5	8.1	28.5	9.6	17.8		26.7	5.9	4.4	10.6	3.9	4.3	3.0	2.7	1.7	2.3	0.2	2.0	2.7	0.5	1.5	2.1	2.9	1.0	0.3	0.5	0.2	0.4	0.3	1.5	0.5	2.6	3.3	1.2	0.2	0.3	0.9	0.8	2.3	0.4	0.8	0.3
Sutherland - Menai - Heathcote	12.8	3.6	3.5	3.0	8.9	16.4	5.9	19.2	10.0	17.2	27.2		10.2	5.8	22.0	5.6	5.7	5.1	3.8	1.7	2.3	0.2	1.6	3.0	0.5	1.9	2.4	4.1	1.3	0.1	0.5	0.2	0.3	0.3	1.4	0.4	1.9	2.4	1.0	0.4	0.3	1.5	0.5	1.7	0.3	0.5	0.4
Liverpool	9.4	2.3	2.9	2.4	9.0	14.9	3.6	7.4	8.6	8.8	9.7	11.2		46.9	35.3	27.1	11.7	51.7	54.1	9.1	20.3	0.8	10.1	3.3	1.0	4.2	3.7	13.4	8.1	1.2	3.9	1.2	2.6	1.4	7.9	2.8	1.6	2.2	1.3	1.3	1.2	5.2	0.5	1.6	0.8	0.9	0.8
Campbelltown (NSW)	8.5	2.0	2.2	2.0	5.9	16.2	2.8	5.7	5.7	5.7	6.4	11.2	45.6		15.9	10.3	6.1	17.1	32.5	7.7	79.3	1.4	24.3	2.2	0.4	1.6	1.7	5.0	4.6	1.0	2.5	1.0	2.0	1.2	6.0	2.3	1.5	2.0	0.6	1.0	0.6	3.0	0.4	1.5	0.4	0.4	0.6
Bankstown	16.2	3.6	5.8	5.0	26.9	16.8	5.6	14.4	27.8	24.6	12.3	22.0	39.8	17.3		31.0	27.2	26.8	14.9	6.0	9.0	0.9	6.6	9.1	2.6	7.8	9.9	16.1	6.3	0.9	2.3	1.1	1.9	1.2	5.4	2.6	2.7	5.0	4.6	2.9	2.5	8.1	0.9	4.0	1.2	2.0	1.6
Merrylands - Guildford	9.7	1.9	2.4	2.4	11.8	15.5	2.4	4.4	6.6	5.4	5.6	6.0	27.1	13.7	31.0		31.9	50.4	14.9	12.2	6.0	0.9	5.7	5.9	3.9	16.4	11.1	61.7	24.6	2.1	6.5	2.3	4.3	3.2	17.6	7.3	2.5	4.6	4.3	5.1	3.9	21.5	0.9	3.7	1.6	1.8	1.9
Auburn	12.1	2.4	3.3	3.2	23.9	13.2	2.7	5.2	8.8	6.5	4.8	5.9	11.4	6.3	28.3	32.3		13.4	5.2	5.6	2.8	0.7	2.9	10.8	4.4	16.6	15.3	31.6	8.1	0.8	2.7	1.0	1.7	1.6	6.7	3.4	3.0	5.9	5.9	4.2	3.7	14.2	0.9	4.2	1.2	2.4	1.3
Fairfield	6.5	1.4	1.6	1.4	7.0	14.6	2.0	3.8	5.7	4.3	5.2	6.0	53.4	21.2	27.0	53.0	14.7		47.2	15.8	11.2	1.0	7.1	2.9	1.8	7.7	5.7	26.8	22.8	2.2	7.6	2.3	4.9	2.8	21.3	6.7	1.1	2.3	2.2	2.8	2.3	11.8	0.4	1.9	1.0	1.0	1.2
Bringelly - Green Valley	5.3	1.3	1.4	1.3	4.2	9.1	1.7	3.6	3.7	3.5	4.5	5.1	54.7	32.3	13.7	16.4	7.1	48.4		15.1	31.4	1.2	10.1	1.5	0.7	2.5	2.2	8.4	7.8	1.6	4.8	1.5	3.2	1.4	10.1	3.0	0.9	1.2	0.7	0.9	0.8	4.0	0.3	1.0	0.5	0.3	0.5
Penrith	8.5	1.9	1.1	1.4	4.3	11.1	1.9	1.8	2.1	1.6	1.9	1.9	9.3	8.8	6.0	13.2	6.4	20.0	15.5		9.3	2.5	5.6	2.3	1.1	4.5	4.1	15.7	15.3	13.8	20.3	9.9	20.1	6.0	32.0	8.8	1.5	2.4	1.8	1.7	2.2	7.7	0.6	1.9	1.8	0.9	1.6
Camden	4.8	1.4	1.3	1.3	3.6	9.5	1.8	3.2	3.2	2.8	3.1	4.8	20.3	78.3	9.0	6.2	3.8	11.0	36.3	9.3		2.8	33.5	1.3	0.3	1.0	1.3	3.4	3.1	1.1	1.6	0.9	1.6	0.7	3.9	1.2	0.8	1.1	0.5	0.4	0.4	2.1	0.2	0.7	0.3	0.2	0.4
Blue Mountains - South	0.2	0.1	0.1	0.0	0.2	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.6	1.3	0.4	0.6	0.2	0.9	1.2	2.4	3.0		1.7	0.0	0.0	0.1	0.1	0.5	0.5	0.2	0.3	0.0	3.3	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0
Wollondilly	9.3	1.2	1.1	1.0	3.4	7.1	1.6	2.8	2.3	1.9	2.4	2.4	10.3	24.7	6.7	5.7	3.0	6.8	11.0	5.4	35.1	1.6		1.1	0.3	1.1	1.3	3.3	2.9	0.8	1.0	0.4	0.6	0.9	3.4	1.3	1.3	2.0	0.4	0.6	0.3	2.1	0.3	1.3	0.8	0.3	0.6
Canada Bay	25.0	4.8	5.4	10.5	29.8	11.2	3.8	6.0	8.2	4.3	2.8	3.1	3.5	2.5	8.9	4.6	9.6	2.3	1.5	2.1	1.3	0.4	1.3		2.9	5.3	21.7	6.7	2.2	0.2	0.8	0.3	0.6	0.5	2.1	1.5	5.2	12.4	7.3	2.3	1.6	4.7	1.4	5.1	0.5	2.1	0.7
Pennant Hills - Epping	2.3	0.7	0.5	1.0	3.0	3.6	0.6	0.6	1.1	0.5	0.3	0.4	1.0	0.5	2.2	3.5	3.7	1.6	0.7	1.0	0.3	0.2	0.4	2.6		9.0	10.0	10.3	3.2	0.3	0.5	0.3	0.4	1.0	1.5	1.6	1.4	3.7	6.3	8.8	3.4	15.5	0.3	2.1	0.4	1.2	0.7
Carlingford	7.1	1.8	1.5	2.2	6.5	8.7	1.4	1.8	2.4	1.8	1.6	1.8	4.0	2.2	7.7	13.9	15.5	6.3	2.0	3.8	0.8	0.4	1.3	5.9	9.2		19.0	41.7	9.3	0.8	1.9	0.9	1.3	1.9	4.8	4.1	2.5	6.3	6.2	6.4	4.8	23.4	0.9	3.7	0.8	1.8	1.2
Ryde - Hunters Hill	26.3	6.0	4.8	10.3	21.2	18.5	5.0	4.3	6.5	3.8	2.5	2.5	4.0	2.1	10.9	9.7	15.7	4.1	1.8	3.3	1.3	0.8	1.6	24.5	10.7	19.4		23.4	5.9	0.5	1.3	0.6	0.7	1.4	3.6	3.9	10.3	30.5	28.4	6.9	4.8	15.8	2.6	12.7	1.1	6.2	1.1
Parramatta	10.7	2.4	2.3	2.8	12.7	21.4	2.3	3.9	5.2	4.4	3.7	4.4	14.7	8.6	18.0	64.0	31.6	27.8	8.7	15.3	3.5	0.9	3.8	9.0	11.0	46.2	25.5		47.1	2.6	8.5	3.5	5.9	6.8	23.5	15.2	3.6	7.6	9.3	11.7	9.6	65.2	1.1	5.5	2.1	3.1	2.5
Blacktown	5.1	1.2	1.0	1.4	4.7	13.0	1.1	1.4	2.2	1.6	1.5	1.7	8.4	6.6	6.9	26.1	8.6	23.5	7.7	14.8	3.2	0.6	3.1	3.1	3.4	11.6	9.8	46.9		5.1	9.2	5.4	5.3	8.9	46.8	33.7	1.9	3.9	4.5	7.2	5.4	49.5	0.5	3.0	1.4	1.6	1.6
Richmond - Windsor	1.4	0.1	0.2	0.2	0.7	3.1	0.1	0.4	0.4	0.2	0.3	0.1	1.2	1.2	0.9	2.1	0.9	2.7	1.7	13.4	1.1	0.3	0.8	0.3	0.3	0.9	0.9	3.5	5.0		2.2	20.1	3.4	10.7	6.5	7.0	0.3	0.7	0.6	0.5	2.6	2.8	0.1	0.6	0.3	0.1	0.3
St Marys	2.0	0.5	0.4	0.6	1.9	4.3	0.5	0.4	0.8	0.4	0.7	0.6	4.0	3.1	2.3	6.8	2.9	8.3	4.8	19.4	1.6	0.2	1.0	1.0	0.5	2.2	1.7	8.3	9.3	2.1		1.6	2.5	1.9	27.2	4.0	0.3	0.8	0.5	0.8	0.7	3.7	0.1	0.5	0.1	0.2	0.2
Hawkesbury	1.4	0.4	0.2	0.3	0.8	2.5	0.3	0.4	0.3	0.3	0.2	0.2	1.0	1.1	1.1	2.1	1.0	2.4	1.4	9.2	0.8	0.0	0.4	0.4	0.3	0.9	0.8	3.7	4.7	20.5	1.5		2.9	8.0	5.0	5.8	0.4	1.0	0.6	0.8	1.6	3.8	0.2	0.5	1.0	0.3	1.0
Blue Mountains	1.6	0.5	0.2	0.3	1.1	4.3	0.3	0.4	0.4	0.2	0.3	0.2	2.1	1.7	1.5	3.2	1.4	3.9	2.6	18.5	1.4	3.0	0.5	0.6	0.4	1.0	0.6	4.2	3.3	3.1	2.9	2.8		1.3	4.4	1.6	0.2	0.6	0.3	0.3	0.3	1.8	0.1	0.2	0.1	0.1	0.2
Rouse Hill - McGraths Hill	1.4	0.4	0.3	0.3	1.0	2.8	0.3	0.4	0.5	0.3	0.4	0.3	1.3	1.5	1.2	3.1	1.5	2.8	1.3	5.7	0.7	0.2	0.9	0.6	1.0	2.1	1.9	6.7	7.8	10.9	1.8	8.7	1.7		6.6	15.4	0.5	1.2	1.4	2.0	5.3	14.7	0.2	0.8	0.5	0.5	0.6
Mount Druitt	5.4	1.1	0.9	1.1	4.4	14.5	0.8	1.2	2.0	1.1	2.0	1.8	8.5	8.1	5.7	19.6	7.4	23.1	10.4	32.0	4.2	0.6	3.8	2.5	1.6	6.3	5.3	23.7	48.2	6.8	27.4	5.7	7.4	7.2		19.8	1.1	2.1	2.0	2.9	2.7	15.4	0.5	1.6	1.1	0.8	1.3
Blacktown - North	2.1	0.5	0.3	0.7	1.9	5.3	0.6	0.5	0.8	0.4	0.4	0.4	2.9	2.9	2.4	7.6	3.1	7.2	3.0	8.8	1.3	0.2	1.4	1.2	1.5	4.4	3.9	15.3	34.2	7.3	4.0	6.5	2.4	16.3	19.9		1.0	2.2	2.2	2.8	4.7	32.1	0.4	1.4	0.6	0.6	0.7
North Sydney - Mosman	40.1	11.4	4.2	7.2	7.5	18.0	9.0	4.7	3.1	2.2	2.9	2.0	1.8	1.7	2.7	2.3	2.7	1.1	0.9	1.5	0.8	0.3	1.4	5.1	1.5	2.3	8.6	3.0	1.6	0.3	0.3	0.4	0.2	0.5	1.9	2.2		31.1	9.1	1.7	1.5	4.1	12.0	20.7	0.8	4.4	0.8
Chatswood - Lane Cove	42.0	12.0	4.9	9.2	13.4	20.8	9.3	5.3	4.5	2.7	3.6	2.6	2.6	2.3	5.4	4.3	5.7	2.2	1.2	2.3	1.1	0.7	2.2	12.9	4.4	6.2	28.3	6.8	3.4	0.6	0.7	1.0	0.7	1.2	3.1	4.7	31.1		31.0	8.0	3.6	9.8	7.0	33.1	1.9	9.4	2.1
Ku-ring-gai	12.6	4.3	2.0	3.5	8.2	11.0	3.3	2.2	2.7	1.6	1.2	1.0	1.5	0.8	4.8	4.1	5.7	2.0	0.6	1.7	0.5	0.3	0.5	7.3	6.8	6.1	27.2	8.7	4.0	0.5	0.4	0.6	0.4	1.2	2.0	2.7	9.1	29.5		20.9	4.0	13.1	2.5	19.2	1.3	7.3	2.0
Hornsby	2.6	0.4	0.5	1.0	2.7	5.2	0.6	0.4	1.1	0.6	0.3	0.4	1.2	1.0	2.6	3.9	3.5	2.0	0.7	1.3	0.3	0.1	0.7	2.3	8.4	6.0	6.4	9.2	4.5	0.4	0.5	0.7	0.4	1.4	2.1	2.3	1.9	8.0	20.3		7.0	16.7	0.9	6.9	2.0	3.7	2.8
Dural - Wisemans Ferry	3.0	0.9	0.5	0.9	2.1	3.3	0.8	0.6	0.8	0.5	0.3	0.3	1.3	0.8	2.5	4.0	3.7	2.3	0.8	2.1	0.4	0.0	0.4	1.7	3.5	5.1	4.7	9.5	5.3	2.7	0.6	1.9	0.4	5.4	2.6	4.8	1.3	3.4	4.3	7.5		23.9	0.4	2.1	0.7	0.8	1.1
Baulkham Hills	6.3	2.0	1.4	2.4	7.4	13.8	1.9	1.4	3.0	1.8	1.1	1.6	5.7	4.5	8.6	22.5	14.3	12.3	4.2	7.9	2.3	0.5	2.6	5.4	16.0	25.9	17.5	66.4	50.5	3.1	3.8	4.7	2.9	15.7	15.8	32.3	3.3	8.6	13.6	21.2	24.6		1.1	5.9	1.9	3.4	2.2
Manly	9.3	2.8	0.9	1.7	2.1	5.9	2.3	1.4	0.8	0.6	0.8	0.5	0.5	0.3	0.8	0.8	0.8	0.4	0.3	0.6	0.2	0.1	0.3	1.3	0.4	0.8	2.4	1.0	0.4	0.0	0.1	0.2	0.1	0.2	0.8	0.6	11.4	6.8	2.4	0.9	0.5	1.3		15.9	0.2	3.0	0.3
Warringah	25.3	7.4	3.0	4.7	7.1	19.0	5.8	3.7	2.5	2.0	2.3	1.7	1.7	1.6	4.0	3.5	4.0	1.8	1.0	1.8	0.8	0.3	1.3	5.1	2.6	3.7	11.8	5.2	2.7	0.5	0.5	0.6	0.2	0.8	2.5	3.0	20.6	30.9	18.4	6.8	2.5	8.1	15.8		1.3	24.2	1.7
Wyong	2.8	0.2	0.2	0.5	0.7	8.4	0.4	0.3	0.5	0.2	0.4	0.3	0.7	0.4	1.1	1.5	1.1	0.9	0.4	1.7	0.2	0.0	0.8	0.4	0.4	0.8	0.9	2.0	1.3	0.3	0.1	0.9	0.1	0.5	1.1	0.5	0.8	1.7	1.2	1.8	0.7	1.8	7.6	1.3		0.7	50.2
Pittwater	7.4	2.4	1.0	1.5	2.9	8.1	1.8	1.1	1.1	0.6	0.8	0.5	1.0	0.5	2.0	1.8	2.3	1.0	0.3	0.9	0.2	0.1	0.3	2.1	1.5	1.9	6.0	3.0	1.5	0.1	0.2	0.2	0.1	0.5	1.0	1.0	4.7	9.2	7.2	3.8	0.9	4.2	3.0	25.3	0.6		0.8
Gosford	3.0	0.2	0.3	0.4	0.8	7.9	0.2	0.4	0.3	0.4	0.3	0.4	0.8	0.6	1.6	1.8	1.3	1.2	0.5	1.6	0.4	0.0	0.6	0.7	0.8	1.2	1.0	2.5	1.5	0.4	0.2	1.0	0.2	0.6	1.3	0.8	0.8	2.2	1.9	2.8	1.1	2.3	2.7	1.7	56.5	0.9	

Source: ACIL Allen Consulting, 2014

Table C2 **Public Transport – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Sydney GCCSA**

SA3 Origin / Destination	Sydney Inner City	Eastern Suburbs - North	Marrickville - Sydenham - Petersham	Leichhardt	Strathfield - Burwood - Ashfield	Botany	Eastern Suburbs - South	Kogarah - Rockdale	Canterbury	Hurstville	Cronulla - Miranda - Caringbah	Sutherland - Menai - Heathcote	Liverpool	Campbelltown (NSW)	Bankstown	Merrylands - Guildford	Auburn	Fairfield	Bringelly - Green Valley	Penrith	Camden	Blue Mountains - South	Wollondilly	Canada Bay	Pennant Hills - Epping	Carlingford	Ryde - Hunters Hill	Parramatta	Blacktown	Richmond - Windsor	St Marys	Hawkesbury	Blue Mountains	Rouse Hill - McGraths Hill	Mount Druitt	Blacktown - North	North Sydney - Mosman	Chatswood - Lane Cove	Ku-ring-gai	Hornsby	Dural - Wisemans Ferry	Baulkham Hills	Manly	Warringah	Wyong	Pittwater	Gosford
Sydney Inner City		36.7	13.5	21.3	30.7	21.6	54.1	20.4	17.3	16.1	22.9	18.7	14.1	18.5	13.3	10.1	10.0	7.8	9.8	13.8	13.8	0.3	4.6	24.3	6.4	8.9	33.0	13.4	9.6	2.8	5.3	3.0	7.5	3.0	7.5	7.2	35.9	34.3	23.1	10.3	4.2	21.3	13.4	41.2	5.1	22.7	5.8
Eastern Suburbs - North	38.7		0.5	0.5	1.2	1.1	3.6	1.4	0.5	1.1	1.0	1.2	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.0	0.2	0.6	0.3	0.2	0.9	0.8	0.5	0.1	0.2	0.3	0.2	0.2	0.3	0.3	2.6	1.8	0.9	0.6	0.1	0.8	0.3	0.6	0.4	0.5	0.3
Marrickville - Sydenham - Petersham	14.2	0.6		0.4	1.3	0.4	1.0	0.9	0.9	0.7	0.6	0.5	0.5	0.4	0.6	0.3	0.4	0.3	0.4	0.3	0.4	0.0	0.1	0.5	0.2	0.1	0.5	0.4	0.3	0.0	0.1	0.1	0.2	0.0	0.1	0.2	1.0	0.6	0.3	0.3	0.1	0.4	0.1	0.5	0.2	0.2	0.3
Leichhardt	22.7	0.6	0.4		0.9	0.2	0.7	0.4	0.4	0.3	0.3	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.1	0.6	0.1	0.1	0.6	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.3	0.8	0.3	0.2	0.0	0.3	0.1	0.5	0.2	0.1	0.2
Strathfield - Burwood - Ashfield	33.0	1.1	1.4	1.1		0.8	1.6	2.6	3.2	2.4	1.2	1.8	1.7	1.7	2.9	1.3	1.9	1.1	1.0	0.9	0.9	0.0	0.4	2.6	0.6	0.6	2.5	1.8	1.3	0.4	0.4	0.4	0.6	0.4	0.9	0.8	2.6	2.7	2.1	0.9	0.3	1.6	0.4	1.2	0.5	0.6	0.8
Botany	23.7	1.4	0.3	0.3	1.0		2.2	0.9	0.5	0.5	0.7	0.8	0.8	1.7	0.5	1.0	0.6	1.0	0.5	1.8	1.0	0.0	0.2	0.4	0.7	0.4	1.2	1.9	1.4	0.7	0.5	0.2	1.3	0.4	1.4	1.5	1.7	1.3	1.2	1.9	0.2	2.0	0.4	1.2	5.9	0.9	5.9
Eastern Suburbs - South	53.7	4.0	0.6	0.7	1.4	2.1		1.9	0.7	1.1	1.2	0.9	0.6	0.9	0.7	0.4	0.6	0.6	0.5	0.7	0.4	0.0	0.1	0.6	0.3	0.2	1.0	0.7	0.5	0.2	0.2	0.1	0.4	0.2	0.2	0.2	3.0	2.0	0.9	0.6	0.1	1.0	0.4	1.1	0.4	0.6	0.2
Kogarah - Rockdale	22.2	1.7	0.8	0.4	2.4	0.9	1.5		1.6	2.3	2.4	1.8	1.1	1.3	1.3	0.7	0.7	0.7	0.7	0.4	0.7	0.0	0.2	0.7	0.2	0.2	0.7	0.7	0.6	0.2	0.2	0.2	0.2	0.2	0.4	0.3	1.9	1.5	1.0	0.6	0.1	0.8	0.3	0.7	0.4	0.3	0.3
Canterbury	18.0	0.6	0.9	0.4	3.5	0.4	0.7	1.8		1.8	0.70	0.8	1.0	0.7	2.0	0.6	0.8	0.6	0.5	0.4	0.5	0.0	0.2	0.6	0.2	0.2	1.0	0.8	0.5	0.1	0.1	0.1	0.1	0.1	0.3	0.2	1.2	1.2	0.4	0.3	0.1	0.6	0.1	0.3	0.0	0.1	0.2
Hurstville	18.2	1.0	0.6	0.3	2.5	0.7	1.1	2.4	1.9		2.2	1.5	1.3	1.3	2.4	0.9	0.8	0.8	0.7	0.4	0.5	0.0	0.3	0.7	0.2	0.2	0.9	1.1	0.6	0.1	0.1	0.1	0.1	0.1	0.4	0.3	1.3	1.1	0.4	0.3	0.1	0.8	0.1	0.5	0.2	0.2	0.3
Cronulla - Miranda - Caringbah	23.4	1.3	0.6	0.2	1.5	0.9	1.0	2.4	0.7	1.8		1.7	0.6	0.8	1.0	0.6	0.5	0.6	0.5	0.4	0.7	0.0	0.1	0.4	0.2	0.2	0.8	0.8	0.4	0.1	0.1	0.1	0.1	0.1	0.3	0.2	2.0	1.2	0.5	0.4	0.1	0.6	0.2	0.5	0.3	0.1	0.3
Sutherland - Menai - Heathcote	19.7	1.2	0.7	0.4	1.9	1.0	1.3	2.1	0.7	1.7	1.6		0.9	0.8	2.8	0.7	1.0	0.6	0.4	0.4	0.3	0.0	0.1	0.4	0.1	0.3	0.9	1.6	0.6	0.0	0.1	0.1	0.1	0.1	0.2	0.1	1.6	1.5	0.3	0.4	0.0	0.7	0.2	0.7	0.0	0.1	0.2
Liverpool	14.8	0.6	0.5	0.4	1.5	0.8	0.6	1.1	1.2	1.3	0.6	1.0		3.8	3.0	2.0	1.2	4.0	5.8	1.0	3.5	0.0	0.5	0.4	0.2	0.2	0.8	2.0	1.1	0.2	0.2	0.2	0.4	0.1	0.6	0.4	1.1	1.0	0.5	0.4	0.1	0.8	0.1	0.6	0.4	0.2	0.5
Campbelltown (NSW)	18.3	0.9	0.6	0.3	1.8	2.3	1.0	1.6	0.7	1.2	0.7	0.7	3.8		1.9	1.4	1.2	2.1	3.4	0.8	6.2	0.0	0.7	0.6	0.1	0.2	1.0	1.2	1.2	0.2	0.2	0.2	0.1	0.2	0.5	0.2	1.3	1.5	0.4	0.5	0.0	0.8	0.2	0.5	0.1	0.2	0.4
Bankstown	14.2	0.8	0.6	0.4	3.2	0.6	0.9	1.3	2.0	2.3	1.1	2.3	3.0	1.8		1.9	2.2	2.1	1.4	0.8	1.0	0.0	0.2	0.6	0.3	0.3	1.0	1.5	0.7	0.2	0.3	0.2	0.4	0.2	0.5	0.6	1.1	1.1	0.6	0.5	0.1	0.8	0.1	0.4	0.4	0.4	0.5
Merrylands - Guildford	9.9	0.5	0.3	0.2	1.3	0.8	0.4	0.9	0.6	0.7	0.6	0.7	2.0	1.5	2.1		1.5	2.7	1.1	0.9	0.8	0.0	0.3	0.3	0.4	0.6	0.9	3.3	1.6	0.3	0.3	0.2	0.6	0.3	0.9	0.6	1.2	1.1	0.6	0.5	0.1	1.1	0.1	0.4	0.2	0.2	0.3
Auburn	10.7	0.6	0.3	0.2	2.1	0.6	0.6	0.7	0.8	0.9	0.7	1.0	1.4	1.1	2.0	1.6		1.3	0.6	0.7	0.5	0.0	0.3	0.6	0.4	0.7	1.1	2.3	1.0	0.1	0.3	0.1	0.4	0.2	0.6	0.5	1.1	1.1	0.8	0.6	0.1	1.0	0.2	0.4	0.4	0.3	0.4
Fairfield	8.5	0.5	0.3	0.2	1.2	0.9	0.9	0.7	0.7	0.9	0.5	0.8	3.7	1.9	2.5	2.9	1.4		4.3	1.3	1.3	0.0	0.4	0.3	0.3	0.5	0.8	2.4	1.9	0.1	0.8	0.2	0.4	0.3	1.8	0.6	0.6	0.8	0.2	0.7	0.2	1.3	0.1	0.5	0.2	0.1	0.4
Bringelly - Green Valley	10.9	0.6	0.3	0.1	0.8	0.4	0.4	0.5	0.4	0.5	0.3	0.3	5.8	3.3	1.1	1.1	0.7	4.3		1.5	2.8	0.0	0.4	0.2	0.1	0.3	0.6	1.6	0.9	0.1	0.3	0.0	0.1	0.1	0.4	0.2	1.1	0.8	0.2	0.3	0.0	0.4	0.1	0.2	0.0	0.1	0.1
Penrith	14.8	0.7	0.3	0.2	1.0	2.2	0.5	0.7	0.4	0.4	0.4	0.4	1.0	0.8	0.5	1.1	0.8	1.5	1.8		1.3	0.0	0.2	0.4	0.2	0.3	1.0	3.1	2.4	0.4	1.9	0.3	1.8	0.4	3.2	1.0	1.4	1.3	0.6	0.7	0.0	1.1	0.1	0.5	0.3	0.2	0.5
Camden	15.0	0.8	0.4	0.2	1.2	1.1	0.6	0.8	0.4	0.6	0.3	0.2	3.6	5.9	0.9	0.9	0.6	1.3	3.0	1.0		0.0	0.8	0.3	0.1	0.1	0.6	1.0	0.7	0.1	0.0	0.0	0.0	0.1	0.2	0.1	1.2	1.0	0.2	0.2	0.0	0.4	0.0	0.3	0.2	0.1	0.0
Blue Mountains - South	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wollondilly	4.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.1	0.3	0.7	0.3	0.1	0.2	0.2	0.5	0.1	1.2	0.0		0.1	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Canada Bay	26.1	0.6	0.5	0.7	2.7	0.4	1.0	0.7	0.6	0.5	0.4	0.3	0.5	0.5	0.6	0.3	0.5	0.3	0.2	0.3	0.4	0.0	0.0		0.3	0.4	1.7	0.8	0.5	0.2	0.0	0.0	0.2	0.2	0.2	0.3	1.9	1.8	0.5	0.3	0.0	0.7	0.2	0.5	0.3	0.2	0.3
Pennant Hills - Epping	6.8	0.3	0.1	0.2	0.5	0.6	0.4	0.3	0.2	0.3	0.2	0.1	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.3	0.2	0.0	0.1	0.3		0.7	1.1	1.9	0.6	0.0	0.1	0.0	0.2	0.2	0.2	0.4	1.0	0.9	0.8	1.0	0.1	1.7	0.0	0.3	0.2	0.2	0.3
Carlingford	10.0	0.3	0.1	0.2	0.6	0.4	0.2	0.3	0.1	0.1	0.1	0.2	0.4	0.1	0.4	0.6	0.9	0.5	0.2	0.2	0.1	0.0	0.0	0.3	0.6		2.1	4.4	0.9	0.0	0.1	0.1	0.2	0.2	0.3	0.2	0.9	0.9	0.3	0.4	0.0	1.2	0.1	0.3	0.1	0.2	0.2
Ryde - Hunters Hill	35.7	1.0	0.6	0.8	2.6	1.3	1.0	0.8	0.9	0.9	0.8	0.9	0.9	1.3	1.0	1.0	1.4	0.7	0.8	1.1	0.8	0.0	0.3	2.0	1.0	2.0		4.1	1.2	0.1	0.3	0.2	0.3	0.6	0.5	1.2	3.8	3.4	2.5	1.4	0.4	2.9	0.2	1.3	0.6	0.7	1.0
Parramatta	13.0	1.0	0.4	0.4	1.9	1.5	0.8	0.8	0.7	0.9	0.9	1.3	1.7	1.7	1.7	3.3	2.2	2.4	1.2	3.0	1.3	0.0	0.3	0.8	1.7	3.9	3.9		4.3	0.4	1.5	0.4	1.3	0.5	2.7	2.0	2.0	2.2	2.1	2.3	0.7	8.1	0.3	1.2	0.5	0.7	1.0
Blacktown	10.5	0.5	0.4	0.2	1.2	1.3	0.5	0.6	0.4	0.6	0.4	0.7	1.0	1.2	0.9	1.7	1.0	2.2	1.0	2.5	0.5	0.1	0.2	0.5	0.5	0.8	1.4	4.3		0.8	1.1	0.5	1.1	0.7	3.9	3.1	1.4	1.2	0.9	1.4	0.3	4.4	0.1	0.8	0.4	0.4	0.5
Richmond - Windsor	3.0	0.2	0.0	0.0	0.4	0.9	0.2	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.6	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.6	0.7		0.0	0.2	0.0	0.2	0.3	0.3	0.3	0.5	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.2
St Marys	6.0	0.3	0.1	0.1	0.5	0.6	0.2	0.2	0.2	0.2	0.1	0.1	0.4	0.1	0.2	0.4	0.4	0.9	0.3	1.9	0.1	0.0	0.0	0.1	0.2	0.1	0.5	1.4	0.9	0.1		0.0	0.1	0.0	1.5	0.2	0.5	0.4	0.2	0.2	0.0	0.3	0.0	0.1	0.0	0.1	0.0
Hawkesbury	2.8	0.2	0.0	0.1	0.3	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.3	0.4	0.4	0.0		0.0	0.1	0.1	0.1	0.3	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Blue Mountains	7.1	0.6	0.2	0.1	0.4	2.1	0.2	0.3	0.3	0.1	0.2	0.2	0.3	0.1	0.5	0.6	0.6	0.4	0.1	2.1	0.1	0.0	0.0	0.5	0.2	0.2	0.4	1.8	0.9	0.1	0.1	0.0		0.1	0.5	0.2	0.5	1.0	0.2	0.2	0.0	0.6	0.0	0.1	0.1	0.1	0.3
Rouse Hill - McGraths Hill	3.2	0.2	0.1	0.1	0.5	0.5	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.1	0.4	0.0	0.0	0.0	0.1	0.2	0.1	0.5	0.6	0.8	0.2	0.0	0.0	0.0		0.4	0.6	0.6	0.6	0.2	0.3	0.0	0.9	0.0	0.1	0.1	0.1	0.2
Mount Druitt	8.2	0.4	0.3	0.0	0.7	1.2	0.3	0.3	0.3	0.2	0.2	0.1	0.7	0.5	0.5	1.0	0.5	2.0	0.5	3.0	0.2	0.0	0.0	0.3	0.2	0.3	0.7	2.4	3.8	0.3	1.5	0.1	0.2	0.3		1.3	0.8	0.6	0.2	0.3	0.0	0.8	0.1	0.2	0.1	0.1	0.2
Blacktown - North	7.4	0.4	0.1	0.1	0.7	1.3	0.3	0.2	0.2	0.3	0.4	0.2	0.4	0.2	0.5	0.7	0.5	0.5	0.3	0.9	0.0	0.0	0.0	0.3	0.4	0.3	1.2	2.0	3.1	0.3	0.1	0.1	0.1	0.6	1.2		1.1	1.1	0.3	0.5	0.1	1.7	0.1	0.2	0.1	0.0	0.2
North Sydney - Mosman	34.4	2.5	1.0	1.3	2.6	1.8	3.3	1.8	1.1	1.3	1.8	1.7	1.1	2.0	1.0	1.1	1.0	0.7	0.9	1.1	1.3	0.1	0.4	1.9	0.9	1.0	3.3	1.5	1.3	0.3	0.5	0.3	0.5	0.4	0.9	1.0		5.3	3.1	1.6	0.5	2.6	2.8	6.5	0.6	3.2	0.6
Chatswood - Lane Cove	33.0	1.8	0.6	0.8	2.5	1.3	2.1	1.3	1.0	1.1	1.5	1.4	1.2	1.6	1.0	1.0	1.1	0.8	0.8	1.1	0.8	0.0	0.5	1.8	0.9	0.9	3.6	1.9	1.6	0.4	0.5	0.4	0.7	0.5	0.8	1.3	5.6		3.2	2.2	0.3	2.8	1.2	4.1	0.9	1.4	0.9
Ku-ring-gai	23.9	0.9	0.5	0.3	2.0	1.3	0.9	0.8	0.5	0.5	0.4	0.5	0.6	0.5	0.8	0.7	1.0	0.4	0.2	0.4	0.3	0.0	0.1	0.6	0.7	0.4	2.8	2.0	1.1	0.1	0.0	0.0	0.4	0.2	0.2	0.3	3.1	3.3		2.3	0.0	1.7	0.2	0.9	0.1	0.3	0.4
Hornsby	11.6	0.5	0.2	0.3	0.9	1.9	0.7	0.5	0.3	0.5	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.5	0.3	0.6	0.2	0.0	0.1	0.5	0.9	0.5	1.4	2.2	1.4	0.1	0.3	0.1	0.2	0.2	0.3	0.7	1.7	2.5	2.4		0.2	2.7	0.2	0.5	0.5	0.3	0.8
Dural - Wisemans Ferry	4.5	0.1	0.1	0.0	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.5	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.1	0.3		0.6	0.0	0.0	0.0	0.0	0.1
Baulkham Hills	22.9	1.1	0.4	0.3	1.9	2.3	1.2	0.9	0.6	0.9	0.6	0.9	0.9	0.9	1.2	1.3	1.0	1.4	0.5	1.0	0.5	0.0	0.1	0.7	1.7	1.4	3.4	8.9	4.3	0.1	0.2	0.1	0.4	0.9	0.9	1.7	2.9	3.3	1.6	2.9	0.4		0.1	0.6	0.8	0.2	1.2
Manly	13.2	0.4	0.2	0.1	0.4	0.4	0.4	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.0	0.4	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	2.9	1.0	0.2	0.1	0.0	0.0		1.3	0.0	0.3	0.1
Warringah	44.1	1.2	0.3	0.5	1.3	1.3	1.2	0.9	0.5	0.4	0.2	0.6	0.6	0.7	0.7	0.5	0.5	0.3	0.3	0.5	0.4	0.0	0.1	0.4	0.3	0.3	1.6	1.2	0.5	0.2	0.1	0.2	0.1	0.2	0.1	0.2	6.3	4.5	1.1	0.7	0.0	0.8	1.3		0.2	2.1	0.3
Wyong	5.3	0.3	0.1	0.1	0.7	6.5	0.3	0.3	0.2	0.2	0.2	0.2	0.4	0.3	0.5	0.4	0.3	0.3	0.1	0.3	0.1	0.0	0.0	0.2	0.2	0.1	0.8	0.4	0.3	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.7	0.9	0.2	0.5	0.0	0.7	0.0	0.1		0.0	3.1
Pittwater	24.9	0.4	0.3	0.4	0.9	1.2	0.6	0.4	0.3	0.3	0.1	0.1	0.4	0.3	0.3	0.3	0.5	0.3	0.1	0.2	0.1	0.0	0.0	0.3	0.2	0.2	1.1	0.8	0.4	0.0	0.0	0.0	0.0	0.1	0.2	0.1	2.8	1.7	0.4	0.3	0.1	0.2	0.4	2.2	0.0		0.0
Gosford	6.4	0.5	0.3	0.1	0.9	5.8	0.2	0.4	0.2	0.3	0.1	0.3	0.6	0.4	0.5	0.5	0.4	0.4	0.1	0.3	0.3	0.0	0.0	0.3	0.4	0.2	1.1	1.0	0.2	0.1	0.0	0.2	0.3	0.2	0.2	0.1	0.7	1.2	0.5	0.8	0.1	1.2	0.2	0.1	3.0	0.0	

Source: ACIL Allen Consulting, 2014

Table C3 Roads – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Melbourne GCCSA

SA3 Origin / Destinatio	Melbourne City	Port Phillip	Hobsons Bay	Maribyrnong	Essendon	Brunswick - Coburg	Yarra	Stonnington - West	Stonnington - East	Glen Eira	Bayside	Kingston	Dandenong	Monash	Boroondara	Darebin - South	Darebin - North	Moreland - North	Keilor
Melbourne City		24.5	25.3	21.4	16.9	18.0	19.6	11.0	6.9	24.5	19.9	14.7	16.9	24.0	37.3	9.7	19.9	14.3	15.1
Port Phillip	25.4		12.5	9.3	5.1	6.2	12.1	12.1	7.1	20.0	15.0	13.1	10.9	15.8	18.4	3.8	5.9	4.1	4.5
Hobsons Bay	27.8	13.4		18.5	6.7	5.0	7.4	5.3	2.2	5.1	4.2	3.4	4.3	5.3	6.7	1.7	4.2	3.4	6.3
Maribyrnong	23.0	9.6	18.1		10.9	7.1	6.7	3.9	1.6	4.0	3.2	2.6	2.6	4.3	6.6	2.8	4.9	5.7	10.5
Essendon	17.8	5.2	6.6	10.8		10.5	5.7	2.2	1.2	2.6	2.0	1.5	1.5	2.4	5.0	3.8	6.4	7.6	10.9
Brunswick - Coburg	19.0	6.3	4.9	7.0	10.5		9.6	3.2	1.3	2.9	2.0	2.0	1.9	3.5	8.1	7.1	12.3	10.9	7.7
Yarra	20.3	12.1	7.0	6.5	5.6	9.4		7.9	3.9	9.4	6.1	4.5	6.5	9.1	22.5	8.1	9.9	4.8	4.0
Stonnington - West	11.6	12.3	5.1	3.8	2.2	3.2	8.1		6.5	13.0	8.3	7.2	6.8	11.6	16.0	2.6	3.2	1.8	1.7
Stonnington - East	7.4	7.3	2.2	1.6	1.2	1.3	4.1	6.6		15.4	6.47	7.6	9.0	16.8	15.7	1.5	2.0	0.9	1.1
Glen Eira	26.0	20.4	4.9	4.0	2.6	2.9	9.7	13.2	15.5		26.7	27.6	24.9	35.3	25.0	2.4	3.7	1.7	2.0
Bayside	21.0	15.2	4.0	3.2	2.0	2.0	6.2	8.3	6.5	26.7		30.5	19.6	18.5	12.0	1.6	1.9	1.2	1.4
Kingston	15.5	13.4	3.3	2.6	1.5	2.0	4.6	7.3	7.6	27.6	30.7		57.7	38.4	13.4	1.2	2.3	1.5	1.1
Dandenong	17.9	11.1	4.3	2.7	1.5	1.9	6.7	6.8	9.2	24.9	19.7	58.0		71.2	17.6	1.3	2.3	1.2	1.4
Monash	25.7	16.2	5.3	4.3	2.4	3.5	9.5	11.8	17.0	35.2	18.4	38.5	70.7		35.6	3.1	4.9	2.0	2.3
Boroondara	39.8	18.8	6.5	6.6	5.1	8.1	23.4	16.2	15.8	24.9	12.0	13.3	17.3	35.2		9.3	13.6	4.0	3.4
Darebin - South	10.4	3.9	1.7	2.8	3.9	7.2	8.5	2.7	1.5	2.4	1.7	1.2	1.3	3.1	9.3		10.5	3.9	3.1
Darebin - North	21.1	6.1	4.1	5.0	6.4	12.6	10.2	3.2	2.0	3.7	1.9	2.3	2.2	4.9	13.6	10.5		11.6	7.4
Moreland - North	14.9	4.3	3.3	5.8	7.7	11.0	4.9	1.8	0.9	1.7	1.2	1.5	1.2	2.0	4.0	3.9	11.6		8.4
Keilor	16.2	4.7	6.2	10.6	11.2	7.9	4.1	1.7	1.1	2.0	1.4	1.1	1.4	2.3	3.4	3.1	7.4	8.3	
Brimbank	39.6	12.8	23.7	28.3	14.6	10.9	9.2	4.8	2.0	5.1	3.4	3.3	4.3	6.3	8.1	4.4	12.2	11.5	23.8
Banyule	26.5	7.3	3.2	4.1	5.0	10.2	12.5	4.8	4.4	5.8	3.0	3.6	5.0	10.3	24.4	11.0	29.5	9.1	6.5
Manningham - West	21.1	5.7	1.8	2.6	2.4	4.1	8.7	3.7	4.0	5.5	2.6	3.6	6.7	16.3	23.6	3.9	9.6	2.8	1.9
Manningham - East	6.5	1.4	0.3	0.6	0.5	0.8	1.7	0.8	0.7	1.5	0.6	1.0	2.7	5.6	4.8	0.8	2.1	0.6	0.6
Whitehorse - West	15.0	6.7	2.7	2.6	2.1	3.6	8.0	5.3	6.3	11.0	5.2	10.0	15.4	32.8	31.6	3.4	6.5	2.0	2.0
Whitehorse - East	10.4	3.1	1.0	1.4	0.7	1.4	4.0	2.4	2.8	4.6	2.2	4.2	10.1	20.4	12.6	1.8	2.6	1.0	0.6
Maroondah	13.2	4.4	1.5	2.2	1.8	2.8	6.0	2.6	2.6	4.3	2.5	6.3	15.0	23.0	14.6	2.3	4.7	1.5	1.1
Knox	20.0	7.9	2.5	2.1	1.7	2.8	6.0	5.1	7.3	13.7	6.7	16.2	45.4	57.6	19.9	2.4	4.6	1.5	1.2
Casey - North	10.0	4.2	1.8	1.4	0.8	0.9	3.6	3.2	4.3	7.6	5.4	18.3	53.6	32.0	8.2	0.7	1.2	0.5	0.7
Casey - South	7.4	3.8	0.9	0.8	0.6	0.8	3.0	2.5	3.3	5.6	5.2	19.9	44.5	22.9	6.8	0.5	0.9	0.3	0.2
Cardinia	4.3	2.5	1.5	0.7	0.6	0.7	2.1	1.8	2.7	4.1	2.4	8.3	24.1	16.7	4.4	0.5	0.9	0.3	0.4
Yarra Ranges	14.8	4.5	1.6	1.9	1.4	2.8	6.2	3.5	3.8	5.7	2.9	8.1	22.1	32.7	15.9	2.2	5.5	1.4	1.3
Nillumbik - Kinglake	12.6	2.7	1.2	1.9	2.0	3.7	5.9	2.1	2.2	2.6	0.7	2.3	3.5	8.3	11.0	3.3	12.6	4.4	3.1
Whittlesea - Wallan	31.9	6.3	5.4	6.9	8.0	13.5	13.9	3.8	2.4	3.7	1.50	2.4	4.1	7.9	15.6	10.2	41.5	16.8	12.0
Tullamarine - Broadme	33.9	11.9	12.2	15.2	16.0	17.3	11.8	5.8	3.5	7.1	5.3	6.0	8.9	11.2	12.4	7.9	27.5	26.0	23.7
Sunbury	8.3	2.0	2.5	3.1	2.8	2.2	1.6	0.8	0.3	0.7	0.5	0.5	0.7	1.1	1.4	0.9	3.1	2.4	4.4
Melton - Bacchus Mars	22.6	9.0	12.2	12.8	7.1	6.2	5.8	2.9	1.3	2.7	2.0	1.9	2.0	3.0	4.3	2.4	7.1	5.3	11.4
Wyndham	37.6	18.4	41.3	21.3	8.5	5.3	9.5	6.7	3.1	7.1	3.9	4.9	4.6	7.0	9.9	2.4	6.5	4.8	9.8

SA3 Origin / Destinatio	Brimbank	Banyule	Manningham - West	Manningham - East	Whitehorse - West	Whitehorse - East	Maroondah	Knox	Casey - North	Casey - South	Cardinia	Yarra Ranges	Nillumbik - Kinglake	Whittlesea - Wallan	Tullamarine - Broadm	Sunbury	Melton - Bacchus M	Wyndham
Melbourne City	37.3	24.6	19.2	5.9	14.2	9.7	12.1	18.7	9.2	6.9	4.1	14.0	11.8	30.5	33.3	8.0	21.4	35.0
Port Phillip	12.4	7.0	5.5	1.3	6.5	3.0	4.1	7.7	4.1	3.8	2.4	4.3	2.6	6.2	12.1	1.9	8.6	17.6
Hobsons Bay	24.0	3.2	1.8	0.3	2.7	1.0	1.5	2.5	1.8	0.9	1.5	1.6	1.2	5.4	12.6	2.6	12.3	39.9
Maribyrnong	28.2	4.0	2.5	0.6	2.6	1.3	2.1	2.0	1.4	0.8	0.7	1.9	1.9	6.8	15.4	3.2	12.7	20.9
Essendon	14.1	5.0	2.3	0.5	2.1	0.7	1.7	1.7	0.8	0.6	0.5	1.4	2.0	7.9	16.0	2.8	6.9	8.3
Brunswick - Coburg	10.7	10.0	4.0	0.8	3.6	1.4	2.7	2.7	0.9	0.8	0.6	2.7	3.7	13.3	17.6	2.3	6.0	5.3
Yarra	9.0	12.0	8.2	1.6	7.8	3.8	5.7	5.7	3.4	2.8	1.9	5.9	5.6	13.7	11.9	1.7	5.7	9.2
Stonnington - West	4.7	4.7	3.8	0.8	5.2	2.4	2.5	5.0	3.2	2.5	1.8	3.4	2.1	3.8	6.0	0.8	2.9	6.4
Stonnington - East	2.0	4.4	4.0	0.7	6.2	2.8	2.5	7.2	4.1	3.3	2.5	3.8	2.2	2.3	3.7	0.32	1.3	3.0
Glen Eira	5.0	5.8	5.5	1.5	11.0	4.6	4.3	13.6	7.6	5.5	4.2	5.6	2.5	3.6	7.6	0.7	2.8	6.9
Bayside	3.4	3.0	2.6	0.6	5.3	2.2	2.5	6.7	5.4	5.1	2.4	3.0	0.7	1.5	5.6	0.5	1.9	3.8
Kingston	3.3	3.7	3.6	1.0	10.1	4.2	6.3	16.1	18.3	19.5	8.4	8.0	2.2	2.5	6.4	0.5	1.9	4.9
Dandenong	4.3	4.9	6.7	2.7	15.4	10.0	15.0	45.4	53.5	44.5	24.3	21.9	3.5	4.1	9.5	0.7	2.1	4.6
Monash	6.3	10.2	16.2	5.6	32.8	20.4	22.6	56.8	31.2	22.4	16.3	32.1	8.1	7.9	11.8	1.1	2.9	6.9
Boroondara	8.1	24.2	23.6	4.7	31.5	12.6	14.4	19.7	7.9	6.4	4.2	15.6	10.7	15.5	13.1	1.4	4.2	9.6
Darebin - South	4.4	10.9	3.8	0.8	3.4	1.8	2.3	2.4	0.7	0.5	0.5	2.1	3.3	10.1	8.0	0.9	2.4	2.4
Darebin - North	12.0	28.9	9.3	2.1	6.4	2.7	4.5	4.5	1.2	0.9	0.9	5.4	12.4	41.1	27.9	3.2	7.0	6.4
Moreland - North	11.4	9.1	2.8	0.6	2.1	1.0	1.5	1.5	0.5	0.3	0.3	1.4	4.3	16.7	26.5	2.4	5.2	4.8
Keilor	23.3	6.5	1.9	0.6	2.0	0.6	1.1	1.2	0.6	0.2	0.4	1.3	3.0	11.8	23.8	4.6	11.1	9.7
Brimbank		9.5	2.6	0.7	3.6	1.1	2.6	2.5	1.3	1.4	0.8	2.0	4.3	17.3	38.1	10.9	49.7	39.7
Banyule	9.6		18.8	3.9	12.6	6.3	9.3	7.4	1.9	1.5	1.6	8.8	32.3	47.3	24.1	2.0	5.1	4.6
Manningham - West	2.7	18.7		7.5	20.5	10.6	13.0	11.4	3.0	2.0	1.4	11.1	12.6	10.9	7.8	0.5	1.0	2.2
Manningham - East	0.7	4.0	7.6		6.1	4.7	10.0	5.9	1.2	0.6	0.6	7.4	3.7	2.5	2.1	0.1	0.2	0.3
Whitehorse - West	3.6	12.4	20.4	6.1		16.9	17.6	21.8	6.9	5.5	4.0	20.5	10.4	9.5	8.2	0.8	2.2	3.9
Whitehorse - East	1.1	6.2	10.5	4.7	17.0		17.9	19.7	4.9	3.8	2.9	16.7	5.3	4.2	3.9	0.3	0.8	1.3
Maroondah	2.6	9.4	13.4	10.1	17.9	18.1		46.3	8.5	5.6	5.9	64.9	11.4	6.9	7.7	0.3	1.0	1.3
Knox	2.5	7.5	11.6	5.9	22.2	19.9	46.4		26.7	16.2	15.6	65.4	7.2	5.7	8.7	0.3	0.9	3.0
Casey - North	1.3	2.0	3.0	1.2	7.2	5.0	8.6	27.3		51.2	37.7	18.2	1.3	1.4	4.8	0.1	0.6	1.6
Casey - South	1.4	1.5	2.0	0.7	5.7	3.9	5.7	16.6	51.9		23.4	8.2	1.0	1.0	5.1	0.1	0.3	1.2
Cardinia	0.8	1.7	1.4	0.6	4.2	3.0	5.9	15.9	37.7	23.2		17.3	0.5	0.7	3.9	0.0	0.1	0.7
Yarra Ranges	1.9	8.8	11.3	7.4	20.8	16.9	65.5	65.7	18.1	8.2	17.1		13.2	7.4	10.9	0.3	0.9	1.5
Nillumbik - Kinglake	4.4	32.3	12.9	3.7	10.5	5.4	11.4	7.2	1.3	1.0	0.5	13.1		31.7	15.1	0.8	1.5	2.1
Whittlesea - Wallan	17.6	46.6	10.8	2.5	9.6	4.2	6.8	5.6	1.4	1.0	0.6	7.3	31.4		66.4	5.49	7.6	8.0
Tullamarine - Broadme	37.7	23.4	7.5	1.9	7.8	3.8	7.3	8.2	4.5	4.8	3.6	10.5	14.7	65.0		14.0	19.7	20.4
Sunbury	10.8	2.0	0.5	0.1	0.8	0.3	0.3	0.3	0.1	0.1	0.0	0.3	0.7	5.4	14.1		9.5	4.1
Melton - Bacchus Mars	50.1	5.2	1.1	0.2	2.2	0.8	1.0	0.9	0.6	0.3	0.1	0.9	1.4	7.7	20.1	9.7		26.7
Wyndham	40.1	4.6	2.1	0.3	3.9	1.3	1.3	2.9	1.6	1.1	0.7	1.5	2.0	8.1	20.9	4.2	26.7	

Source: ACIL Allen Consulting, 2014

Table C4 Public Transport – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Melbourne GCCSA

SA3 Origin / Destination	Melbourne City	Port Phillip	Hobsons Bay	Maribyrnong	Essendon	Brunswick - Coburg	Yarra	Stonnington - West	Stonnington - East	Glen Eira	Bayside	Kingston	Dandenong	Monash
Melbourne City		27.4	24.5	26.2	16.0	22.8	22.4	15.9	9.4	34.0	24.3	32.4	34.5	31.9
Port Phillip	26.4		1.8	2.4	0.9	1.8	4.3	2.0	1.0	3.0	1.8	2.0	2.3	1.9
Hobsons Bay	22.5	1.9		1.2	0.7	0.5	1.4	0.9	0.4	0.9	0.5	0.9	0.6	1.5
Maribyrnong	22.4	2.7	1.2		1.6	1.4	2.3	1.0	0.5	1.4	0.4	0.7	1.0	1.2
Essendon	15.6	1.2	0.7	1.4		1.1	1.4	0.6	0.3	0.4	0.4	0.4	0.4	0.7
Brunswick - Coburg	23.2	2.1	0.5	1.5	1.1		2.6	0.6	0.6	1.0	0.6	0.8	0.5	0.5
Yarra	23.2	4.3	1.6	2.5	1.6	2.6		1.9	1.0	2.9	1.8	1.3	2.6	2.4
Stonnington - West	14.1	2.1	0.8	0.9	0.6	0.6	1.8		0.6	1.2	0.9	1.0	1.7	2.1
Stonnington - East	8.5	1.1	0.4	0.5	0.3	0.5	0.9	0.5		1.1	0.48	0.6	1.5	1.5
Glen Eira	30.5	3.3	1.0	1.5	0.3	1.1	2.7	1.2	1.1		1.5	1.8	1.9	3.9
Bayside	21.5	1.8	0.6	0.4	0.3	0.6	1.8	0.9	0.4	1.6		1.7	1.6	1.4
Kingston	25.3	1.6	0.8	0.7	0.3	0.7	1.1	0.6	0.5	1.4	1.7		5.5	2.8
Dandenong	32.5	2.3	0.6	0.9	0.4	0.4	2.2	1.5	1.5	1.8	1.6	5.6		7.9
Monash	30.7	1.8	1.4	1.2	0.6	0.4	2.1	2.0	1.4	3.8	1.3	2.8	7.7	
Boroondara	41.8	3.5	1.1	1.1	1.0	1.4	4.2	1.9	1.3	2.2	0.8	1.2	2.2	2.6
Darebin - South	12.9	1.1	0.3	0.7	0.5	1.0	2.0	0.4	0.2	0.2	0.2	0.4	0.5	0.6
Darebin - North	31.8	2.2	0.9	1.4	0.7	2.2	3.7	1.1	0.7	1.2	0.5	1.2	0.8	0.7
Moreland - North	16.9	1.4	0.3	0.8	0.5	0.9	1.5	0.3	0.3	0.5	0.3	0.2	0.6	0.7
Keilor	11.8	0.6	0.5	1.0	0.7	0.8	1.2	0.2	0.1	0.0	0.1	0.2	0.4	0.2
Brimbank	32.0	2.5	1.7	2.7	1.3	1.4	2.2	0.9	0.5	0.8	0.5	1.0	0.9	1.5
Banyule	37.4	1.6	0.5	0.3	1.0	1.3	2.8	0.8	1.0	0.9	0.3	0.2	0.0	1.6
Manningham - West	31.3	1.2	0.4	0.5	0.5	0.7	2.1	0.3	0.5	0.1	0.1	0.5	0.4	2.0
Manningham - East	9.8	0.1	0.0	0.0	0.1	0.0	0.3	-0.1	0.2	0.2	-0.1	0.1	0.1	-0.1
Whitehorse - West	25.4	1.4	0.3	0.6	0.7	0.6	2.1	1.0	0.9	1.3	0.5	1.0	1.2	3.1
Whitehorse - East	16.0	0.3	0.1	0.4	0.1	0.3	0.7	0.1	0.3	0.2	0.4	0.4	0.2	2.0
Maroondah	28.4	1.2	0.2	0.5	0.0	0.4	2.2	0.6	0.6	0.3	0.2	0.7	1.1	3.1
Knox	33.2	1.2	0.4	0.2	0.1	0.0	1.2	0.4	0.5	0.6	0.6	0.3	3.2	6.0
Casey - North	27.6	1.4	0.2	0.5	0.0	0.4	1.5	1.0	0.5	1.0	0.4	1.3	3.9	3.4
Casey - South	77.5	2.7	0.5	0.6	0.5	0.6	2.9	1.4	1.2	2.0	0.7	3.4	6.6	7.1
Cardinia	37.5	2.6	0.4	0.6	0.1	0.4	3.6	1.4	1.3	1.6	0.3	1.9	5.0	5.2
Yarra Ranges	33.3	0.7	-0.1	0.7	0.2	0.3	2.7	0.5	0.1	0.8	-0.1	0.6	0.8	3.2
Nillumbik - Kinglake	17.1	0.9	0.1	0.1	0.0	-0.1	1.2	0.2	0.3	0.3	-0.1	0.0	0.3	0.7
Whittlesea - Wallan	109.6	5.1	1.6	3.6	3.7	3.5	8.3	2.0	0.9	1.3	0.72	0.8	1.5	3.1
Tullamarine - Broadmeadows	79.4	11.9	2.3	4.3	2.5	3.1	7.6	4.1	2.8	6.8	3.9	9.1	11.2	12.5
Sunbury	31.7	1.7	0.3	0.8	0.6	0.6	1.9	0.5	0.5	0.4	0.3	0.2	0.5	0.9
Melton - Bacchus Marsh	48.9	4.5	1.9	3.5	1.5	1.2	3.4	2.0	0.8	1.5	0.5	0.8	0.6	2.9
Wyndham	80.5	7.2	3.9	4.7	1.9	1.8	6.6	3.5	1.5	3.3	1.1	2.0	1.7	5.7

SA3 Origin / Destination	Boroondara	Darebin - South	Darebin - North	Moreland - North	Keilor	Brimbank	Banyule	Manningham - West	Manningham - East	Whitehorse - West	Whitehorse - East	Maroondah	Knox	Casey - North
Melbourne City	43.0	12.2	30.5	17.6	12.3	34.0	36.0	28.9	9.4	25.4	16.0	28.7	33.4	28.6
Port Phillip	3.2	1.0	2.2	1.0	0.6	1.4	1.9	1.1	0.1	1.3	0.2	1.1	1.0	1.3
Hobsons Bay	1.0	0.4	0.8	0.3	0.5	1.4	0.5	0.4	0.0	0.4	0.0	0.2	0.4	0.3
Maribyrnong	1.0	0.6	1.4	0.7	1.1	2.7	0.2	0.4	0.0	0.6	0.4	0.5	0.3	0.4
Essendon	0.9	0.5	0.6	0.5	0.6	1.3	1.0	0.5	0.1	0.7	0.2	0.0	0.2	0.1
Brunswick - Coburg	1.6	1.0	2.2	0.9	0.7	1.5	1.2	0.7	0.0	0.7	0.3	0.4	0.0	0.4
Yarra	4.3	1.9	3.9	1.6	1.2	2.4	2.9	2.1	0.3	2.4	0.7	2.4	1.4	1.7
Stonnington - West	1.9	0.3	1.1	0.4	0.3	0.9	0.9	0.4	-0.1	1.1	0.1	0.7	0.4	1.1
Stonnington - East	1.3	0.2	0.6	0.3	0.0	0.5	0.9	0.5	0.2	0.9	0.3	0.6	0.5	0.6
Glen Eira	2.0	0.3	1.1	0.5	-0.1	0.7	0.8	0.1	0.3	1.2	0.3	0.3	0.6	1.1
Bayside	0.9	0.3	0.6	0.2	0.1	0.5	0.4	0.1	-0.2	0.6	0.4	0.2	0.6	0.5
Kingston	0.9	0.3	0.8	0.2	0.1	1.1	0.2	0.5	0.1	0.9	0.5	0.6	0.3	1.0
Dandenong	1.7	0.3	0.5	0.6	0.4	0.8	0.0	0.4	0.2	1.3	0.3	1.0	3.2	3.9
Monash	2.4	0.5	0.6	0.7	0.1	1.4	1.2	1.8	-0.1	3.0	1.9	3.2	5.7	3.4
Boroondara		0.8	1.7	0.9	0.4	1.4	1.8	1.2	0.0	2.0	0.7	1.3	1.2	1.1
Darebin - South	0.8		1.4	0.4	0.3	0.3	0.5	0.1	0.0	0.6	0.0	0.0	0.3	0.1
Darebin - North	1.7	1.3		1.7	1.4	2.2	2.2	1.4	-0.1	2.1	0.8	0.8	0.3	1.0
Moreland - North	0.9	0.3	1.7		0.6	1.0	0.2	0.4	0.0	0.3	0.1	0.1	0.0	0.2
Keilor	0.4	0.3	1.3	0.6		2.1	0.5	0.0	0.0	0.1	0.0	0.2	0.1	0.2
Brimbank	1.4	0.4	2.0	1.1	2.3		1.3	0.2	0.1	1.0	0.2	0.5	0.4	0.2
Banyule	2.0	0.6	2.4	0.3	0.5	1.4		1.2	0.0	0.6	0.3	0.2	-0.1	0.6
Manningham - West	1.1	0.2	1.6	0.4	-0.1	0.2	1.1		0.0	1.3	0.8	0.3	0.7	0.2
Manningham - East	-0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0		0.4	0.2	0.2	0.3	0.2
Whitehorse - West	2.0	0.5	2.1	0.4	0.0	0.8	0.6	1.3	0.4		0.8	1.0	1.2	0.5
Whitehorse - East	0.7	0.0	0.7	0.1	0.0	0.2	0.3	0.8	0.2	0.7		0.7	0.8	0.3
Maroondah	1.2	0.0	0.8	0.1	0.2	0.5	0.1	0.2	0.2	1.0	0.7		2.4	0.7
Knox	0.9	0.2	0.4	0.0	0.1	0.4	-0.1	0.6	0.4	1.2	0.7	2.3		0.6
Casey - North	1.0	0.1	0.8	0.1	0.2	0.2	0.6	0.2	0.1	0.5	0.2	0.7	0.5	
Casey - South	1.7	0.3	1.4	0.0	0.0	0.6	0.6	0.2	0.0	1.3	0.6	0.8	1.2	10.7
Cardinia	1.6	0.2	1.9	0.4	0.2	0.3	0.5	0.5	0.0	1.2	0.6	0.7	0.6	4.0
Yarra Ranges	2.0	0.3	1.1	0.1	-0.1	0.4	0.5	0.6	0.2	0.5	0.5	2.3	1.6	0.4
Nillumbik - Kinglake	0.1	-0.1	1.5	0.3	0.4	0.7	0.6	0.7	0.0	0.3	0.0	0.1	0.0	0.2
Whittlesea - Wallan	3.4	1.8	12.5	2.8	2.1	5.4	6.5	1.8	0.4	2.3	0.9	1.2	0.9	0.4
Tullamarine - Broadmeadows	8.0	2.2	8.0	2.7	2.0	6.7	5.7	5.3	1.4	6.1	3.6	5.7	8.4	7.4
Sunbury	0.7	0.1	1.6	0.5	0.7	2.6	0.6	0.3	0.0	0.5	0.1	0.1	0.1	0.1
Melton - Bacchus Marsh	1.5	0.3	4.3	0.8	1.5	12.5	1.5	0.3	0.0	1.9	0.4	0.4	0.3	0.1
Wyndham	2.6	0.5	4.3	1.1	2.1	8.6	1.5	0.5	0.0	2.0	0.6	0.6	0.6	1.1

SA3 Origin / Destination	Casey - South	Cardinia	Yarra Ranges	Nillumbik - Kinglake	Whittlesea - Wallan	Tullamarine - Broadmeadows	Sunbury	Melton - Bacchus Marsh	Wyndham	Geelong	Surf Coast - Bellarine Peninsula	Barwon - West	Mornington Peninsula	Frankston
Melbourne City	78.4	38.1	33.9	16.9	107.2	84.7	32.9	50.6	84.5	24.0	9.7	1.3	26.0	20.9
Port Phillip	2.5	2.5	0.7	0.9	5.2	12.1	1.5	4.3	7.3	2.1	0.6	0.1	2.0	1.8
Hobsons Bay	0.4	0.4	-0.1	0.1	1.6	2.6	0.3	2.1	3.7	0.1	0.0	0.0	0.6	0.4
Maribyrnong	0.5	0.6	0.7	0.1	3.5	4.5	0.9	3.6	4.8	0.4	0.1	0.2	0.6	0.9
Essendon	0.5	0.1	0.2	-0.1	3.7	2.5	0.6	1.6	2.0	0.3	0.0	0.1	0.0	0.0
Brunswick - Coburg	0.6	0.5	0.3	0.0	3.7	3.4	0.7	1.3	1.8	0.3	0.0	0.0	0.7	0.1
Yarra	3.1	3.7	3.1	1.2	8.5	8.3	2.0	3.5	6.8	1.5	-0.1	0.3	1.5	1.6
Stonnington - West	1.4	1.3	0.4	0.2	2.0	4.5	0.6	2.1	3.7	0.6	0.1	0.0	0.7	0.7
Stonnington - East	1.3	1.3	0.1	0.3	1.0	3.0	0.40	0.9	1.5	0.3	0.1	0.0	0.6	0.4
Glen Eira	2.1	1.6	0.8	0.4	1.3	7.5	0.4	1.6	3.4	0.4	0.2	0.0	1.1	1.0
Bayside	0.7	0.3	-0.1	-0.1	0.7	4.0	0.3	0.4	1.1	0.4	0.0	0.0	0.5	0.8
Kingston	3.4	2.0	0.5	0.1	0.8	9.3	0.2	0.8	2.1	0.5	0.0	0.0	1.7	1.3
Dandenong	6.7	5.0	0.9	0.3	1.5	12.4	0.6	0.7	1.8	0.4	0.2	0.1	1.6	3.1
Monash	7.2	5.4	3.1	0.5	2.9	13.0	0.8	2.9	5.4	0.9	0.4	0.1	1.7	2.3
Boroondara	1.7	1.6	2.2	0.2	3.3	9.0	0.7	1.7	2.7	0.6	0.2	0.0	0.5	0.7
Darebin - South	0.3	0.2	0.4	-0.1	2.0	2.3	0.1	0.3	0.5	0.1	0.0	0.0	0.1	0.2
Darebin - North	1.6	1.8	1.2	1.5	12.8	8.2	1.7	4.3	4.6	1.2	0.2	0.1	0.8	1.5
Moreland - North	0.0	0.4	0.1	0.4	2.9	3.1	0.6	0.8	1.1	0.4	0.1	0.0	0.0	0.3
Keilor	0.1	0.3	0.0	0.5	2.1	2.0	0.6	1.5	2.2	0.3	0.0	0.0	0.2	0.2
Brimbank	0.6	0.4	0.4	0.7	5.7	7.0	2.7	12.2	8.8	0.8	0.2	0.0	-0.1	0.6
Banyule	0.6	0.5	0.4	0.8	6.4	6.2	0.6	1.7	1.5	0.2	0.1	0.1	0.2	0.4
Manningham - West	0.2	0.5	0.7	0.6	1.7	6.2	0.3	0.3	0.5	0.1	-0.1	0.0	0.2	-0.1
Manningham - East	0.0	0.0	0.2	0.0	0.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
Whitehorse - West	1.4	1.1	0.5	0.4	2.4	6.9	0.5	2.0	2.2	0.4	0.2	0.2	0.6	0.5
Whitehorse - East	0.6	0.6	0.4	0.0	0.7	4.2	0.1	0.4	0.6	0.2	-0.1	0.0	0.3	0.2
Maroondah	0.9	0.7	2.0	0.1	1.2	6.4	0.2	0.4	0.7	0.1	0.1	0.0	0.5	0.4
Knox	1.2	0.6	1.4	-0.1	1.0	9.4	0.1	0.3	0.7	0.2	0.1	-0.1	0.7	0.5
Casey - North	10.4	4.2	0.4	0.1	0.4	8.2	0.1	0.2	1.1	0.4	0.0	0.0	0.6	1.2
Casey - South		5.3	0.1	0.0	0.7	17.7	0.2	0.3	0.7	0.3	0.2	0.0	1.7	7.0
Cardinia	5.4		0.5	0.2	0.4	12.8	0.1	0.2	0.4	0.2	0.0	0.0	0.4	2.2
Yarra Ranges	0.3	0.5		0.0	1.1	9.9	0.2	0.3	0.2	0.1	0.1	0.0	0.1	0.1
Nillumbik - Kinglake	0.0	0.2	0.0		2.3	2.8	0.1	0.2	0.2	0.3	-0.1	0.0	0.0	0.1
Whittlesea - Wallan	0.8	0.4	1.0	2.3		28.9	1.48	2.2	3.7	0.5	0.2	0.0	0.4	0.4
Tullamarine - Broadmeadows	16.2	11.9	9.2	2.7	28.5		2.1	5.5	9.2	11.6	6.1	0.7	17.4	12.0
Sunbury	0.2	0.1	0.2	0.1	1.5	2.3		1.1	1.2	0.1	0.1	0.0	0.1	0.2
Melton - Bacchus Marsh	0.3	0.1	0.2	0.2	2.1	5.4	1.1		7.6	0.3	-0.1	0.0	0.2	0.4
Wyndham	0.7	0.5	0.1	0.2	3.5	9.5	1.2	7.7		0.8	0.1	0.0	0.4	0.9

Source: ACIL Allen Consulting, 2014

Table C5 Roads – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Brisbane GCCSA

SA3 Origin / Destination	Brisbane Inner	Brisbane Inner - East	Brisbane Inner - North	Brisbane Inner - West	Bald Hills - Everton Park	Chermside	Nundah	Sandgate	Wynnum - Manly	Capalaba	Holland Park - Yeronga	Carindale	Mt Gravatt	Cleveland - Stradbroke	Nathan	Sunnybank	Rocklea - Acacia Ridge	Sherwood - Indooroopilly	Centenary	Kenmore - Brookfield - Moggill	The Gap - Enoggera	Springwood - Kingston	Loganlea - Carbrook	Beenleigh	Browns Plains	Jimboomba	Beaudesert	Ipswich Inner	Springfield - Redbank	Forest Lake - Oxley	Ipswich Hinterland	Ormeau - Oxenford	Strathpine	North Lakes	Hills District	Redcliffe	Narangba - Burpengary	Caboolture	Bribie - Beachmere
Brisbane Inner		12.7	28.3	17.3	6.0	16.4	24.0	5.8	16.6	12.1	23.4	12.5	15.1	9.8	10.8	5.7	13.4	14.0	5.5	11.8	14.1	9.9	7.8	3.6	7.5	5.9	1.6	8.1	8.0	10.3	7.8	6.4	4.7	4.8	15.2	3.9	4.0	2.8	1.8
Brisbane Inner - East	13.3		7.1	4.0	0.9	2.8	4.2	1.0	11.0	4.7	10.5	9.5	5.6	2.9	3.3	1.4	3.7	3.1	0.9	1.6	2.0	2.7	1.7	0.8	1.6	0.8	0.3	1.7	1.6	2.7	1.2	1.4	0.9	0.8	1.9	0.8	0.8	0.6	0.3
Brisbane Inner - North	28.2	6.9		18.5	8.9	29.4	31.4	9.5	10.3	5.8	12.1	6.2	7.0	4.8	5.0	2.7	7.2	10.7	4.1	7.8	17.1	4.8	3.4	1.7	3.5	2.5	0.7	5.7	5.1	6.3	4.8	3.5	6.7	6.1	17.6	5.4	5.6	3.9	2.1
Brisbane Inner - West	17.5	3.9	17.8		4.1	9.2	9.5	3.0	4.7	3.3	8.7	3.9	5.4	2.6	3.7	2.0	4.8	13.3	4.4	8.9	12.6	3.4	2.4	1.1	2.5	1.7	0.4	5.0	4.8	6.0	3.7	2.1	2.9	2.4	9.1	1.8	2.2	1.5	0.8
Bald Hills - Everton Park	6.1	0.9	9.1	4.2		15.7	8.2	7.9	1.5	0.8	2.0	0.8	1.2	0.6	0.8	0.3	1.0	2.2	0.7	1.1	6.7	0.7	0.5	0.2	0.5	0.2	0.1	0.8	0.8	1.1	0.6	0.4	7.6	4.5	12.0	3.0	2.9	2.1	0.8
Chermside	16.6	2.8	29.8	9.4	15.3		28.4	17.8	6.3	3.0	5.3	2.6	3.2	2.5	2.3	1.1	3.6	4.9	1.9	3.6	13.7	2.1	1.5	0.8	1.6	1.1	0.3	2.7	2.4	2.9	2.4	1.6	11.3	9.4	24.7	7.3	7.9	5.2	2.6
Nundah	23.9	4.3	31.9	9.7	8.1	28.3		16.1	14.5	6.3	7.8	4.5	5.5	6.6	3.7	2.3	7.4	6.7	2.8	4.7	8.9	4.7	3.5	2.0	3.7	2.3	1.1	5.8	4.0	4.9	4.6	5.2	8.4	8.2	14.6	9.6	8.1	6.4	3.5
Sandgate	5.8	1.1	9.7	3.0	7.8	18.1	16.4		2.7	1.3	2.1	1.2	1.3	1.0	0.8	0.4	1.1	1.8	0.6	0.9	3.6	0.9	0.6	0.3	0.6	0.3	0.1	0.7	0.6	0.9	0.5	0.6	10.1	8.0	9.4	9.7	5.4	3.7	1.5
Wynnum - Manly	16.5	11.1	10.1	4.6	1.5	6.2	14.1	2.6		24.1	11.56	17.4	13.7	12.6	6.0	3.2	10.6	3.7	1.2	1.7	2.6	9.0	5.3	2.4	5.0	2.4	0.8	3.3	3.2	5.8	2.2	5.7	3.3	1.9	3.3	2.7	2.5	2.0	0.8
Capalaba	12.3	4.7	5.8	3.3	0.8	3.0	6.2	1.3	24.2		8.5	11.0	13.2	32.2	4.6	2.8	5.6	3.2	1.0	1.2	1.5	8.3	5.2	2.2	3.5	1.7	0.5	1.7	1.6	3.0	1.4	3.8	1.0	0.9	1.5	1.1	0.9	0.8	0.4
Holland Park - Yeronga	24.0	10.5	12.3	8.7	2.0	5.3	7.7	2.1	11.5	8.5		14.3	18.5	6.4	13.5	5.4	12.9	9.7	3.6	5.3	4.9	7.9	5.1	2.4	5.4	3.3	0.9	6.2	6.6	9.7	4.8	4.2	1.9	1.7	5.2	1.4	1.6	1.1	0.6
Carindale	12.7	9.5	6.2	4.0	0.8	2.5	4.3	1.2	17.4	11.1	14.4		15.6	6.4	5.2	2.8	4.7	3.4	1.1	1.9	2.1	5.4	3.1	1.4	2.8	1.7	0.5	1.9	1.9	2.9	1.7	2.5	0.8	0.9	2.1	1.0	0.9	0.7	0.3
Mt Gravatt	15.5	5.7	7.2	5.4	1.2	3.2	5.2	1.3	13.8	13.1	18.8	15.6		10.7	15.8	13.7	16.9	5.5	3.0	3.0	3.0	21.8	10.1	4.3	9.2	5.1	1.2	4.8	5.1	8.6	4.2	6.6	1.1	1.0	3.1	1.1	1.1	0.8	0.4
Cleveland - Stradbroke	9.8	2.8	4.7	2.6	0.6	2.4	6.5	0.9	12.6	32.2	6.5	6.3	10.7		4.3	2.3	5.9	2.9	0.9	0.8	1.1	9.7	10.4	4.4	3.7	1.5	0.6	1.6	1.5	2.8	1.0	6.8	0.9	0.7	1.1	0.8	0.7	0.6	0.2
Nathan	10.9	3.3	5.0	3.7	0.8	2.3	3.7	0.8	6.0	4.6	13.6	5.2	15.8	4.3		7.1	17.0	6.5	3.2	3.2	2.0	7.5	4.0	1.9	6.7	3.7	1.0	5.3	5.9	9.9	4.3	3.2	0.9	0.7	2.2	0.7	0.8	0.6	0.3
Sunnybank	5.7	1.4	2.8	2.0	0.3	1.1	2.2	0.4	3.2	2.8	5.5	2.7	13.9	2.4	7.2		14.6	2.7	1.5	1.1	1.0	12.3	4.3	1.7	7.3	2.6	0.6	2.0	2.3	5.7	1.4	2.4	0.3	0.3	0.8	0.3	0.3	0.2	0.1
Rocklea - Acacia Ridge	13.4	3.7	7.2	4.8	1.0	3.6	7.2	1.1	10.6	5.7	13.0	4.6	17.0	5.9	17.1	14.7		8.7	5.4	4.3	2.6	18.9	8.9	3.8	25.0	9.0	2.4	10.4	12.4	24.9	7.5	6.8	1.9	0.9	2.8	1.2	1.3	1.0	0.4
Sherwood - Indooroopilly	13.9	3.0	10.2	13.2	2.1	4.7	6.5	1.8	3.7	3.2	9.6	3.4	5.5	2.8	6.4	2.7	8.6		9.0	17.0	5.8	3.5	2.1	1.1	3.6	2.9	0.7	7.7	8.4	14.3	6.0	2.0	1.8	1.7	5.7	1.2	1.8	1.2	0.7
Centenary	5.7	0.9	4.0	4.6	0.6	1.9	2.7	0.6	1.2	1.0	3.5	1.1	3.0	0.9	3.2	1.5	5.4	9.7		6.6	1.9	1.6	0.9	0.4	2.4	1.5	0.3	5.7	7.6	15.0	3.5	0.7	0.6	0.4	1.6	0.3	0.4	0.4	0.2
Kenmore - Brookfield - Moggill	11.7	1.5	7.6	9.0	1.1	3.5	4.6	0.9	1.7	1.1	5.3	1.8	3.0	0.8	3.3	1.1	4.3	17.6	6.6		4.1	1.6	0.8	0.3	1.7	0.8	0.2	7.4	4.5	7.7	2.6	0.6	1.1	0.7	2.4	0.5	0.5	0.5	0.1
The Gap - Enoggera	14.3	2.0	17.3	13.0	6.7	13.7	8.9	3.6	2.7	1.5	4.9	2.1	2.9	1.1	2.0	1.0	2.6	5.9	2.0	4.2		1.9	1.2	0.6	1.1	0.8	0.2	2.4	2.2	3.1	1.8	1.0	4.6	2.7	18.2	2.0	2.4	1.7	0.8
Springwood - Kingston	10.2	2.8	4.9	3.4	0.7	2.2	4.7	1.0	9.3	8.5	8.1	5.5	22.8	9.7	7.7	12.4	19.1	3.5	1.7	1.6	1.9		29.3	9.9	24.5	8.6	1.9	3.9	4.4	6.9	3.6	12.4	0.8	0.8	1.9	0.9	0.8	0.7	0.4
Loganlea - Carbrook	7.6	1.7	3.4	2.4	0.5	1.5	3.4	0.6	5.3	5.2	5.0	3.1	10.3	10.3	4.0	4.3	8.9	2.1	0.9	0.8	1.2	29.4		16.7	16.3	7.2	1.6	2.5	2.7	3.6	2.0	14.9	0.6	0.4	1.0	0.5	0.5	0.4	0.2
Beenleigh	3.6	0.8	1.6	1.1	0.2	0.8	2.0	0.3	2.5	2.2	2.3	1.4	4.3	4.4	1.9	1.8	3.8	1.1	0.4	0.3	0.6	9.9	16.8		6.8	4.7	1.3	1.2	1.2	1.7	0.9	16.8	0.2	0.2	0.4	0.2	0.2	0.2	0.1
Browns Plains	7.4	1.6	3.5	2.4	0.5	1.6	3.6	0.6	5.0	3.5	5.4	2.8	9.4	3.7	6.7	7.3	24.9	3.6	2.3	1.7	1.1	24.5	16.6	6.9		15.9	2.8	5.3	7.9	10.8	3.7	7.1	0.5	0.4	1.0	0.5	0.4	0.4	0.2
Jimboomba	5.8	0.8	2.4	1.7	0.2	1.1	2.2	0.3	2.3	1.7	3.3	1.7	5.1	1.5	3.7	2.6	8.9	2.9	1.5	0.8	0.8	8.6	7.2	4.7	15.9		4.8	4.2	6.2	5.3	1.8	6.4	0.3	0.2	0.4	0.3	0.1	0.2	0.1
Beaudesert	1.6	0.3	0.7	0.4	0.1	0.3	1.1	0.1	0.8	0.5	0.9	0.5	1.2	0.6	1.0	0.6	2.3	0.7	0.3	0.2	0.2	1.9	1.6	1.3	2.8	4.8		1.0	1.1	1.3	2.9	3.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0
Ipswich Inner	8.0	1.7	5.5	5.0	0.8	2.6	5.6	0.7	3.2	1.6	6.0	1.9	4.7	1.5	5.2	1.9	10.3	7.8	5.5	7.3	2.3	3.8	2.5	1.1	5.4	4.3	1.0		30.4	15.9	50.5	2.2	1.1	0.4	1.9	0.5	0.6	0.5	0.1
Springfield - Redbank	8.1	1.6	5.0	4.9	0.7	2.4	3.9	0.6	3.2	1.6	6.6	1.8	5.1	1.4	6.0	2.2	12.5	8.9	7.7	4.5	2.2	4.3	2.7	1.2	8.0	6.3	1.1	30.4		23.6	11.0	2.0	0.9	0.4	1.8	0.4	0.4	0.3	0.2
Forest Lake - Oxley	10.2	2.7	6.2	6.1	1.1	2.9	4.7	0.9	5.7	3.0	9.7	2.9	8.7	2.8	10.0	5.7	25.0	14.9	14.6	7.6	3.1	6.7	3.5	1.6	10.9	5.3	1.3	16.1	23.1		9.9	2.8	1.3	0.7	2.9	0.6	0.8	0.6	0.3
Ipswich Hinterland	7.6	1.2	4.7	3.6	0.6	2.4	4.5	0.5	2.2	1.4	4.7	1.6	4.1	1.0	4.2	1.4	7.4	6.0	3.4	2.6	1.8	3.5	2.0	0.9	3.7	1.8	2.9	50.5	10.9	9.8		2.1	1.0	0.5	1.3	0.5	0.5	0.9	0.2
Ormeau - Oxenford	6.3	1.4	3.5	2.1	0.4	1.6	5.2	0.6	5.8	3.8	4.1	2.5	6.7	6.8	3.2	2.4	6.8	2.0	0.7	0.6	1.0	12.4	14.8	16.6	6.9	6.4	3.0	2.2	2.0	2.8	2.2		0.6	0.4	0.9	0.6	0.5	0.5	0.2
Strathpine	4.7	0.9	6.8	2.9	7.7	11.7	8.7	10.4	3.4	1.0	1.9	0.9	1.1	0.9	0.9	0.3	2.0	1.9	0.6	1.1	4.6	0.9	0.6	0.2	0.5	0.3	0.1	1.1	0.9	1.3	1.0	0.6		15.7	23.8	7.2	10.1	5.7	2.3
North Lakes	4.9	0.8	6.1	2.4	4.5	9.4	8.1	8.2	1.9	0.9	1.6	0.9	1.0	0.7	0.7	0.3	0.9	1.7	0.4	0.7	2.7	0.7	0.4	0.2	0.4	0.2	0.0	0.4	0.4	0.7	0.5	0.4	15.7		9.1	13.6	16.5	9.1	2.8
Hills District	15.5	1.9	17.8	9.3	12.1	24.9	14.7	9.5	3.3	1.5	5.1	2.1	3.1	1.1	2.2	0.8	2.8	5.8	1.6	2.4	18.4	1.9	1.0	0.5	1.0	0.4	0.1	1.9	1.8	2.9	1.3	0.9	23.8	9.2		6.0	7.2	6.1	1.4
Redcliffe	3.9	0.8	5.5	1.8	3.1	7.5	9.5	9.8	2.7	1.1	1.4	1.0	1.1	0.8	0.7	0.3	1.2	1.2	0.3	0.6	2.0	0.9	0.5	0.2	0.5	0.3	0.1	0.5	0.4	0.6	0.5	0.6	7.2	13.6	6.0		14.4	7.3	2.6
Narangba - Burpengary	4.0	0.7	5.6	2.2	2.9	7.8	8.0	5.5	2.5	0.9	1.6	0.9	1.1	0.7	0.7	0.3	1.3	1.9	0.4	0.5	2.4	0.8	0.4	0.2	0.4	0.1	0.1	0.6	0.4	0.8	0.5	0.5	10.1	16.6	7.1	14.3		27.0	4.8
Caboolture	2.7	0.6	3.9	1.5	2.1	5.2	6.3	3.8	2.0	0.7	1.1	0.7	0.8	0.6	0.6	0.2	1.0	1.2	0.4	0.5	1.7	0.7	0.4	0.2	0.4	0.2	0.1	0.5	0.3	0.6	0.9	0.5	5.8	9.3	6.1	7.2	27.3		15.8
Bribie - Beachmere	1.6	0.3	2.1	0.8	0.8	2.5	3.4	1.5	0.8	0.4	0.6	0.3	0.4	0.2	0.3	0.1	0.4	0.7	0.2	0.1	0.8	0.3	0.2	0.1	0.2	0.1	0.0	0.1	0.2	0.3	0.2	0.2	2.2	2.8	1.4	2.5	4.7	15.9	

Source: ACIL Allen Consulting, 2014

Table C6 **Public Transport – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Brisbane GCCSA**

SA3 Origin / Destination	Brisbane Inner	Brisbane Inner - East	Brisbane Inner - North	Brisbane Inner - West	Bald Hills - Everton Park	Chermside	Nundah	Sandgate	Wynnum - Manly	Capalaba	Holland Park - Yeronga	Carindale	Mt Gravatt	Cleveland - Stradbroke	Nathan	Sunnybank	Rocklea - Acacia Ridge	Sherwood - Indooroopilly	Centenary	Kenmore - Brookfield - Moggill	The Gap - Enoggera	Springwood - Kingston	Loganlea - Carbrook	Beenleigh	Browns Plains	Jimboomba	Beaudesert	Ipswich Inner	Springfield - Redbank	Forest Lake - Oxley	Ipswich Hinterland	Ormeau - Oxenford	Strathpine	North Lakes	Hills District	Redcliffe	Narangba - Burpengary	Caboolture	Bribie - Beachmere
Brisbane Inner		6.4	9.3	5.8	3.4	6.8	3.8	4.0	6.5	4.6	8.5	8.0	8.9	6.9	5.2	5.0	7.2	5.7	4.1	8.1	6.0	4.0	3.0	1.4	4.3	0.7	0.1	3.6	2.9	5.5	1.6	2.4	2.1	2.4	6.3	2.0	2.8	1.6	0.8
Brisbane Inner - East	6.4	-	0.4	0.2	0.0	0.0	0.1	0.0	0.2	0.1	0.3	0.3	0.2	0.3	0.1	0.0	0.1	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brisbane Inner - North	8.9	0.3	-	0.9	0.4	1.4	0.6	0.6	0.4	0.2	0.7	0.3	0.4	1.1	0.3	0.2	0.3	0.9	0.2	0.3	0.6	0.2	0.2	0.1	0.1	0.0	0.0	0.2	0.2	0.4	0.1	0.1	0.3	0.3	0.6	0.2	0.3	0.2	0.1
Brisbane Inner - West	6.0	0.2	0.9	-	0.2	0.5	0.3	0.2	0.1	0.1	0.4	0.2	0.3	0.5	0.2	0.2	0.1	1.1	0.4	0.7	0.5	0.1	0.1	0.0	0.1	0.0	0.0	0.2	0.2	0.3	0.0	0.1	0.1	0.1	0.2	0.0	0.1	0.1	0.0
Bald Hills - Everton Park	3.8	0.0	0.5	0.2	-	0.4	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.0	0.0	0.5	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0
Chermside	7.0	0.1	1.5	0.5	0.4	-	0.4	0.5	0.1	0.0	0.2	0.1	0.2	0.5	0.1	0.0	0.1	0.6	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.4	0.1	0.1	0.0	0.0
Nundah	3.8	0.1	0.6	0.3	0.1	0.4	-	0.3	0.1	0.1	0.2	0.1	0.2	0.9	0.1	0.1	0.1	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Sandgate	4.2	0.0	0.7	0.2	0.2	0.6	0.3	-	0.1	0.0	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.2	0.1	0.1	0.0
Wynnum - Manly	6.2	0.2	0.4	0.1	0.0	0.1	0.1	0.0	-	0.2	0.23	0.3	0.3	0.7	0.2	0.1	0.1	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capalaba	4.5	0.1	0.2	0.1	0.0	0.0	0.1	0.0	0.2	-	0.2	0.2	0.3	1.7	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holland Park - Yeronga	8.8	0.3	0.6	0.4	0.1	0.2	0.2	0.1	0.3	0.2	-	0.7	0.9	0.9	0.5	0.3	0.4	0.5	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Carindale	8.1	0.3	0.4	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.7	-	0.6	1.0	0.3	0.1	0.1	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mt Gravatt	9.2	0.2	0.4	0.4	0.1	0.2	0.2	0.1	0.4	0.3	0.9	0.6	-	1.4	0.7	0.6	0.7	0.5	0.1	0.1	0.1	0.6	0.2	0.1	0.4	0.0	0.0	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Cleveland - Stradbroke	7.1	0.2	1.1	0.6	0.2	0.6	1.0	0.2	0.7	1.8	1.1	0.9	1.4	-	0.6	0.2	0.5	1.3	0.1	0.2	0.3	0.5	0.6	0.2	0.3	0.0	0.0	0.4	0.2	0.3	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.0
Nathan	5.3	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.2	0.8	0.7	-	0.3	0.4	0.3	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Sunnybank	5.1	0.0	0.2	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.3	0.1	0.7	0.2	0.3	-	0.4	0.5	0.0	0.0	0.1	0.2	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rocklea - Acacia Ridge	7.5	0.1	0.3	0.2	0.0	0.1	0.1	0.0	0.1	0.0	0.4	0.1	0.7	0.5	0.5	0.4	-	0.6	0.1	0.0	0.0	0.2	0.1	0.0	0.3	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sherwood - Indooroopilly	5.7	0.4	0.9	1.0	0.4	0.6	0.4	0.3	0.4	0.5	0.5	0.4	0.6	1.4	0.3	0.5	0.7	-	0.9	1.5	0.5	0.4	0.3	0.1	0.5	0.1	0.0	0.7	0.7	1.2	0.3	0.3	0.4	0.4	0.7	0.3	0.5	0.3	0.1
Centenary	4.1	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	1.0	-	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kenmore - Brookfield - Moggill	8.3	0.0	0.4	0.9	0.0	0.1	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.2	0.1	0.0	0.1	1.6	0.1	-	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
The Gap - Enoggera	6.3	0.1	0.7	0.6	0.1	0.3	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.3	0.1	0.0	0.0	0.6	0.0	0.1	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Springwood - Kingston	4.4	0.0	0.2	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.6	0.6	0.3	0.2	0.2	0.4	0.0	0.0	0.1	-	0.5	0.1	0.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loganlea - Carbrook	3.4	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.4	0.6	0.2	0.1	0.1	0.3	0.0	0.0	0.0	0.6	-	0.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beenleigh	1.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Browns Plains	4.5	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.3	0.2	0.2	0.4	0.5	0.0	0.0	0.0	0.5	0.5	0.0	-	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jimboomba	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beaudesert	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ipswich Inner	3.6	0.0	0.3	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.1	0.0	0.0	0.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Springfield - Redbank	3.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	-	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forest Lake - Oxley	5.8	0.0	0.3	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.4	0.1	0.3	0.5	0.3	0.1	0.3	1.2	0.3	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.2	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ipswich Hinterland	1.8	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ormeau - Oxenford	2.5	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Strathpine	2.1	0.0	0.2	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.2	0.2	0.1	0.1	0.1	0.0
North Lakes	2.4	0.0	0.2	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-	0.0	0.3	0.1	0.1	0.0
Hills District	6.4	0.0	0.6	0.3	0.2	0.4	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	0.8	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	-	0.1	0.0	0.0	0.0
Redcliffe	2.0	0.0	0.2	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	-	0.3	0.1	0.0
Narangba - Burpengary	2.7	0.0	0.3	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2	-	0.3	0.0
Caboolture	1.7	0.0	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.3	-	0.3
Bribie - Beachmere	0.9	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	-

Source: ACIL Allen Consulting, 2014

Table C7 Roads – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Perth GCCSA

SA3 Origin / Destination	Cottesloe - Claremont	Perth City	Bayswater - Bassendean	Mundaring	Swan	Joondalup	Stirling	Wanneroo	Armadale	Belmont - Victoria Park	Canning	Gosnells	Kalamunda	Serpentine - Jarrahdale	South Perth	Cockburn	Fremantle	Kwinana	Melville	Rockingham	Bunbury	Mandurah	Wheat Belt - South	Wheat Belt - North
Cottesloe - Claremont		74.3	9.3	4.8	28.1	20.1	41.9	46.3	9.0	27.9	19.0	13.5	5.2	5.4	9.5	25.4	31.9	6.6	19.1	11.2	0.3	5.2	0.4	4.0
Perth City	72.6		70.4	27.1	180.6	80.5	189.2	163.2	36.6	182.0	95.5	66.9	35.0	17.3	57.3	66.9	34.5	17.4	60.1	23.3	3.4	12.4	2.6	24.6
Bayswater - Bassendean	9.1	70.2		13.2	135.4	18.9	47.2	51.6	15.1	56.4	27.4	24.8	15.1	6.5	8.1	10.9	6.3	3.9	8.9	5.2	1.9	3.2	1.1	9.2
Mundaring	4.5	26.3	12.7		70.5	7.9	17.1	13.0	7.0	22.0	16.9	12.0	10.6	2.3	2.8	6.2	2.7	1.8	4.2	2.8	0.5	1.7	0.3	5.3
Swan	27.3	175.7	133.0	71.6		98.3	167.1	201.8	38.6	135.8	88.1	64.2	54.4	15.2	18.6	31.5	16.4	10.3	26.0	14.3	6.3	9.2	4.1	38.9
Joondalup	19.5	79.7	18.6	8.0	98.8		116.8	536.6	7.3	39.5	22.2	12.9	6.5	3.5	8.6	14.7	11.1	4.4	12.4	6.0	0.6	3.7	0.6	12.5
Stirling	44.2	197.1	48.8	17.8	172.4	121.9		256.7	22.5	79.2	47.6	34.9	16.8	10.8	21.3	37.7	22.9	11.9	28.8	17.2	2.8	10.0	2.1	18.5
Wanneroo	45.1	162.2	50.2	12.9	199.1	521.7	249.6		10.8	105.6	50.0	21.3	13.0	4.6	15.5	24.0	22.2	6.6	26.0	8.6	2.7	4.9	1.5	36.5
Armadale	8.8	36.6	14.8	7.2	38.6	7.2	21.8	10.8		47.1	68.88	132.9	22.3	49.1	7.9	45.8	13.9	16.1	24.0	23.3	0.8	13.3	1.8	4.1
Belmont - Victoria Park	27.9	183.4	59.0	23.5	142.4	39.7	77.7	107.0	48.3		97.7	81.5	35.1	21.9	32.5	45.5	23.3	18.6	32.6	39.0	5.7	34.0	4.4	21.4
Canning	19.0	95.8	28.1	18.0	91.2	22.2	46.4	51.1	70.3	96.7		147.6	35.4	31.3	28.4	78.8	26.8	25.5	52.0	37.1	5.8	20.3	3.8	18.3
Gosnells	13.2	66.7	24.5	12.6	65.0	12.8	33.6	21.4	132.7	79.4	145.6		39.6	31.4	15.9	59.0	19.2	17.0	36.7	23.9	2.0	13.1	2.3	8.1
Kalamunda	4.9	34.0	14.9	11.4	55.4	6.4	16.0	13.2	22.0	34.0	34.7	38.8		6.7	4.4	12.7	5.0	4.1	7.0	5.9	1.5	3.4	0.8	4.7
Serpentine - Jarrahdale	5.2	17.4	6.4	2.3	15.1	3.4	10.6	4.6	49.5	21.4	30.6	31.0	6.7		3.6	23.3	8.0	17.4	13.0	36.0	0.6	20.7	1.3	1.4
South Perth	9.6	57.4	8.2	3.0	19.1	8.5	20.3	15.7	8.1	32.4	27.9	16.1	4.4	3.6		15.5	6.5	4.7	16.7	6.6	0.1	3.1	0.1	2.0
Cockburn	25.4	68.6	11.1	6.7	32.6	14.9	37.1	24.8	49.0	46.9	85.8	63.0	13.5	24.7	16.5		64.1	54.8	76.3	77.2	3.9	28.1	2.8	10.3
Fremantle	31.5	35.3	6.4	2.9	16.7	11.3	22.6	23.2	14.3	23.4	27.2	19.6	5.0	8.3	6.6	63.7		16.6	28.5	26.2	2.4	9.9	1.4	5.6
Kwinana	6.6	18.0	4.0	1.9	10.5	4.4	12.1	6.6	16.8	19.1	26.6	17.5	4.2	18.2	4.8	53.2	16.6		19.0	98.1	2.6	28.7	1.8	6.2
Melville	18.9	59.7	8.9	4.5	26.6	12.5	27.5	26.7	24.3	32.5	52.1	36.9	7.1	13.2	17.4	70.0	27.8	18.5		28.1	0.9	13.4	1.0	4.2
Rockingham	11.1	24.0	5.2	2.9	14.6	5.9	17.7	8.4	23.3	39.7	38.0	23.9	5.9	36.5	6.5	74.0	25.7	93.7	28.1		1.7	170.3	2.2	3.1
Bunbury	0.3	3.4	2.0	0.5	6.3	0.6	2.8	2.7	0.8	5.8	5.9	2.0	1.5	0.6	0.1	3.9	2.4	2.6	0.9	1.7		8.0	0.3	0.9
Mandurah	5.1	12.7	3.2	1.8	9.4	3.7	10.4	4.8	13.0	34.4	20.6	13.0	3.4	20.5	3.2	27.0	9.8	27.0	13.4	165.6	8.0		7.6	4.0
Wheat Belt - South	0.4	2.7	1.1	0.3	4.1	0.6	2.1	1.5	1.8	4.4	3.8	2.3	0.8	1.3	0.1	2.7	1.4	1.8	1.0	2.1	0.2	7.6		0.8
Wheat Belt - North	3.8	23.6	8.6	5.1	37.1	11.7	17.5	35.9	4.0	20.2	17.4	7.8	4.5	1.4	1.9	9.8	5.5	6.0	4.0	3.0	0.8	4.0	0.8	

Source: ACIL Allen Consulting, 2014

Table C8 **Public Transport – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Perth GCCSA**

SA3 Origin / Destination	Cottesloe - Claremont	Perth City	Bayswater - Bassendean	Mundaring	Swan	Joondalup	Stirling	Wanneroo	Armadale	Belmont - Victoria Park	Canning	Gosnells	Kalamunda	Serpentine - Jarrahdale	South Perth	Cockburn	Fremantle	Kwinana	Melville	Rockingham	Bunbury	Mandurah	Wheat Belt - South	Wheat Belt - North
Cottesloe - Claremont		10.0	0.5	0.4	1.5	1.1	1.7	5.2	1.0	0.9	0.7	0.8	0.4	0.5	0.3	1.7	1.1	0.9	0.7	2.6	0.0	1.8	0.0	0.1
Perth City	10.2		7.3	4.8	24.1	16.5	17.5	58.5	14.0	14.5	13.5	15.0	5.4	6.5	6.6	18.2	7.4	8.1	8.1	21.5	0.2	14.1	0.3	2.0
Bayswater - Bassendean	0.4	7.0		0.2	2.5	0.4	0.8	2.5	0.5	0.7	1.0	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	1.1	0.0	0.6	0.0	0.0
Mundaring	0.3	4.6	0.1		0.8	0.2	0.1	0.2	0.1	0.1	0.4	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
Swan	1.3	24.2	3.2	0.9		1.8	1.8	4.5	0.6	1.1	2.6	0.7	0.5	0.2	0.3	0.4	0.5	0.5	0.8	1.6	0.0	1.3	0.0	0.1
Joondalup	1.0	17.6	0.5	0.2	1.6		2.6	19.0	1.0	1.1	1.6	1.0	0.2	0.4	0.4	1.1	0.6	0.9	1.0	2.2	0.0	1.7	0.0	0.1
Stirling	1.7	18.9	0.9	0.2	1.5	2.3		10.3	1.0	0.9	1.6	0.9	0.1	0.5	0.3	1.0	0.7	0.9	0.9	3.0	0.0	2.4	0.0	0.0
Wanneroo	4.6	57.3	2.2	0.2	4.2	19.8	9.3		1.6	5.1	7.0	2.1	0.3	0.1	1.4	2.5	2.6	0.9	3.9	2.2	0.0	1.5	0.0	0.1
Armadale	1.0	13.3	0.5	0.1	0.8	0.9	0.9	2.0		0.6	2.38	1.5	0.2	1.0	0.2	0.5	0.4	0.2	0.7	0.5	0.0	0.5	0.0	0.0
Belmont - Victoria Park	0.8	15.3	0.8	0.1	1.1	0.9	1.0	5.6	1.1		2.5	1.0	0.4	0.3	0.6	0.6	0.6	0.6	0.7	2.4	0.0	2.0	0.0	0.0
Canning	0.8	13.1	1.1	0.3	2.4	1.6	1.3	7.5	2.3	2.4		3.3	0.9	1.0	1.0	2.6	0.7	1.6	1.9	4.9	0.1	3.8	0.0	0.1
Gosnells	0.7	15.4	0.5	0.0	0.8	1.1	0.5	2.2	1.6	1.1	3.6		0.3	0.4	0.3	0.8	0.5	0.4	1.7	1.0	0.0	0.7	0.0	0.0
Kalamunda	0.3	5.4	0.1	0.2	0.6	0.1	0.1	0.4	0.3	0.7	1.0	0.3		0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0
Serpentine - Jarrahdale	0.5	6.2	0.2	0.0	0.2	0.4	0.3	0.2	1.6	0.3	1.0	0.4	0.0		0.0	0.1	0.2	0.1	0.4	0.1	0.0	0.0	0.0	0.0
South Perth	0.1	5.8	0.2	0.0	0.3	0.2	0.2	1.2	0.2	0.6	1.1	0.4	0.0	0.1		0.4	0.2	0.3	0.4	0.7	0.0	0.5	0.0	0.0
Cockburn	1.4	15.7	0.4	0.0	0.5	1.1	0.7	2.3	0.4	0.7	2.7	0.7	0.0	0.1	0.3		2.6	1.0	2.7	2.1	0.0	1.3	0.0	0.0
Fremantle	1.1	6.2	0.2	0.1	0.5	0.6	0.6	2.5	0.4	0.4	0.7	0.3	0.0	0.3	0.3	2.3		0.8	0.8	2.0	0.0	1.5	0.0	0.0
Kwinana	0.8	7.1	0.3	0.0	0.4	0.7	0.8	0.9	0.4	0.7	1.3	0.4	0.0	0.1	0.2	1.1	0.7		0.9	1.8	0.0	0.7	0.0	0.0
Melville	0.6	5.9	0.2	0.1	0.8	0.9	0.6	3.7	0.6	0.6	1.9	1.3	0.1	0.3	0.3	2.3	0.8	0.9		3.0	0.0	2.3	0.0	0.1
Rockingham	2.6	20.2	0.9	0.1	1.5	2.3	2.5	1.9	0.7	1.9	4.5	0.8	0.1	0.2	0.6	1.9	1.9	2.0	2.7		0.0	4.8	0.0	0.0
Bunbury	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Mandurah	1.9	13.5	0.7	0.0	1.0	1.8	2.0	1.4	0.6	2.0	3.4	0.6	0.0	0.1	0.4	1.1	1.0	0.7	2.2	4.6	0.0		0.0	0.1
Wheat Belt - South	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Wheat Belt - North	0.2	1.6	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Source: ACIL Allen Consulting, 2014

Table C9 Roads – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Adelaide GCCSA

SA3 Origin / Destination	Adelaide City	Adelaide Hills	Burnside	Campbelltown (SA)	Norwood - Payneham - St Peters	Prospect - Walkerville	Unley	Gawler - Two Wells	Playford	Port Adelaide - East	Salisbury	Tea Tree Gully	Holdfast Bay	Marion	Mitcham	Onkaparinga	Charles Sturt	Port Adelaide - West	West Torrens	Fleurieu - Kangaroo Island	Barossa	Lower North	Yorke Peninsula	Murray and Mallee
Adelaide City		32.4	15.8	14.2	17.8	12.3	17.8	4.2	45.6	20.3	20.4	12.6	8.1	21.3	20.9	25.9	42.4	18.8	50.5	7.5	10.2	1.7	0.7	4.9
Adelaide Hills	31.4		5.3	3.5	6.9	1.7	6.5	1.6	6.4	3.6	4.3	5.4	2.9	7.9	8.7	10.1	6.8	4.1	14.3	9.6	3.1	0.1	0.1	6.2
Burnside	16.3	5.3		4.3	6.2	1.2	4.5	0.7	4.7	1.8	1.3	2.1	1.0	3.1	3.6	2.7	4.3	1.7	7.7	0.6	1.5	0.1	0.2	0.4
Campbelltown (SA)	13.9	3.5	4.2		7.2	0.8	2.3	0.8	6.3	0.9	1.0	5.0	0.6	1.8	1.8	1.5	3.2	1.4	6.3	0.5	2.1	0.1	0.1	0.4
Norwood - Payneham - St Peters	18.2	7.0	6.1	7.2		2.2	4.7	1.1	10.4	3.6	3.0	3.8	1.1	3.6	3.7	3.8	6.2	2.7	9.6	1.0	3.1	0.4	0.0	0.8
Prospect - Walkerville	12.4	1.8	1.2	0.8	2.2		2.1	1.1	8.5	6.4	5.2	2.2	0.8	2.0	1.6	1.7	7.6	3.8	6.8	0.4	2.0	0.3	0.1	0.3
Unley	18.5	6.7	4.6	2.4	4.8	2.1		0.7	6.7	3.0	3.0	2.1	2.6	8.1	8.6	6.3	7.8	3.0	13.9	1.2	2.1	0.3	0.1	0.7
Gawler - Two Wells	4.2	1.6	0.7	0.8	1.1	1.0	0.7		56.9	3.9	15.1	6.5	0.4	0.8	0.6	0.4	3.4	4.1	5.5	0.3	28.3	2.5	0.2	1.2
Playford	44.3	6.3	4.5	6.1	9.9	8.1	6.5	56.7		28.5	122.26	41.4	3.1	6.2	5.5	4.4	26.8	31.8	26.6	0.7	39.1	5.6	0.8	2.3
Port Adelaide - East	19.9	3.7	1.8	1.0	3.6	6.5	2.9	4.1	30.0		21.8	13.5	1.0	3.3	2.4	3.3	13.1	10.8	11.0	0.6	6.7	0.9	0.3	0.8
Salisbury	19.7	4.4	1.3	1.0	2.9	5.0	2.9	16.0	125.0	21.3		30.8	1.4	3.3	2.6	3.1	15.5	18.7	14.0	0.8	20.2	2.1	0.4	1.0
Tea Tree Gully	11.9	5.5	2.1	5.0	3.7	2.1	2.0	6.9	43.4	13.3	31.1		0.7	1.9	1.5	1.6	8.1	7.8	9.1	0.5	9.9	1.0	0.3	1.2
Holdfast Bay	8.2	3.0	1.0	0.6	1.1	0.8	2.6	0.4	3.3	1.0	1.4	0.7		15.2	6.1	9.6	6.4	2.3	10.9	1.1	1.1	0.0	0.1	0.4
Marion	20.7	7.9	2.9	1.8	3.5	1.9	7.6	0.8	6.4	3.3	3.3	2.0	14.7		23.5	38.3	12.2	4.9	24.8	4.0	2.1	0.4	0.0	1.2
Mitcham	20.6	8.7	3.6	1.8	3.8	1.6	8.4	0.6	5.6	2.4	2.6	1.5	6.0	25.0		18.1	7.2	2.9	15.2	3.3	1.9	0.2	0.2	1.2
Onkaparinga	25.3	10.2	2.7	1.4	3.8	1.6	6.2	0.4	4.5	3.3	3.1	1.5	9.5	38.2	19.3		11.2	5.7	26.1	15.4	1.8	0.3	0.1	1.4
Charles Sturt	43.0	7.1	4.4	3.3	6.3	7.8	7.8	3.6	28.4	13.4	16.1	8.5	6.4	12.5	7.3	11.5		27.0	40.3	2.0	7.5	1.2	0.4	1.0
Port Adelaide - West	18.8	4.2	1.7	1.4	2.7	3.9	3.0	4.3	33.3	10.9	19.3	8.0	2.3	5.0	3.0	5.8	27.1		14.7	1.0	7.6	1.1	0.2	0.8
West Torrens	50.9	14.4	7.6	6.4	9.6	6.9	13.7	5.6	27.3	11.0	14.2	9.2	10.8	25.2	15.3	26.0	39.8	14.4		6.9	9.7	2.5	2.3	5.7
Fleurieu - Kangaroo Island	7.3	9.6	0.6	0.5	1.0	0.3	1.1	0.3	0.7	0.6	0.8	0.5	1.1	3.9	3.4	15.2	1.9	1.0	6.9		0.3	0.1	0.0	1.7
Barossa	10.0	3.0	1.4	2.0	3.0	1.9	2.0	28.9	39.0	6.4	19.3	9.5	1.1	2.0	1.9	1.8	7.0	7.3	9.6	0.3		6.0	0.3	3.8
Lower North	1.7	0.1	0.1	0.1	0.3	0.3	0.3	2.5	5.5	0.8	2.0	0.9	0.0	0.4	0.2	0.3	1.1	1.1	2.4	0.1	6.0		2.1	0.2
Yorke Peninsula	0.7	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.8	0.2	0.4	0.3	0.1	0.0	0.2	0.1	0.4	0.2	2.3	0.0	0.2	2.1		0.0
Murray and Mallee	4.8	6.2	0.4	0.4	0.8	0.3	0.7	1.2	2.3	0.7	1.0	1.2	0.4	1.2	1.2	1.4	0.9	0.8	5.8	1.7	3.8	0.2	0.0	

Source: ACIL Allen Consulting, 2014

Table C10 **Public Transport – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Adelaide GCCSA**

SA3 Origin / Destination	Adelaide City	Adelaide Hills	Burnside	Campbelltown (SA)	Norwood - Payneham - St Peters	Prospect - Walkerville	Unley	Gawler - Two Wells	Playford	Port Adelaide - East	Salisbury	Tea Tree Gully	Holdfast Bay	Marion	Mitcham	Onkaparinga	Charles Sturt	Port Adelaide - West	West Torrens	Fleurieu - Kangaroo Island	Barossa	Lower North	Yorke Peninsula	Murray and Mallee
Adelaide City		6.9	3.9	4.7	3.4	2.9	3.4	2.6	7.2	5.4	6.0	6.0	2.6	5.7	4.6	8.4	9.7	3.5	6.9	0.8	3.6	0.5	0.0	0.5
Adelaide Hills	7.6		0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Burnside	3.6	0.0		0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Campbelltown (SA)	4.5	0.1	0.0		0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Norwood - Payneham - St Peters	3.0	0.0	0.0	0.0		0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Prospect - Walkerville	2.6	0.0	0.0	0.0	0.1		0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Unley	2.8	0.0	0.0	0.1	0.1	0.1		0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Gawler - Two Wells	2.5	0.0	0.0	0.0	0.0	0.0	0.1		0.4	0.0	0.3	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Playford	7.3	0.0	0.0	0.2	0.1	0.0	0.1	0.3		0.3	1.43	0.4	0.0	0.1	0.2	0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0
Port Adelaide - East	5.2	0.1	0.1	0.0	0.1	0.2	0.1	0.0	0.2		0.3	0.1	0.0	0.1	0.2	0.0	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Salisbury	6.6	0.1	0.0	0.1	0.0	0.2	0.0	0.2	0.9	0.5		0.3	0.0	0.1	0.1	0.0	0.1	0.3	0.1	0.0	0.1	0.0	0.0	0.0
Tea Tree Gully	5.9	0.0	0.1	0.2	0.0	0.1	0.1	0.1	0.4	0.2	0.4		0.0	0.1	0.2	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0
Holdfast Bay	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.2	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Marion	5.8	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.3		0.7	0.6	0.2	0.1	0.3	0.0	0.1	0.0	0.0	0.0
Mitcham	4.3	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.1	0.2	0.6		1.0	0.2	0.0	0.2	0.1	0.1	0.0	0.0	0.1
Onkaparinga	9.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.7	1.1		0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Charles Sturt	8.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.1		0.4	0.3	0.0	0.0	0.0	0.0	0.0
Port Adelaide - West	3.3	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.4		0.1	0.0	0.1	0.0	0.0	0.0
West Torrens	6.6	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.2	0.2	0.1	0.4	0.2		0.0	0.0	0.0	0.0	0.0
Fleurieu - Kangaroo Island	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Barossa	3.4	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0		0.0	0.0	0.0
Lower North	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Yorke Peninsula	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Murray and Mallee	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Source: ACIL Allen Consulting, 2014

Table C11 **Roads – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Canberra GCCSA**

SA3 Origin / Destination	North Canberra	South Canberra	Belconnen	Gungahlin	Woden	Weston Creek	Tuggeranong	Cotter - Namadgi	Fyshwick - Pialligo - Hume
North Canberra		25.3	28.8	40.1	7.5	3.4	11.6	36.9	10.8
South Canberra	26.7		11.7	12.5	7.5	2.8	9.3	17.8	9.5
Belconnen	33.0	13.0		27.2	4.2	2.0	4.2	37.4	7.2
Gungahlin	70.0	13.7	27.6		6.0	2.4	6.8	15.2	11.0
Woden	7.6	7.4	3.7	5.6		1.2	4.5	10.9	3.4
Weston Creek	3.6	2.9	1.8	2.3	1.3		1.2	5.9	0.8
Tuggeranong	12.9	9.9	4.5	6.6	4.9	1.4		10.9	3.8
Cotter - Namadgi	40.2	19.3	40.3	15.1	11.6	6.3	11.1		9.3
Fyshwick - Pialligo - Hume	10.9	9.6	6.5	10.3	3.4	0.7	3.6	8.8	

Source: ACIL Allen Consulting, 2014

Table C12 **Public Transport – GCCSA origin-destination pairs – increases in DEC 2010-11 to 2030-31 $millions – Canberra GCCSA**

SA3 Origin / Destination	North Canberra	South Canberra	Belconnen	Gungahlin	Woden	Weston Creek	Tuggeranong	Cotter - Namadgi	Fyshwick - Pialligo - Hume
North Canberra		4.6	14.3	30.2	2.5	0.6	3.5	9.1	0.4
South Canberra	4.8		1.9	3.6	0.8	0.1	1.2	1.5	0.4
Belconnen	14.1	1.9		13.7	1.5	0.2	0.2	5.9	0.6
Gungahlin	31.0	3.7	13.4		1.2	0.0	1.0	0.4	1.3
Woden	2.4	0.8	1.4	1.1		0.1	0.7	1.2	0.1
Weston Creek	0.7	0.2	0.2	0.0	0.1		0.1	1.0	0.1
Tuggeranong	3.3	1.3	0.3	0.9	0.7	0.0		0.4	0.1
Cotter - Namadgi	9.1	1.4	6.2	0.4	1.2	1.0	0.4		0.2
Fyshwick - Pialligo - Hume	0.4	0.3	0.5	1.3	0.1	0.1	0.1	0.2	

Source: ACIL Allen Consulting, 2014