Veitch Lister Consulting Pty Ltd

IN ASSOCIATION WITH

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GREATER ADELAIDE TRAVEL MODELLING REPORT

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PREPARED FOR

Infrastructure Australia

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Greater Adelaide – Travel modelling report

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1. Introduction

1.1 Background

In April 2014 Veitch Lister Consulting (VLC) was commissioned by Infrastructure Australia (IA) to produce travel demand forecasts and transport network performance assessments for Adelaide and its associated regions for 2011 and 2031. This document presents the results of this work.

The 2031 travel predictions and transport network performance assessments have been produced for a low transport investment scenario - i.e. the transport networks (road and public transport) used in the modelling only included current transport network infrastructure and services, supplemented by committed and "highly likely" transport network enhancements.

The travel predictions and transport system performance measures presented in this report have been generated using VLC's Zenith model - a four-step multimodal model encompassing the entire region. The area modelled encompasses Adelaide and incorporates Fleurieu Peninsula – Kangaroo Island, the Barossa, the Lower North, Yorke Peninsula and Murray & Mallee Regions.

1.2 Purpose of this investigation

The primary purpose of this consulting commission is to provide input to the Australian Infrastructure Audit (AIA) being conducted by Infrastructure Australia, by:

a) robustly predicting the scale of travel increase in the entire region, where it is likely to occur and the modes of travel that will be chosen;
b) assessing the degree to which the performance of the transport network will deteriorate by 2031 under a *low transport investment* scenario - including identification of those elements of the road network that will, by 2031, be generating large economic costs due to congestion, and sections of the rail network that will be subject to severe over-crowding; and
c) providing travel and transport system performance data suitable for input to the ACIL Allen Tasman economic model of the region.

1.3 Structure of report

The balance of the report is structured as follows:

Section 2: Land use assumptions used in the modelling

Section 3: Assumed 2031 base case transport networks

Section 4: Other modelling assumptions

Section 5: Methodology

Section 6: Travel demand increase in Adelaide and associated regions 2011-2031

Section 7: Road network performance

Section 8: Public transport system performance

2. Land use assumptions

Land use and transport system operation are linked by complex, yet identifiable relationships which are investigated through transport modelling activities. It is crucial therefore to utilise the most current, rigorous land use dataset available to underpin the traffic modelling.

In this section, we outline the land use and demographic variables underpinning travel behaviour within the region, and describe the application of land use projections developed by VLC for the purpose of forecasting travel demand and the performance of the transport network within the region.

2.1 Demographic dataset development

VLC has developed a current baseline demographic dataset to underpin traffic forecasting for this project. This dataset contains population, employment, education enrolment and visitor data for a base year of 2011 and future year 2031 appropriate for input into VLC's Zenith model. This demographic dataset developed as a result of this project contains the most current and rigorous small area demographic projections which form an essential input into transport modelling and traffic forecasting.

Datasets used as inputs in the development of the baseline demographic dataset include, but are not limited to:

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

Development has also included advice from local governments in relation to current planning intentions and expectations in the region.

2.1.1 Base year (2011) data development

Base year data has been derived from the 2011 Census of Population and Housing. Population variables have been derived from Estimated Resident Population data, rebased to the 2011 Census. Base year employment has been derived from Place of Work DZN data, with adjustments made to account for Census under-reporting, and "Not Stated" responses.

Enrolment data has been obtained from The Australian Curriculum, Assessment and Reporting Authority (ACARA), as well as contact with various primary, secondary and tertiary institutions to confirm enrolment figures, and associated employment. Visitor data, both domestic and international, has been obtained from the 2011 Census of Population and Housing.

2.1.2 Baseline dataset future year land use projection development

Future year projections for the baseline demographic in the various regions' datasets have been developed using the ABS Series B population projections. The population dataset is constrained to Department of Planning and Environment projections at 2031. Base 2031 population projections are adjusted to match ABS Series B 2031 population. ABS population projections are provided at Greater Capital City Statistical Area, therefore the difference between base 2031 projected population and ABS Series B 2031 projected population is apportioned to small areas according to their share of growth between 2011 and 2031.

Future year employment has been based on the 2011 Journey to Work statistical relationships. Employment growth is distributed based on knowledge of known future developments and information obtained from local and regional planning instruments.

The ratio of domestic and international visitors to the number of usual residents at the small area level is assumed to be the same in future years and is applied to future years' total residents to forecast the number of domestic and international visitors. These figures are validated at aggregate levels to figures provided by relevant Government authorities.

For future enrolments, an age-cohort model has been used to allocate additional students to existing institutions based on notional capacities of institutions in the future. Any surplus students were then allocated to schools with additional capacity in neighbouring Small Areas at level 2 (SA2s), or new schools allocated to areas of high growth and/or where planning information is available.

Tertiary education centres are expected to experience a capped growth per year.

2.2 The Zenith model and small area demographics

The Zenith model for the regions takes into account information describing the location and scale of various land uses, activities and demographics across the region in reflecting the travel choices of households and firms.

When applying the model, the region is divided into a number of zones whose size depends on the scope of impacts being investigated and the resolution of information available. Forecasts of demographic variables for each zone used in the model include:

- Population – number of persons whose usual place of residence is within a zone
- Households – number of households including occupied private dwellings and group households
- White Collar Workers – persons employed in occupations classified as 'white-collar'
- Blue Collar Workers – persons employed in occupations classified as 'blue-collar'
- Dependants (0-17) – number of non-workers aged up to 17 years
- Dependants (18-64) – number of non-workers aged 18 to 64 years
- Dependants (65+) – number of non-workers aged 65 and over
- Cars – number of private motor vehicles garaged at occupied private dwellings

The model uses this information to generate profiles of households of different structure, the members of which would each make different choices regarding the frequency, purpose, location, period, mode and route of travel.

The model also defines a number of activities for which travel is undertaken. A number of socioeconomic and land use variables are used to determine the level of participation or attraction for each activity in each zone, which influences the number of trips undertaken for a range of purposes.

These activity variables include:

- Employment by industry (14 custom categories based on 1-digit ANZSIC industry divisions) Educational enrolment by 3 levels
- Demand information for special generators:
  - Airport passengers (3 categories)
  - Tourism and recreation visitation rates (4 categories)
  - Freight and logistics terminals demand forecasts

VLC have defined a small area cadastre for the region, for which data for all of the land use and demographic variables is maintained for the forecast horizon. This is aggregated as needed to provide an efficient zoning system for application of the Zenith model.

VLC has undertaken extensive data acquisition, research and fieldwork to ensure the accuracy of the demographic and socioeconomic data that underpins the forecasting of travel demand in the region. For the small area cadastre, the data for 2011 is developed from and validated against the Australian Bureau of Statistics Census of Population and Housing.

VLC maintains its own scenarios of land use projections, integrating planning information from various local, state and federal government bureaux, supplemented with its knowledge of proposed developments.

The following sections summarise the population and employment characteristics and forecasts for the region by SA3.

2.3 Population

2.3.1 Population projections for the region

The region as a whole is comprised of 24 SA3's. These areas vary widely in nature, from inner city urban areas with very high population densities to rural-fringe areas characterised by small local centres interspersed with open space and agricultural production areas.

The following sections summarise the population characteristics and projections for SA3's in the region.

Table 2-1 provides population estimates for the region by SA3 for 2011 and 2031.

These tables also show the absolute growth in population and the equivalent average annual growth rate.

In the region as a whole, essentially the State of South Australia, the existing population is approximately 1.5 million increasing to a projected 1.8 million in 2031. Reflecting the centralised nature of development in the state, the Adelaide region accounted for approximately 1.3 million in 2011 rising to 1.6 million in 2031. That is, about 85 percent of the population is centred on the Adelaide region.

Figure 2-1 illustrates the spatial pattern of population growth by small area for the Adelaide region only.

The highest projected rates of growth occur in Adelaide City (albeit off a relatively small base) and in Playford (off a relatively substantial base). Gawler – Two Wells also is expected to experience a relatively high rate of growth.

In the outlying regions, the Barossa (101 percent) and Fleurieu – Kangaroo Island (53 percent) are also significant growth areas.

Table 2-1: Existing and Projected Populations in the Region

SA3	2011	2031	Growth	%	AAGR
Adelaide City	*21,000*	*38,300*	+17,400	+83%	3.1%
Adelaide Hills	*69,900*	*92,700*	+22,800	+33%	1.4%
Burnside	*44,000*	*44,200*	+200	+0%	0.0%
Campbelltown (SA)	*50,000*	*54,500*	+4,500	+9%	0.4%
Norwood – Payneham – St Peters	*36,400*	*37,700*	+1,300	+4%	0.2%
Prospect – Walkerville	*28,000*	*32,400*	+4,300	+16%	0.7%
Unley	*38,300*	*43,000*	+4,700	+12%	0.6%
Gawler – Two Wells	*32,200*	*50,400*	+18,200	+56%	2.3%
Playford	*81,500*	*166,700*	+85,200	+104%	3.6%
Port Adelaide – East	*63,000*	*73,500*	+10,500	+17%	0.8%
Salisbury	*131,000*	*143,500*	+12,500	+10%	0.5%
Tea Tree Gully	*94,000*	*108,100*	+14,200	+15%	0.7%
Holdfast Bay	*34,500*	*37,900*	+3,400	+10%	0.5%
Marion	*86,800*	*103,300*	+16,500	+19%	0.9%
Mitcham	*63,800*	*67,200*	+3,400	+5%	0.3%
Onkaparinga	*164,800*	*206,000*	+41,300	+25%	1.1%
Charles Sturt	*105,600*	*129,500*	+23,900	+23%	1.0%
Port Adelaide – West	*58,400*	*66,800*	+8,400	+14%	0.7%
West Torrens	*59,900*	*71,300*	+11,400	+19%	0.9%
Greater Adelaide Region (GCCSA)	*1,263,100*	*1,567,000*	*+303,900*	*+24%*	*1.1%*
Fleurieu – Kangaroo Island	*47,100*	*72,000*	+24,900	+53%	2.1%
Barossa	*33,600*	*67,600*	+34,000	+101%	3.6%
Lower North	*22,300*	*24,500*	+2,200	+10%	0.5%
Yorke Peninsula	*24,300*	*30,000*	+5,700	+24%	1.1%
Murray and Mallee	*68,900*	*75,900*	+7,000	+10%	0.5%
Other regions	*196,200*	*270,000*	*+73,800*	*+38%*	*1.6%*
Total to SA3	***1,459,300***	***1,837,000***	***+377,700***	***+26%***	***1.2%***

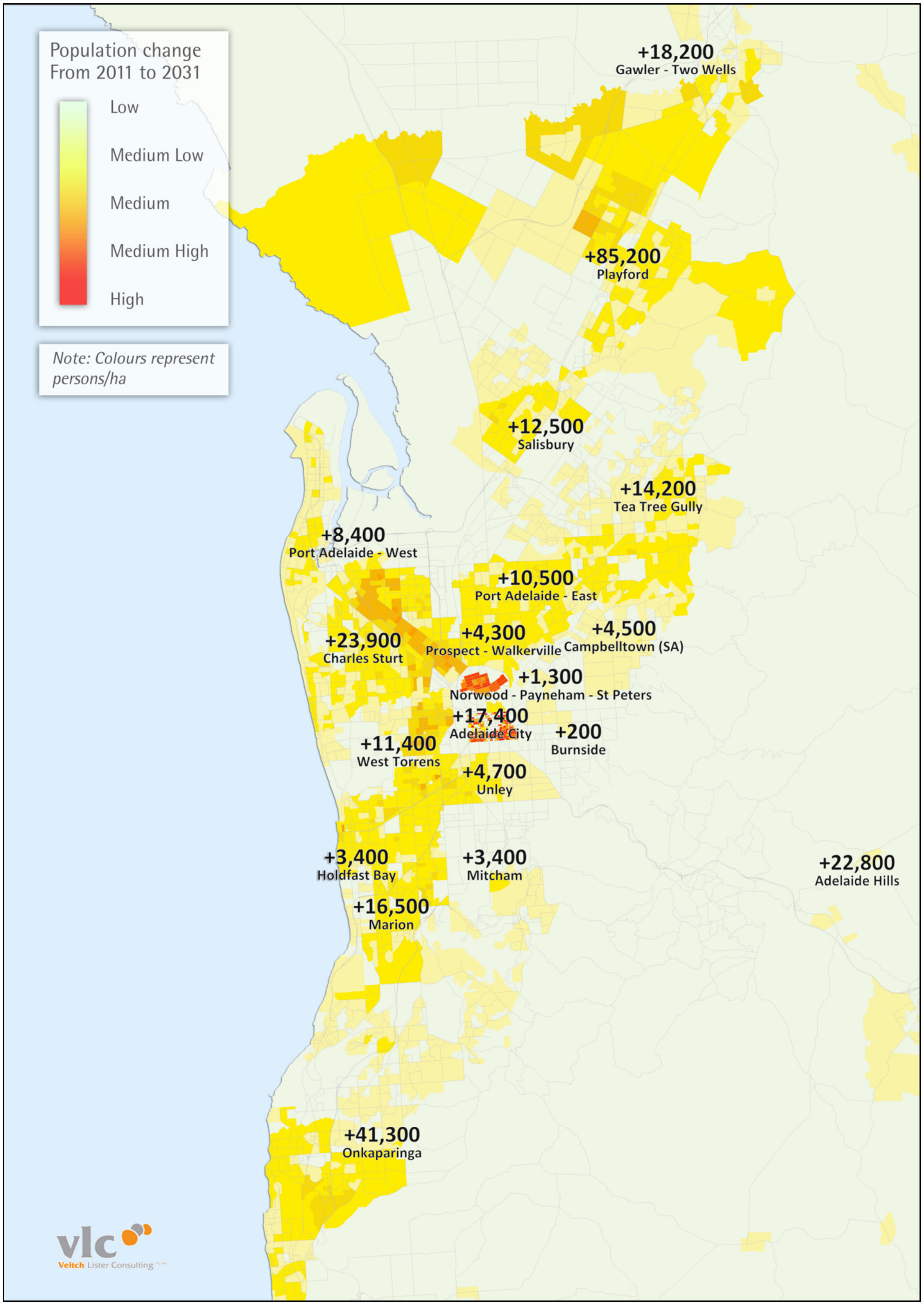

Figure 2-1: Spatial Pattern of Population Growth

2.4 Employment

VLC has prepared forecasts for employment, consistent with the population projections constrained to the ABS B series forecast. The employment forecasts are based on projected levels of employment self-containment within each LGA, which recognise the structure planning of local authorities and the longer term infrastructure and development planning by the state government.

2.4.1 Employment characteristics and projections for the region

The Zenith model requires employment estimates and projection across a range of industries and occupations for the region. As well as indicating the number of jobs, this is also indicative of the opportunities to participate in a range of commercial and social activities, such as education, business, shopping, dining and entertainment, health and recreation, as well as activities generating freight.

Table 2-2 summarises existing and projected employment in the region as a whole. This is expected to amount to approximately 26 percent over the projection period.

Within the Greater Adelaide Region the highest rates of employment growth are expected to arise in Adelaide City (30 percent), Playford (79 percent), and Gawler – Two Wells (77 percent). Figure 2-2 illustrates this pattern of growth.

In the other regions Fleurieu – Kangaroo Island (46 percent) and the Barossa (59 percent) are expected to be the highest growth areas.

Table 2-2: Existing and Projected Employment in the Region

SA3	2011	2031	Growth	%	AAGR
Adelaide City	*138,700*	*192,500*	+53,800	+39%	1.7%
Adelaide Hills	*23,300*	*29,600*	+6,400	+27%	1.2%
Burnside	*18,700*	*19,400*	+700	+4%	0.2%
Campbelltown (SA)	*11,700*	*12,900*	+1,200	+11%	0.5%
Norwood – Payneham – St Peters	*29,100*	*31,500*	+2,400	+8%	0.4%
Prospect – Walkerville	*9,000*	*10,500*	+1,500	+16%	0.8%
Unley	*23,300*	*26,300*	+3,000	+13%	0.6%
Gawler – Two Wells	*9,600*	*17,000*	+7,400	+77%	2.9%
Playford	*27,500*	*49,300*	+21,800	+79%	3.0%
Port Adelaide – East	*26,900*	*31,600*	+4,700	+18%	0.8%
Salisbury	*52,200*	*59,600*	+7,400	+14%	0.7%
Tea Tree Gully	*25,000*	*29,400*	+4,400	+18%	0.8%
Holdfast Bay	*14,800*	*16,600*	+1,800	+12%	0.6%
Marion	*28,600*	*34,600*	+5,900	+21%	0.9%
Mitcham	*32,300*	*34,900*	+2,700	+8%	0.4%
Onkaparinga	*47,900*	*62,100*	+14,200	+30%	1.3%
Charles Sturt	*49,300*	*59,000*	+9,700	+20%	0.9%
Port Adelaide – West	*47,200*	*55,100*	+7,900	+17%	0.8%
West Torrens	*55,200*	*68,200*	+13,000	+24%	1.1%
Greater Adelaide Region (GCCSA)	*670,300*	*840,100*	*+169,800*	*+25%*	*1.1%*
Fleurieu – Kangaroo Island	*16,600*	*24,100*	+7,600	+46%	1.9%
Barossa	*15,400*	*24,500*	+9,100	+59%	2.4%
Lower North	*10,200*	*11,700*	+1,500	+15%	0.7%
Yorke Peninsula	*9,500*	*11,900*	+2,300	+24%	1.1%
Murray and Mallee	*30,200*	*35,100*	+4,900	+16%	0.8%
Other regions	*81,900*	*107,300*	*+25,400*	*+31%*	*1.4%*
Total to SA3	***752,200***	***947,400***	***+195,200***	***+26%***	***1.2%***

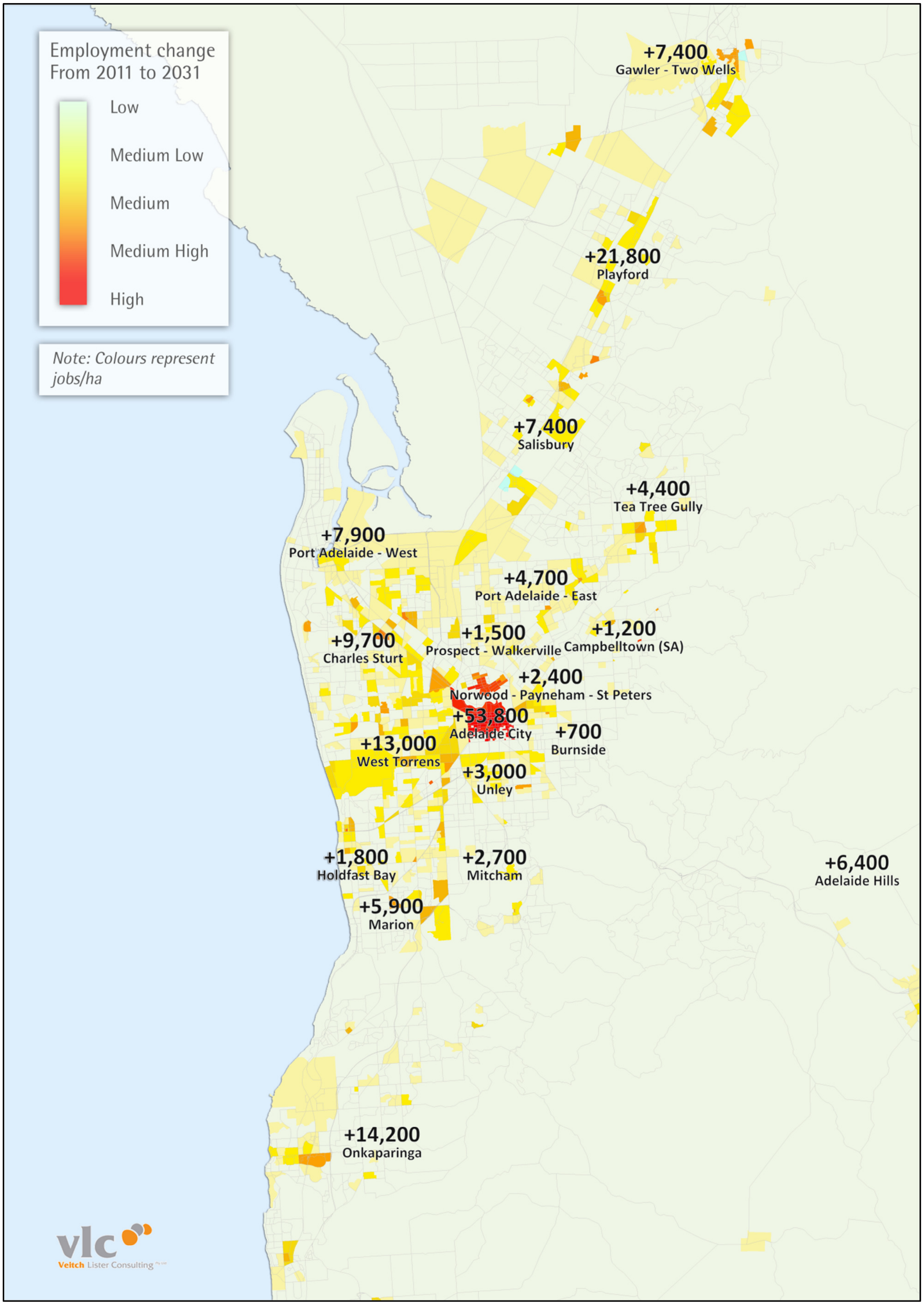

Figure 2-2: Spatial Pattern of Employment Growth

3. Assumed base case transport networks

This section of the report describes the transport network improvements that have been assumed for the AIA base case networks. In order to assess properly the priorities for development of the transport network under the planned strategies for urban growth, the base case assumes a balance of committed future works, as well as those that are required to support the development of urban growth centres.

Table 3-1 summarises the funded and committed works across the region. Figure 3-1 indicates the location of each of the proposed projects.

3.1 Road network assumptions

The major roadworks in the programme include:

- Construction of the McLaren Vale Overpass
- South Road Superway
- Southern Expressway Duplication
- Gawler East LINK road
- Minor local roads in support of PT extension
- South Road upgrades: Torrens to Torrens and Regency Road to Torrens Road
- Main North Road/Tiver Road/Gordon Road intersection upgrade
- Victor Harbour Road duplication Stages 1 and 2
- Adelaide Western Link Road
- Adelaide Airport access improvements
- Duplication of Main South Road (Seaford – Aldinga)
- Duplication of Beach Road and Dyson road (Noarlunga)
- Duplication of Richmond Road (Keswick)
- Duplication of West Lakes Boulevard
- Duplication of Churchill Road
- Duplication of Montague Road (Modbury)
- Duplication of Elder Smith Road
- Duplication of Kings Road
- Duplication of Womma Road
- Duplication of Curtis Road (Munno Para West)
- Duplication of Adelaide Road/Main North Road (Evanston Park)
- Additional lanes on Main North Road (Parafield)
- New interchange on the South East Freeway at Bald Hills
  New connector roads in Happy Valley and Parafield Gardens to accommodate new PT services
- North East Road and Sudholz Road re-design

3.2 Public Transport and Active Transport Network Assumptions

Significant projects in these categories are:

- The Marino Rocks Greenway (a pedestrian and cycle pathway connecting West Terrace to Marino Rocks railway station)
- Grange Greenway (connecting Seaton Park with Outer Harbour)
- A new railway station in Wayville
- The Darlington Transport Study examining rail duplication and extension with associated road improvements to facilitate station access
- Seaford Rail Extension with two new stations at Seaford Meadows and Seaford
- The O-Bahn City Access project which connects the existing Hackney terminus with the central city via Hackney Road and Wakefield Road

Table 3-1: Summary of Major Funded and Committed Works: Adelaide and Associated Regions

Project Nr	Project Description
1.	McLaren Vale Overpass Grade separation of the Victor Harbor Road/Main Road junction
2.	South Road Superway Elevated road over existing arterial, with upgrades to southern section of south road (not-elevated)
3.	Southern Expressway Duplication Construction of additional lanes to the west of the existing road, with two lanes from Old Narolunga to Reynella and four lates 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
4.	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
5.	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
6.	New Railway Station at Wayville
7.	Gawler East local link road Local link road between Potts Road and land owned by Lend Lease bordering Calton Road, Gawler East
8.	Minor New Infrastructure Construction of various local roads to accommodate additional PT network in 2013
9.	South Road Upgrade: Torrens to Torrens Reduction in capacity of existing South Road surface road, construction of a new underpass enabling continuous traffic flow
10.	Darlington Transport Study Rail duplication and extension and associated road infrastructure
11.	Main North Road / Tiver Road / Gordon Road Intersection Upgrade Lower Speed limit of 80kph on Main North Road through intersection
12.	South Road Upgrade: Regency Road to Torrens Road Grade separation of South Road from Regency Road to Torrens Road
13.	Victor Harbor Road Duplication Stage 1 From Old Noarlunga to McLaren Vale
14.	Victor Harbor Road Duplication Stage 2 MacLaren Vale to Mount Compass
15.	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
16.	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
17.	Duplication of Main South Road (Seaford to Aldinga) Upgraded from one to two lanes in both directions
18.	Duplication of Beach Road (Noarlunga) Upgraded from one to two lanes in both directions
19.	Duplication of Dyson Road (Noarlunga) Assuming South of Beach Rd to Murray Rd

Project Nr	Project Description
20.	Duplication of Richmond Road (Keswick) Upgraded from one to two lanes in both directions
21.	Duplication of West Lakes Boulevard Upgraded from one to two lanes from Port Rd to Clark Terrace in both directions
22.	Duplication of Churchill Road Upgraded from one to two lanes in both directions from Torrens Road to Redin Street
23.	Duplication of Montague Road (Modbury) Upgraded from one to two lanes in both directions from Charmaine Ave to North East Rd
24.	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
25.	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
26.	Duplication of Womma Road Upgraded from one to two lanes in both directions from Main North Road to Heaslip Road
27.	Duplication of Curtis Road (Munno Para West) Upgraded from one to two lanes in both directions from Main North Road to Northern Expressway
28.	Duplication of Adelaide Rd/Main North Rd (Evanston Park) From Sturt Highway to Seventh Street
29.	Additional lanes on Main North Road (Parafield) Three lanes each way between Montague Road and The Grove Way
30.	New Interchange on the South Eastern Freeway At Bald Hills Road (Part of Mount Barker growth area infrastructure improvements)
31.	New connector roads in Happy Valley Construction of local roads to accommodate additional PT network in 2014
32.	New connector roads in Parafield Gardens Construction of local roads to accommodate additional PT network in 2014
33.	North East Road and Sudholz Road Redesign
34.	Seaford Rail Extension Two new stations at Seaford Meadows and Seaford
35.	Darlington Transport Study Rail duplication and extension and associated road infrastructure
36.	O-Bahn City Access project (Bus tunnel)

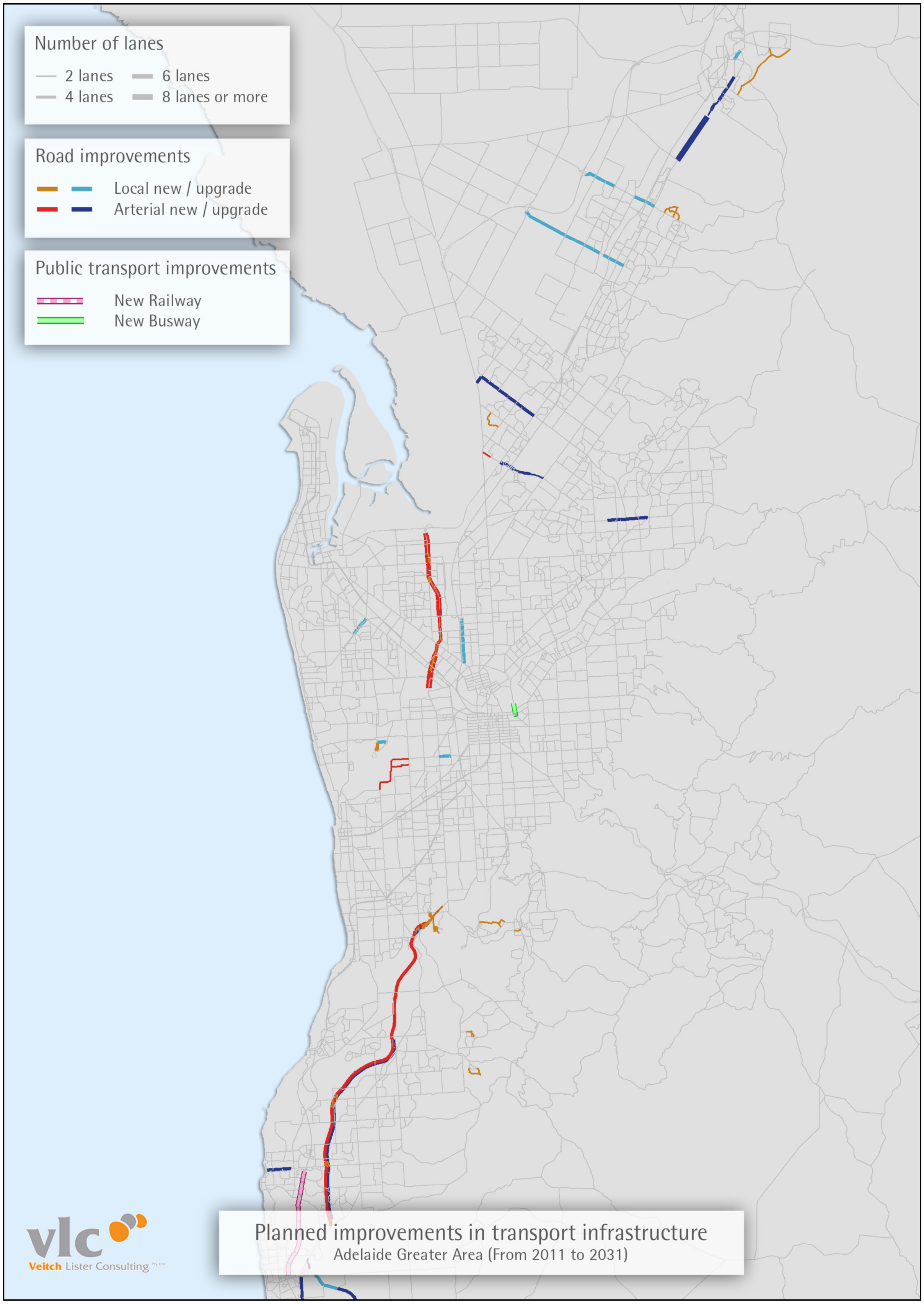

Figure 3-1: Location of Funded and Committed Works: Adelaide Region

4. Pricing and behavioural assumptions

When individuals make choices regarding how, when and where to travel, they take into account the costs and convenience of each of the options available. These considerations may include the value of time spent travelling, the cost of fuel, public transport fares, parking charges and tolls, as well as longer term costs associated with vehicle ownership and use. Likewise firms that schedule commercial travel take into account the costs associated with operation and maintenance of the vehicle and labour costs of the driver or crew, as well as the efficiency of travel on each route and the cost of tolls.

The modelling of future travel in the region for the Australian Infrastructure Audit makes certain assumptions about how these costs will change, and how preferences affecting travel behaviour may evolve over time. These assumptions are based on available evidence and are intended to reflect the current policies of all levels of government.

4.1 Value of travel time

The value of time spent travelling and its influence on travel behaviour depends on a range of factors, such as the reason for travel, and the use to which the time might otherwise be put. The modelling of travel choices reflects preferences that imply different values of travel time for each trip purpose and for each mode of travel, including walking and waiting associated with using public transport and the use of toll roads.

There is a significant volume of behavioural research that suggests values of travel time increase with increasing income. For the purposes of the modelling on this project VLC has assumed that values of travel time remain at current levels in the future.

4.2 Fuel costs

There is a range of influences on the unit cost of fuel consumed in urban transport, which can be affected by global and local conditions. The most significant influences on the costs of fuel include:

- real increases in the price of transport fuels
- reduction in the rate of fuel consumption due to improved vehicle efficiency and increased use of more efficient fuels within the vehicle fleet

These two factors act to counter each other, and with insufficient evidence to indicate which will dominate in future, may well result in no real change in the average unit costs of fuel. The base case for the AIA has therefore assumed no real change in the unit of costs of fuel in future.

4.3 Public transport fares

While there have been real increases in public transport fares during recent years, there is a growing concern to maintain prices and provide off-peak discounts to encourage greater use of public transport. In order to maintain a neutral position on pricing, the base case for the AIA has assumed no real change in public transport fares.

4.4 Parking charges and supply

The availability and cost of parking can have a strong influence on the choice of destination or mode used for travel, particularly to CBD destinations, where high parking costs and a high level of public transport accessibility contribute to public transport being relatively attractive.

There are however, strong pressures on price arising from increasing demand and constrained supply of parking in the CBD and major activity centres.

With increasing demand and constrained supply of parking spaces, it is reasonable to expect that parking costs within the CBD and at major activity centres will experience real increases of 1-2% per annum. The base case modelling for the AIA has assumed a real annual increase of 1.5% in parking charges.

4.5 Airport passenger demands

Travel demands associated with the region's airports are based upon forecasts of passenger demand by BITRE, categorised according to whether travel is for business, and for non-business travel, whether by residents of the region, or visitors.

The passenger demand estimates and forecasts assumed in the base year and in 2031 are provided in Table 4-1.

Table 4-1: Air passenger demand estimates and forecasts (average weekday)

Terminal	Year	Business	Local	Visitors	Total
Domestic	2011	7,600	4,000	7,700	19,300
	2031	13,700	7,200	14,000	34,900
	(% increase)	+80%	+80%	+82%	+81%
International	2011	600	300	600	1,500
	2031	1,500	800	1,500	3,800
	(% increase)	+150%	+167%	+150%	+153%

That is, significant increases in the numbers of both domestic and international air travellers are anticipated, most significantly in the international market (at least in percentage terms).

5. Methodology

The use of VLC's Zenith Travel model provides insights into urban transport at a high level of granularity. In order to allow for detailed analyses of the vast amount of data a number of spreadsheets have been created to inform the National Audit of Urban Infrastructure at different levels of data aggregation:

- Metrics from SA3 to SA3
- Key Model Statistics
- Corridor analysis
- Rail demand and supply analysis

This chapter describes the methodology adopted.

5.1 Description of metrics

The Zenith model contains a wealth of information. This section describes the metrics and where applicable the calculations to generate these metrics.

5.1.1 Network (lane) kilometres

The Zenith model describes travel demands on individual links (sections of road) for roads generally carrying over 3,000 vehicles per day. The total number of kilometres this network encompasses is described in this metric. A link that can be travelled in both directions will be accounted for in each direction. Network lane kilometres describe a similar metric but also take into account the number of lanes for each link and direction.

5.1.2 Demand

Demand is measured in trips. Depending on the mode of travel these trips can be either vehicular trips (car, light or heavy goods vehicles) or person trips (car driver or car passenger, public transport and active transport).

5.1.3 Speeds

Speeds can either be reported under free-flow or under congested conditions. The free-flow speeds are the input speeds to the travel model whereas the congested speeds are a result of traffic impeding other traffic.

5.1.4 Vehicle Kilometres Travelled (VKT), Passenger Kilometres Travelled (PKT)

The number of vehicle kilometres travelled is a key part of the network performance indicators. This metric is calculated by multiplying the demand on a link by the length of this link. In a similar way passenger kilometres travelled can be calculated.

5.1.5 Vehicle Hours Travelled (VHT), Passenger Hours Travelled (PHT) and Hours of Delay

The number of Vehicle Hours Travelled is calculated by multiplying the vehicle demand on a link by the time to traverse that link in the network. This metric can be reported either under free-flow or congested conditions. The difference between the Vehicle Hours Travelled under free-flow and congested conditions results in the Hours of Delay metric. Passenger Hours Travelled is a similar metric which is based on the passenger demand on a link.

5.1.6 Traffic Volume over Capacity Ratios

Volume over Capacity ratios or V/C ratios are calculated by dividing the vehicular demands by the capacity of a link. For peak periods the maximum peak hour demand is used to calculate the V/C ratios. In the off-peak situation the average demand is used. It is worth noting that goods vehicles are weighted the same as cars. This might cause lower than actual V/C ratio's on roads with high volumes of goods vehicles. However the weighting of goods vehicles would also be included the capacity of a road, the magnitude of difference therefore is expected to be generally limited. A public transport trip that utilises a car to access a stop is excluded from the vehicular demands. Buses are also excluded from the vehicular demands. This could potentially result in understated V/C ratios around stations and bus corridors but generally not to any significant degree.

5.1.7 Public Transport Volume over Capacity Ratios

Determining V/C ratios for public transport take into account the number of passengers on a particular service and the capacity of the vehicle used for that service. This capacity can either be expressed as seated or crush capacity. The seated capacity is total number of seats in a vehicle. The absolute maximum number of passengers a vehicle can (legally) carry is the crush capacity. Depending on the metric either the seated or crush capacity is used. The method to determine seated and crush capacities is described in Appendix C.

5.1.8 LOS

An LOS analysis provides an indication of where the road network would fail to meet desired standards of service under the travel demands and traffic volumes forecast. By extension, it illustrates where such behavioural changes are likely to impact on forecasts to some degree, if these levels of congestion result in a change in travel behaviour.

The ability of a road to maintain high levels of service under increasing traffic levels depends upon its design standard and access controls, junction operation and coordination, degree of separation of conflicting movements, as well as its local environment and relation to connecting roads. Higher standards of roads, junctions and network management are able to provide better performance under similar levels of congestion (ratio of volume to capacity) than those of a lower standard. Austroads defines six threshold levels for standardised performance assessment, for which we describe how this affects driver behaviour, and provide typical threshold levels of congestion for three standards of roads.

Table 5-1: AustRoads Level of Service (LOS) definitions

Level of service		Threshold ratio of volume to capacity		
		Motorway	Arterial	Local
A	Drivers may travel at desired speed, and manoeuvre freely, experiencing no delay due to other traffic	0.50	0.40	0.35
B	Drivers will incur occasional minor delays and restrictions to manoeuvre due to other traffic	0.65	0.60	0.50
C	Drivers will experience interrupted travel, with minor delays and stops, but with network operating efficiently providing predictable travel times	0.85	0.75	0.65
D	Drivers will experience occasional major delays, with variable travel times due to conflicting traffic and volumes approaching capacity	1.00	0.90	0.80
E	Drivers will experience frequent major delays, with volumes at or exceeding capacity for short periods, unpredictable travel times	1.15	1.05	0.95
F	Drivers will experience severe congestion and delays, with volumes exceeding capacity for long periods, strong influence on route choice			

5.1.9 Fuel Consumption and Greenhouse Gas Emissions

Vehicle fleet mix can be expected to change reflecting the entry of hybrid, plug in hybrids and electric vehicles challenging the dominant market position of vehicles powered by an internal combustion engine (ICE). Most evidence available today is about hybrid vehicles. Hybrid cars use an ICE engine as well as electrical generators and motors. They are very fuel efficient using around 50 per less fuel in normal use than ICE powered cars and a similar amount less in GHG emissions, with performance differing by make.

The fuel efficiency and fleet mix assumptions used when estimating Greenhouse Gas Emissions in 2011 and 2031 are presented in Tables 5-2 and 5-3.

Table 5-2: Relative fuel intensity assumptions

Year	Mode	ICE	Hybrid	PHEV	Electric
2011	Cars	94.9%	87.1%	42.8%	0.0%
	Commercial vehicles	94.9%	88.4%	42.8%	0.0%
2031	Cars	76.9%	61.4%	22.8%	0.0%
	Commercial vehicles	76.9%	66.3%	22.8%	0.0%

Table 5-3: Fleet mix composition assumptions

Year	ICE	Hybrid	PHEV	Electric
2011	100.0%	0.0%	0.0%	0.0%
2031	80.5%	18.0%	1.5%	0.0%

5.2 Metrics by SA3 to SA3

This analysis disaggregated urban transport activity according to the origin and destination of trips to and from a pair of SA3s (ABS level 3 statistical areas).

Table 5-4 shows an example of the format of the data provided. Metrics are presented in matrix format where the horizontal rows contain the origin SA3 sectors and the vertical columns contain the destination SA3 sectors. A visual representation of the SA3 sectors is provided in Appendix C. For each origin & destination pair metrics are provided for 2011 and 2031 together with the absolute and relative growth between 2011 and 2031. Subtotals for the region are available together with a grand total for the modelled area.

The full matrix is available at:

vlc_yymmdd_01_ADL_Tables by SA3.xlsx

Table 5-4: Example of Metrics by SA3 to SA3

To SA3 sector / From SA3 sector

	Adelaide City				Adelaide Hills			
	2011	2031	Diff	%Diff	2011	2031	Diff	%Diff
Adelaide City	5,275	9,373	+4,099	+78%	342	471	+128	+38%
Adelaide Hills	2,441	3,341	+900	+37%	15,579	21,649	+6,070	+39%
Burnside	3,882	4,447	+565	+15%	425	418	-6	-1%
Campbelltown (SA)	1,964	2,390	+426	+22%	342	382	+40	+12%
Norwood - Payneham - St Peters	3,558	4,245	+687	+19%	279	288	+9	+3%
Prospect - Walkerville	2,303	2,978	+675	+29%	56	56	-1	-1%
Unley	3,524	4,444	+920	+26%	244	265	+21	+9%
Gawler - Two Wells	206	198	-9	-4%	38	52	+14	+36%
Playford	566	1,575	+1,009	+178%	84	155	+71	+85%
Port Adelaide - East	2,310	2,959	+650	+28%	133	136	+3	+2%
Salisbury	1,981	2,142	+161	+8%	161	160	-2	-1%
Tea Tree Gully	1,505	1,641	+137	+9%	329	361	+32	+10%
Holdfast Bay	1,021	1,214	+194	+19%	75	82	+7	+10%
Marion	2,116	2,640	+525	+25%	208	269	+61	+30%
Mitcham	2,997	3,445	+448	+15%	457	485	+28	+6%
Onkaparinga	2,288	2,745	+458	+20%	527	700	+173	+33%

All metrics are available for the morning peak (7-9am), the evening peak (4-6pm), off peak and daily. Certain metrics are only available for certain activity and mode combinations. Table 5-5 below details the availability of metrics by activity and mode combination.

Table 5-5: Availability of metrics by activity and mode combination

Metric	Activity	Modes
Demand, VKT, VHT	Work, Business, Other, Total	Car, Person Car, (Light, Heavy) Commercial Vehicles, Public Transport, Active Transport
Hours of Delay	Work, Business, Other, Total	Car
	Total	Commercial Vehicles
Fuel, Green House Gas Emissions	Total	Car, Commercial Vehicles

A map showing the geographical cover of each SA3 is included in Appendix B.

5.3 Corridor Analysis

All of the more major road corridors in Adelaide were identified and subjected to more detailed analysis in terms of how they perform in 2011 and 2031. A total of 39 important road corridors were identified, as shown in Figure 5-1.

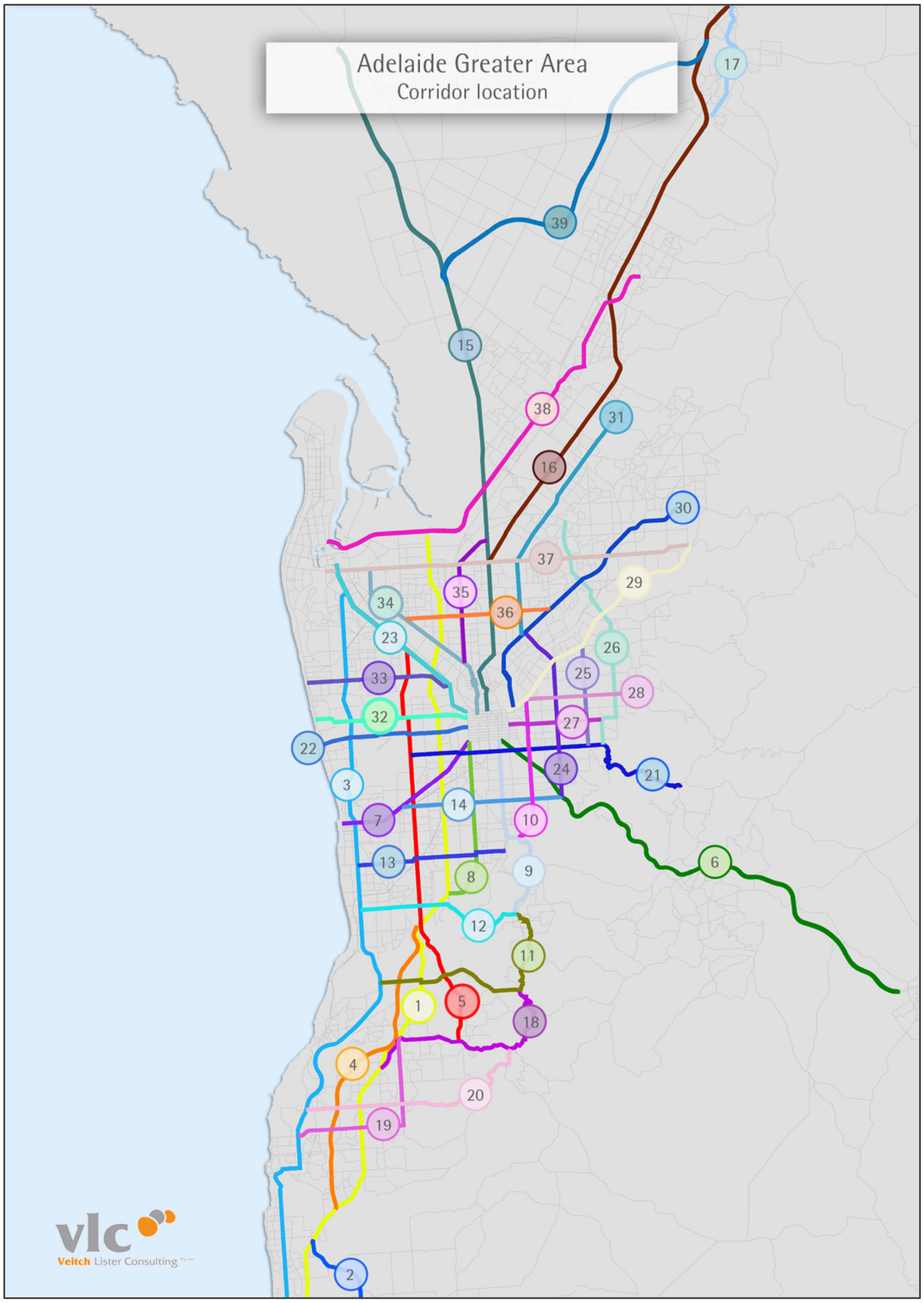

Figure 5-1: Major road corridors in Adelaide

Each of the major roads in each corridor was then divided up into subsections, based on variations in the road's characteristics - such as the number of traffic lanes, posted speed and likely changes in traffic demand. How the roads in Corridor 12 (the Sturt Road and Shephards Hill Rd corridor) were split into subsections is shown in Figure 5-2.

The Zenith model has then been used to produce a number of metrics that, in combination, help define the importance of the various section of Adelaide's higher order road network, their economic contribution and how efficiently they perform in 2011 and 2031. Such information is important, as it guides transport planners to those portions of the road network that will in the future be generating large economic cost due to congestion, yet still be making a large economic contribution as a result of the number of vehicle-kilometres of travel they accommodate each weekday.

The full set of metrics produced for each subsection of road in each corridor are listed in Table 5-6.

The spreadsheet containing the metrics by road subsection for all the identified corridors in Adelaide is titled **vlc_yymmdd_02_ADL_Corridor Analysis.xlsx**

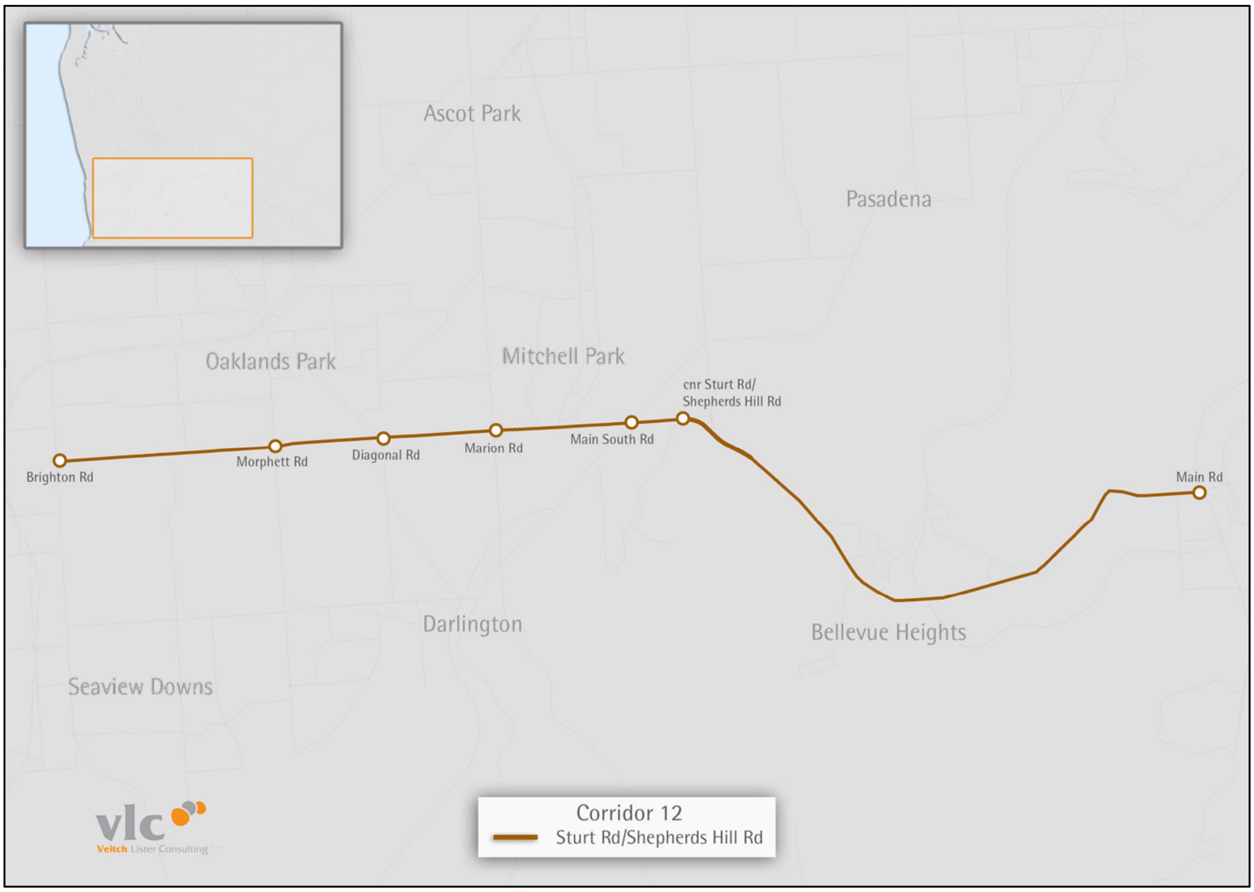

Figure 5-2: Subsections in Corridor 12 - Sturt Rd and Shepherds Hill Rd

Table 5-6: Metrics reported for major road subsections

Type	Metric
Corridor Type	Corridor Type
Length	Total Length (km)
Capacities (veh/hr)	Average Hourly Capacity per km
Traffic volumes weighted by vehicle kilometers (busiest peak hour)	Average Peak Hour Traffic Volumes Average Peak Hour CV Volumes % Average Peak Hour CV Volumes
Traffic speeds under freeflow (modelled) and congested conditions	Average Speed Freeflow (kph) Average Speed Congested (kph)
Travel Times under freeflow (modelled) and congested conditions	Total Travel Time Freeflow (min) Total Travel Time Congested (min)
Network performance daily	Total Vehicle Kilometers Travelled (km) Total Vehicle Hours Travelled Congested (hrs) Total Vehicle Hours Travelled Freeflow (hrs) Total hours of delay (hrs)
Level of Service (Traffic) (busiest peak hour)	Minimum Level of Service Average Level of Service Maximum Level of Service
Traffic V/C (busiest peak hour)	Weighted V/C Traffic

5.4 Rail analysis

Based on the seating capacity and crush capacity of Adelaide's trains (as described in Appendix A), the Zenith model has been used to assess the degree of crowding and overcrowding across the entire rail network.

Passenger loading profiles have been produced for all lines in both the AM and PM peaks for both 2011 and 2031. Examples for the Outer Harbour line are presented in Figures 5-3 and 5-4.

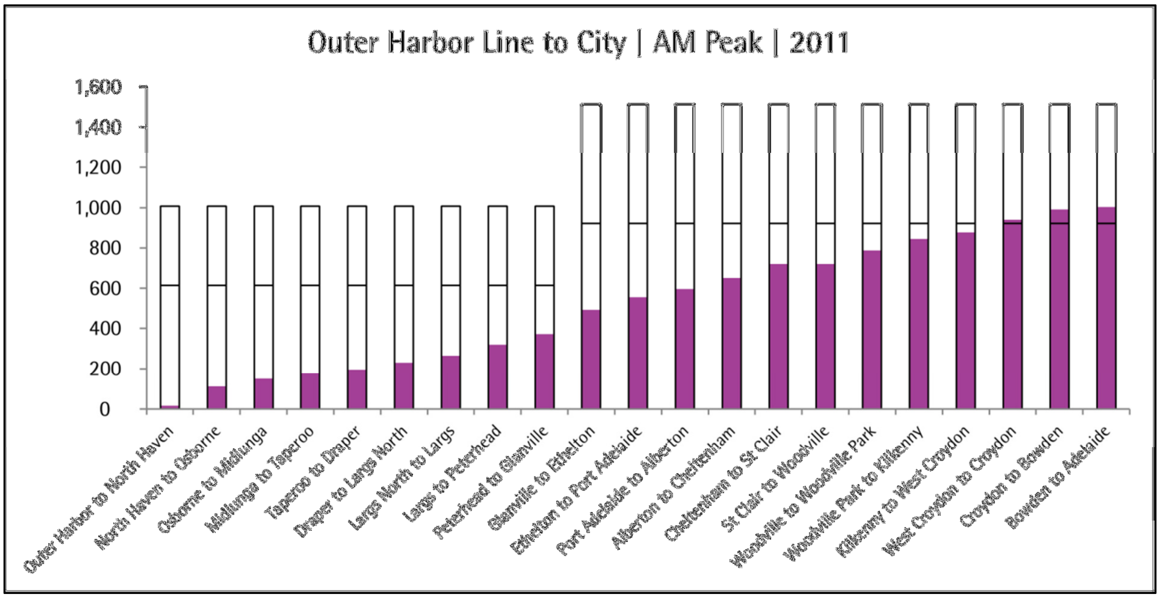

Figure 5-3: Passenger loading profile - Outer Harbor Line in the AM peak (2011)

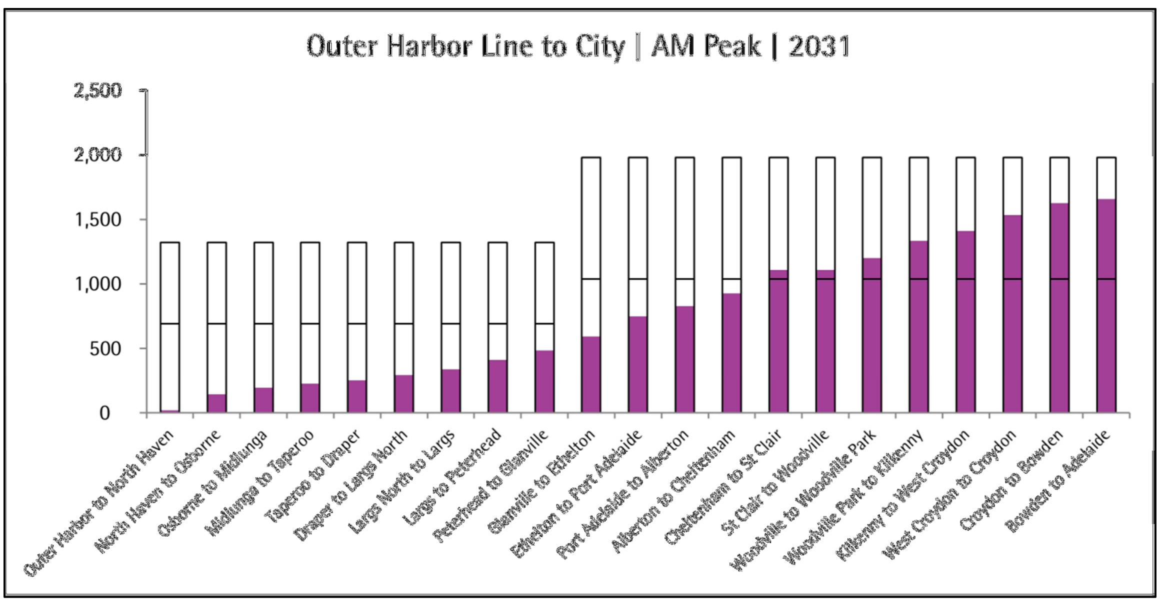

Figure 5-4: Passenger loading profile - Outer Harbor Line in the AM peak (2031)

Passenger load profiles have also been produced for all rail lines, the LRT, and all bus routes.

6. Changes in travel demand

6.1 Introduction

This section of the report provides the Zenith model's travel estimates and forecasts for 2011 and 2031 for Adelaide and regions elsewhere in the state, as well as the model's high level assessment of the performance of the transport network for these two time horizons under a *low transport network investment* scenario. More detailed information on travel demands and network performance at specific locations in the road and public transport networks is provided in Sections 7 and 8 of the report.

6.2 Forecast growth in person travel by mode (2011-2031)

Table 6-1 summarises the model's estimates of person trips by mode and by time of day for the modelled area.

Table 6-1: Change in person travel in the modelled area (2011-2031)

Model Statistics		2011	2031	Change	% change
Person car trips	AM	884,556	1,108,575	+224,018	*+25%*
	OP	3,211,839	4,038,546	+826,707	*+26%*
	PM	863,041	1,080,533	+217,491	*+25%*
	24H	4,959,436	6,227,653	+1,268,217	*+26%*
PT trips	AM	49,368	66,343	+16,974	*+34%*
	OP	102,093	133,704	+31,611	*+31%*
	PM	35,267	48,831	+13,565	*+38%*
	24H	186,728	248,878	+62,150	*+33%*
Walk/cycling trips	AM	144,988	185,155	+40,166	*+28%*
	OP	702,645	897,235	+194,590	*+28%*
	PM	164,151	209,946	+45,796	*+28%*
	24H	1,011,784	1,292,336	+280,552	*+28%*
Total trips	AM	1,078,913	1,360,072	+281,159	*+26%*
	OP	4,016,576	5,069,484	+1,052,908	*+26%*
	PM	1,062,459	1,339,310	+276,852	*+26%*
	24H	6,157,948	7,768,867	+1,610,919	*+26%*

As would be expected, motorised travel is dominated by person car trips and relatively stable (approximately 80 percent of person trips are undertaken by car in both 2011 and 2031). Not surprisingly, therefore, the mode split to public transport is stable at about 3 percent though rising marginally over this period.

Also not surprisingly the mode split to public transport is higher in peak periods (4.6 percent in 2011 and 4.8 percent in 2031) reflecting higher levels of service in the peaks and ambient road congestion.

6.3 Growth in vehicular travel and road network performance in 2011 and 2031

A summary of these estimates is provided in Tables 6-1 and 6-2. Results in the tables indicate:

a) Overall daily person car trips increase from approximately 5m trips per day rising to 6.2m in 2031 (26 percent) – see Table 6-1.

b) This level of growth is very similar across each of the time periods (that is, by time of day)

c) Car kilometres increase disproportionately (by 31 percent) implying that there is a higher incidence of longer trips (consistent with the demographic forecasts)

d) Vehicle hours also increases disproportionately (by approximately 50 percent) reflecting a significant decline in average network speeds across the network (5 kms/hr)

e) Not unexpectedly, given the assumed infrastructure investment strategy, the decline is most pronounced in the peak periods.

Table 6-2: Growth in vehicular travel in the Modelled Area

Traffic statistics		2011	2031	% change
Car trips	AM	608,067	760,517	+25%
	OP	2,247,845	2,829,784	+26%
	PM	634,184	794,744	+25%
	24h	3,490,096	4,385,044	+26%
Car kilometres	AM	5,770,510	7,517,858	+30%
	OP	19,619,355	25,752,962	+31%
	PM	6,224,774	8,180,302	+31%
	24h	31,614,639	41,451,122	+31%
Car hours	AM	149,708	228,192	+52%
	OP	410,130	588,935	+44%
	PM	159,840	249,000	+56%
	24h	719,679	1,066,127	+48%
Car Average assigned speed (kph)	AM	38.5	32.9	-15%
	OP	47.8	43.7	-9%
	PM	38.9	32.9	-16%
	24h	43.9	38.9	-11%
Commercial Vehicle trips	AM	19,892	25,327	+27%
	OP	172,348	219,541	+27%
	PM	22,443	28,579	+27%
	24h	214,682	273,447	+27%
Commercial Vehicle kilometres	AM	214,775	282,553	+32%
	OP	1,764,293	2,315,545	+31%
	PM	239,938	316,203	+32%
	24h	2,219,006	2,914,301	+31%
Commercial Vehicle hours	AM	5,090	7,756	+52%
	OP	36,676	53,372	+46%
	PM	5,828	9,088	+56%
	24h	47,594	70,216	+48%

Traffic statistics		2011	2031	% change
Commercial Vehicle Average assigned speed (kph)	AM	42.2	36.4	-14%
	OP	48.1	43.4	*-10%*
	PM	41.2	34.8	*-15%*
	24h	46.6	41.5	*-11%*
Total trips	AM	627,958	785,844	*+25%*
	OP	2,420,192	3,049,325	*+26%*
	PM	656,627	823,322	*+25%*
	24h	3,704,778	4,658,491	*+26%*
Total kilometres	AM	5,985,285	7,800,411	*+30%*
	OP	21,383,648	28,068,508	*+31%*
	PM	6,464,713	8,496,505	*+31%*
	24h	33,833,646	44,365,424	*+31%*
Total hours	AM	154,798	235,948	*+53%*
	OP	446,807	642,307	*+44%*
	PM	165,668	258,088	*+56%*
	24h	767,273	1,136,343	*+48%*
Total Average assigned speed (kph)	AM	38.7	33.1	*-15%*
	OP	47.9	43.7	*-9%*
	PM	39.0	32.9	*-16%*
	24h	44.1	39.0	*-11%*

6.4 Growth in public transport ridership (2011-2031)

Tables 6-3 and 6-4 below summarises the modelled base year and the 2031 forecasts for the modelled area in terms of patronage and network supply indicators by mode and by time of day.

The following points are notable:

a) Total PT boardings increase by 38 percent over the period; this is in contrast to the 33 percent increase in PT trips (implying a higher level of interchanging is expected to occur).

b) The rate of growth is highest on the rail system (at about 70 percent) which is presumably mainly a function of the fact that the rail system is largely insulated from the effects of congestion.

c) This conclusion is reinforced by the fact that the level of service parameters are changed only moderately (eg service frequency levels in 2031 are assumed to be the same as in 2011).

d) However, other contributing factors would include parking charges which have been assumed to increase at an annual rate of 1.5 percent in real terms (or 35 percent over 20 years).

Table 6-3: Predicted growth in public transport ridership (2011-2031)

Public transport statistics		2011	2031	% change
Total PT boardings	AM	60,103	82,367	*+37%*
	OP	127,295	172,437	*+35%*
	PM	47,178	68,662	*+46%*
	24h	234,575	323,466	*+38%*
In vehicle passenger kilometres	AM	508,133	752,552	*+48%*
	OP	854,783	1,169,427	*+37%*
	PM	385,612	594,206	*+54%*
	24h	1,748,528	2,516,185	*+44%*
In vehicle passenger hours	AM	18,885	29,317	*+55%*
	OP	30,899	44,842	*+45%*
	PM	14,217	23,264	*+64%*
	24h	64,001	97,423	*+52%*
Total Rail boardings	AM	11,902	21,435	*+80%*
	OP	17,273	27,276	*+58%*
	PM	9,203	17,133	*+86%*
	24h	38,379	65,845	*+72%*
Total Bus boardings	AM	46,975	59,189	*+26%*
	OP	107,822	141,956	*+32%*
	PM	37,015	49,997	*+35%*
	24h	191,811	251,142	*+31%*
Total Light Rail boardings	AM	1,225	1,743	*+42%*
	OP	2,200	3,205	*+46%*
	PM	960	1,531	*+60%*
	24h	4,385	6,479	*+48%*

Table 6-4: Increase in in-service public transport vehicle-kilometres (2011-2031)

Public transport statistics		2011*	2031*	% change
In-Service Kilometres by Rail	AM	2,053	2,134	*+4%*
	OP	8,433	8,858	*+5%*
	PM	2,029	2,126	*+5%*
	24h	12,516	13,118	*+5%*
In-Service Kilometres by Bus	AM	27,571	27,579	*0%*
	OP	105,346	105,279	*0%*
	PM	27,923	27,987	*0%*
	24h	160,840	160,846	*0%*
In-Service Kilometres by LRT	AM	398	399	*0%*
	OP	1,939	1,945	*0%*
	PM	391	392	*0%*
	24h	2,729	2,736	*0%*

7. Road network performance

7.1 Introduction

This section of the report presents the Zenith model's predictions as to how traffic demand in Metropolitan Adelaide will increase between 2011 and 2031, and how these predicted increases will affect the performance of the road network under a reference scenario that assumes only committed and "highly likely" road projects will be initiated in the future.

7.2 Increase in traffic (2011-2031)

Figure 7-1 shows the Zenith model's predicted increases in weekday traffic flows (shown in dark green) in Adelaide between 2011 and 2031.

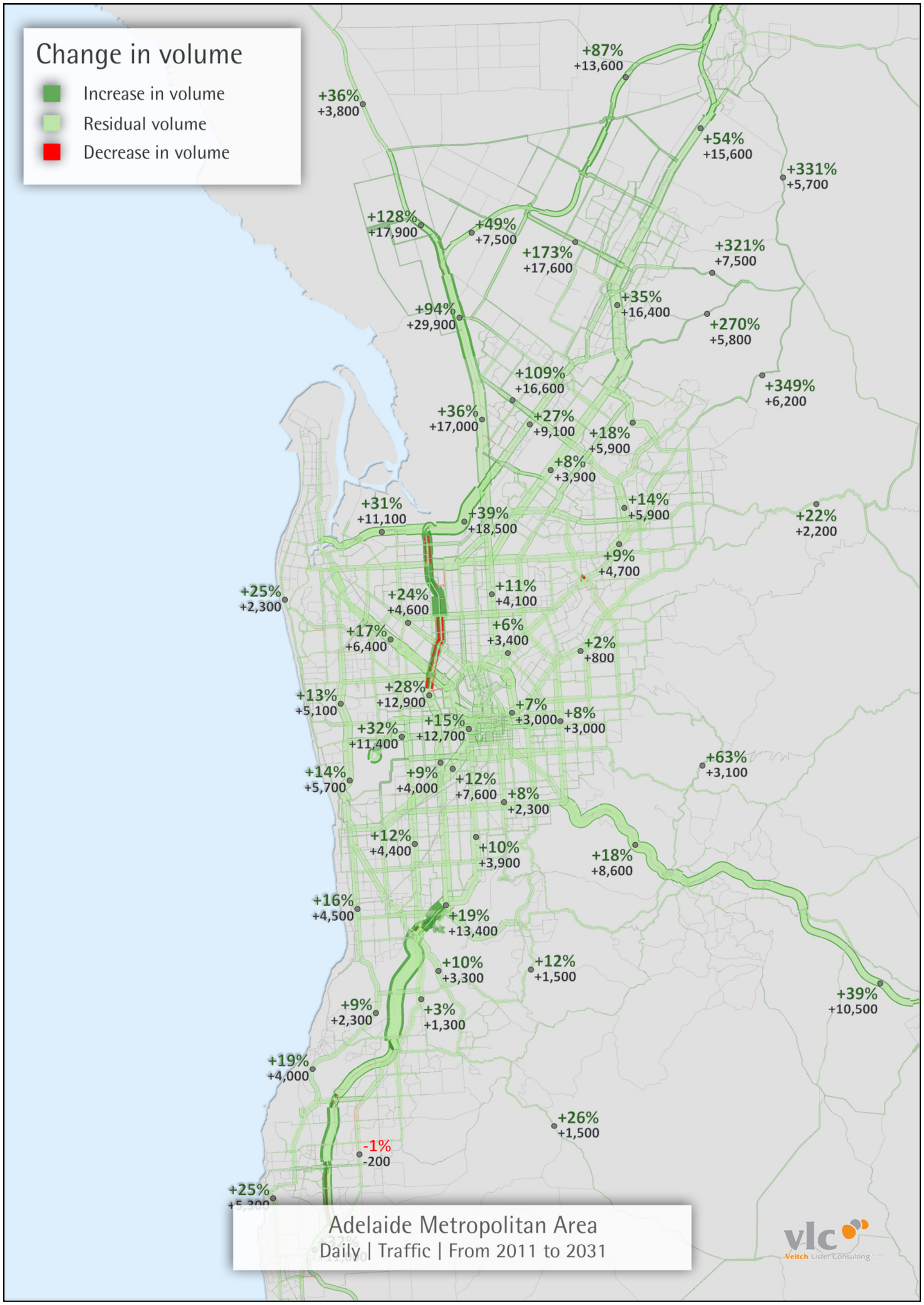

Figure 7-1: Predicted increase in Adelaide weekday traffic (2011-2031)

Daily (weekday) traffic demand is forecast to increase significantly (2011-2031) on the main roads through the northern suburbs of metropolitan Adelaide, i.e. Port Wakefield Road (A1), Main North Road (A20), and the Northern Expressway (M20). Otherwise, forecast growth on most of the network is in the range 15%-40% over the twenty year period. (Forecasts of very high percentage traffic growth on roads in the outer north-eastern suburbs reflect traffic expected to be generated in and by new residential development.)

The predicted changes in traffic volumes (2011-2031) in the AM and PM peaks are shown in Figures 7-2 and 7-3. They mirror the traffic patterns in Figure 7-1, which is to be expected as peak demands create a high proportion of daily total traffic.

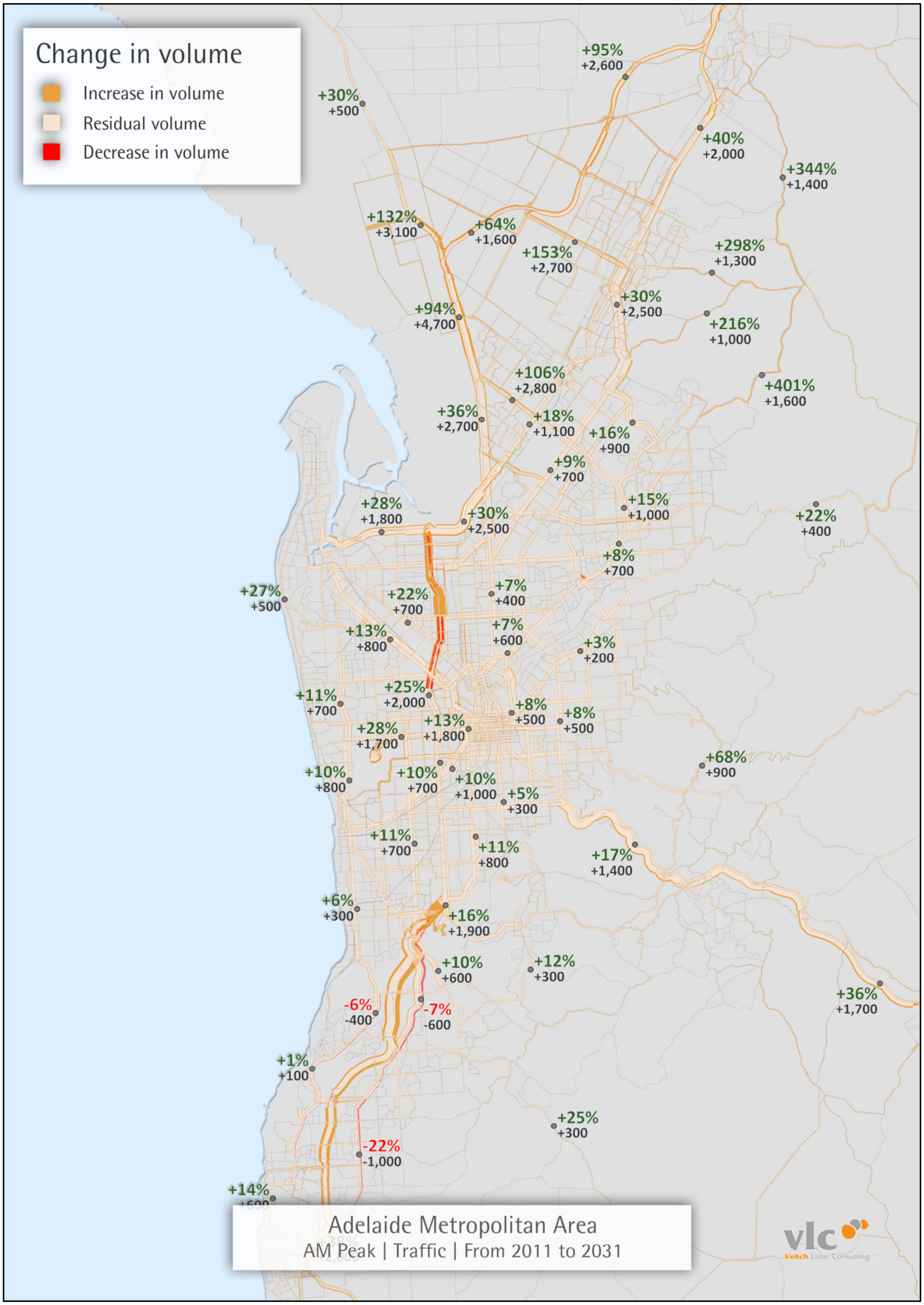

Figure 7-2: Predicted increase in Adelaide weekday AM peak traffic (2011-2031)

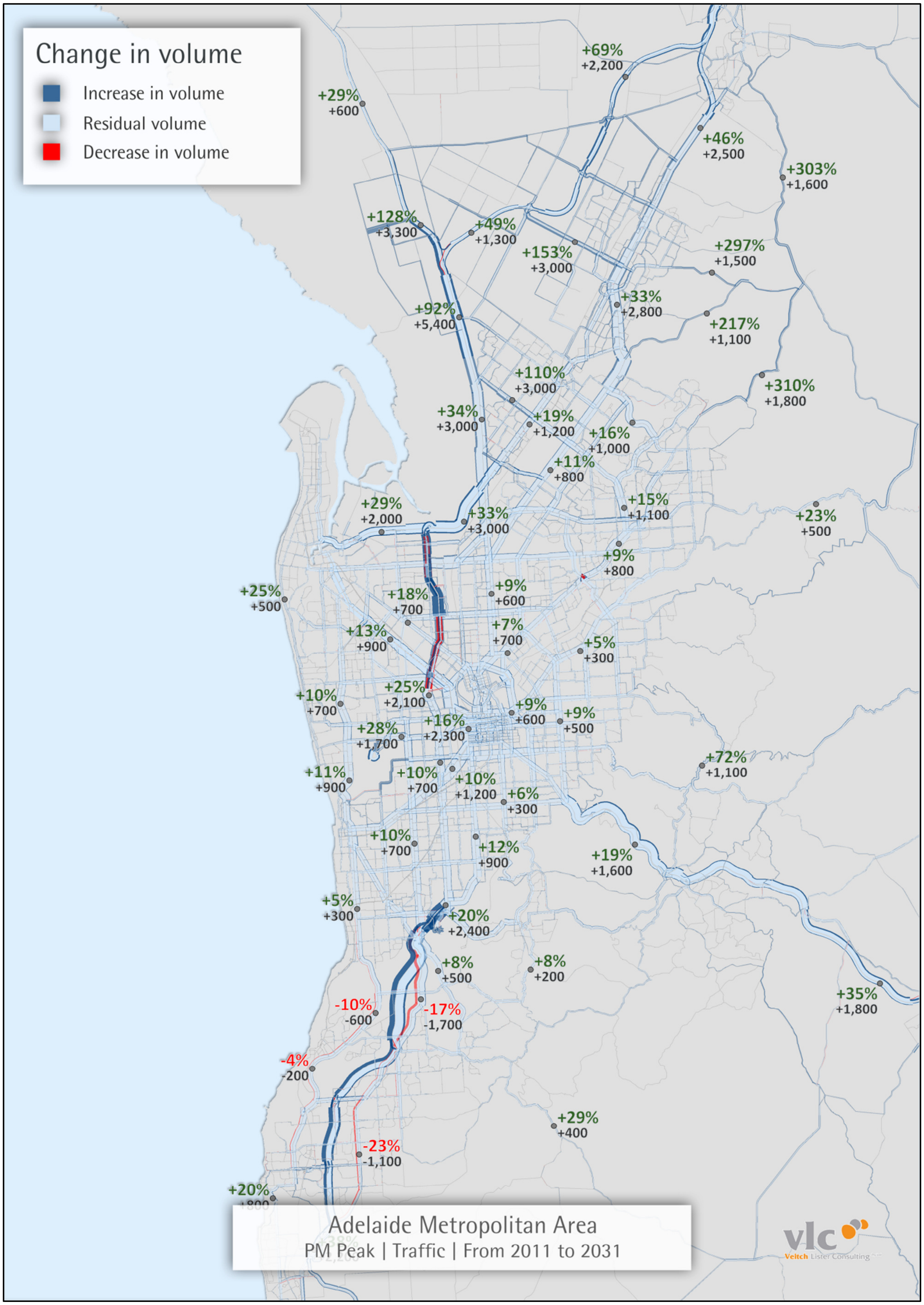

Figure 7-3: Predicted increase in Adelaide weekday PM peak traffic (2011-2031)

7.3 Volume/capacity ratios (V/C)

The Zenith model's assessment of the performance of the road network in 2011 and 2031 can be gauged from volume/capacity ratio plots (V/C).

V/C ratios are used to gauge the level of congestion in the road network. Significant congestion and delays occur as the V/C ratio approaches unity. Should the V/C ratio exceed unity then the excess demand can only be accommodated by drivers choosing to switch to the shoulders of the peak thereby extending the duration of the peak, changing their destination, or not making the journey at all.

Figures 7-4, 7-5 and 7-6 show the Zenith model's estimates of V/C for the Adelaide road network in 2011 for the maximum AM peak hour, typical off-peak hour and maximum PM peak hour respectively

Figures 7-7, 7-8 and 7-9 present the same information for 2031 based on the Zenith model's traffic forecasts.

While Figure 7-5 shows the Adelaide metropolitan road network operates well within its practical capacity during off-peak periods, reference to Figures 7-4 and 7-6 shows that a significant number of Adelaide's major roads are already operating at or close to capacity in both peak periods in 2011, particularly South Road (A13), Goodwood Road, Cross Road (A3), Main North Road (A20) and Port Wakefield Road (A1), all of which exhibit V/C ratios of 1.1 or above.

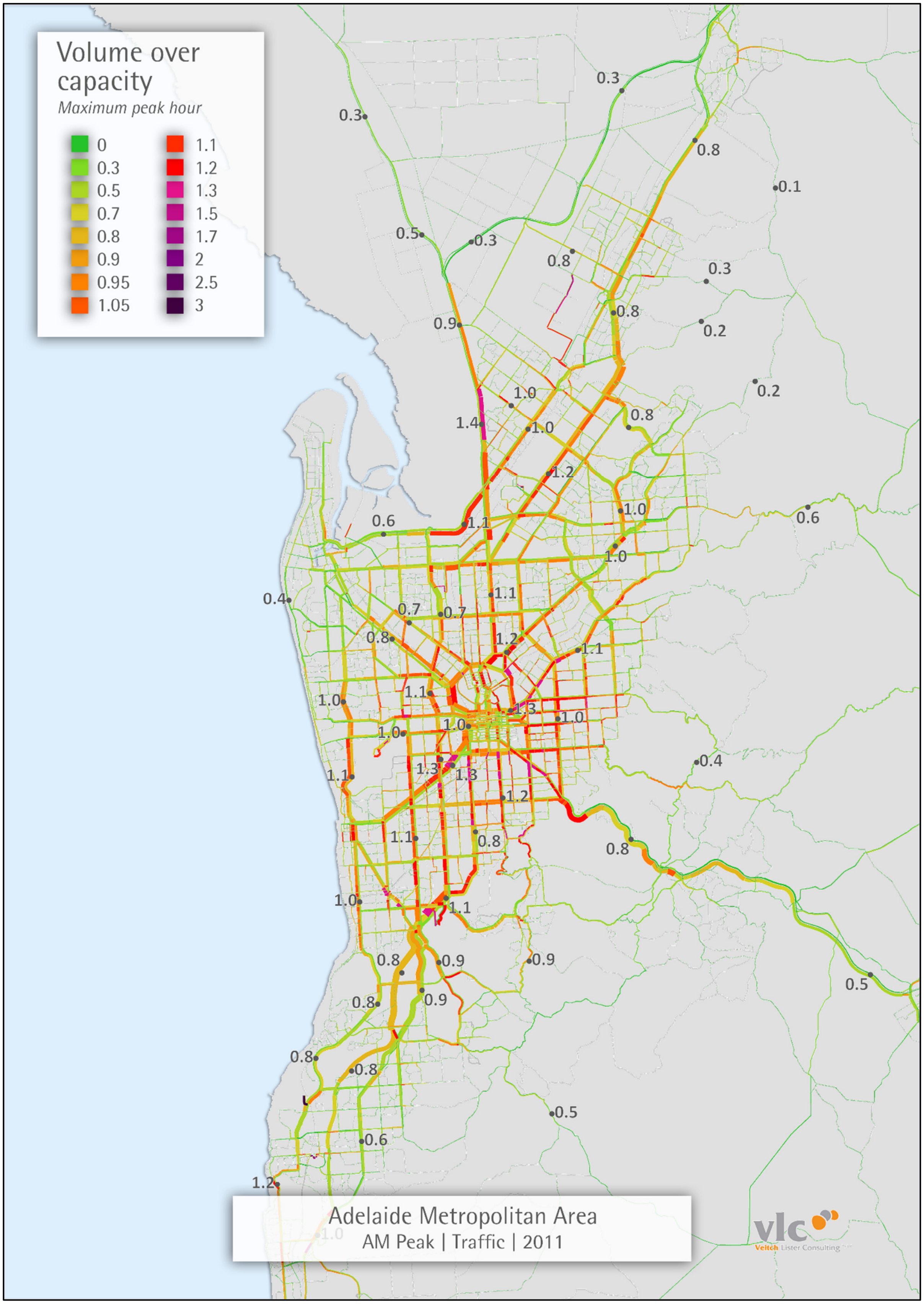

Figure 7-4: Road network volume/capacity ratios in 2011 - AM maximum peak hour

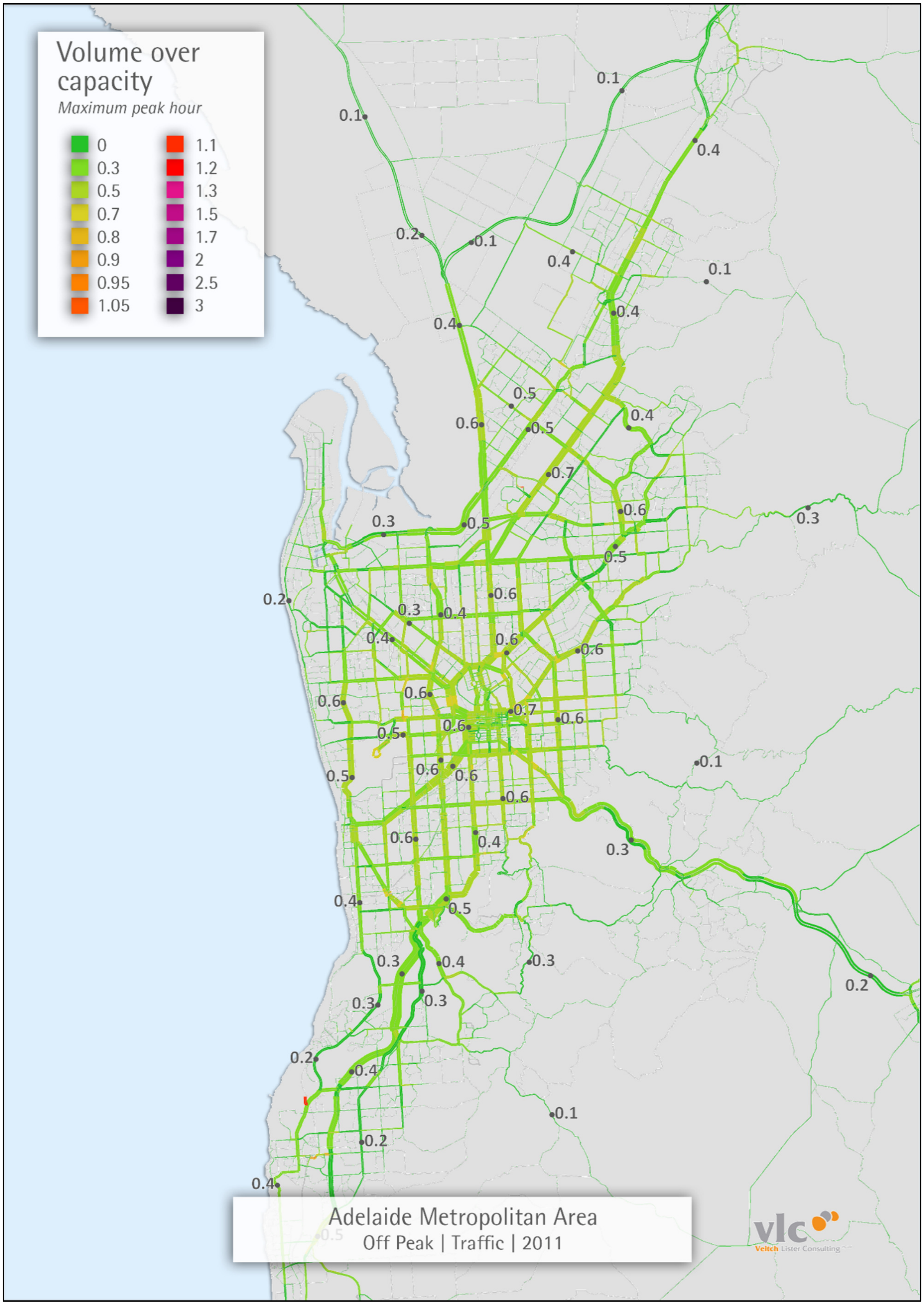

Figure 7-5: Road network volume/capacity ratios in 2011 - daytime off-peak

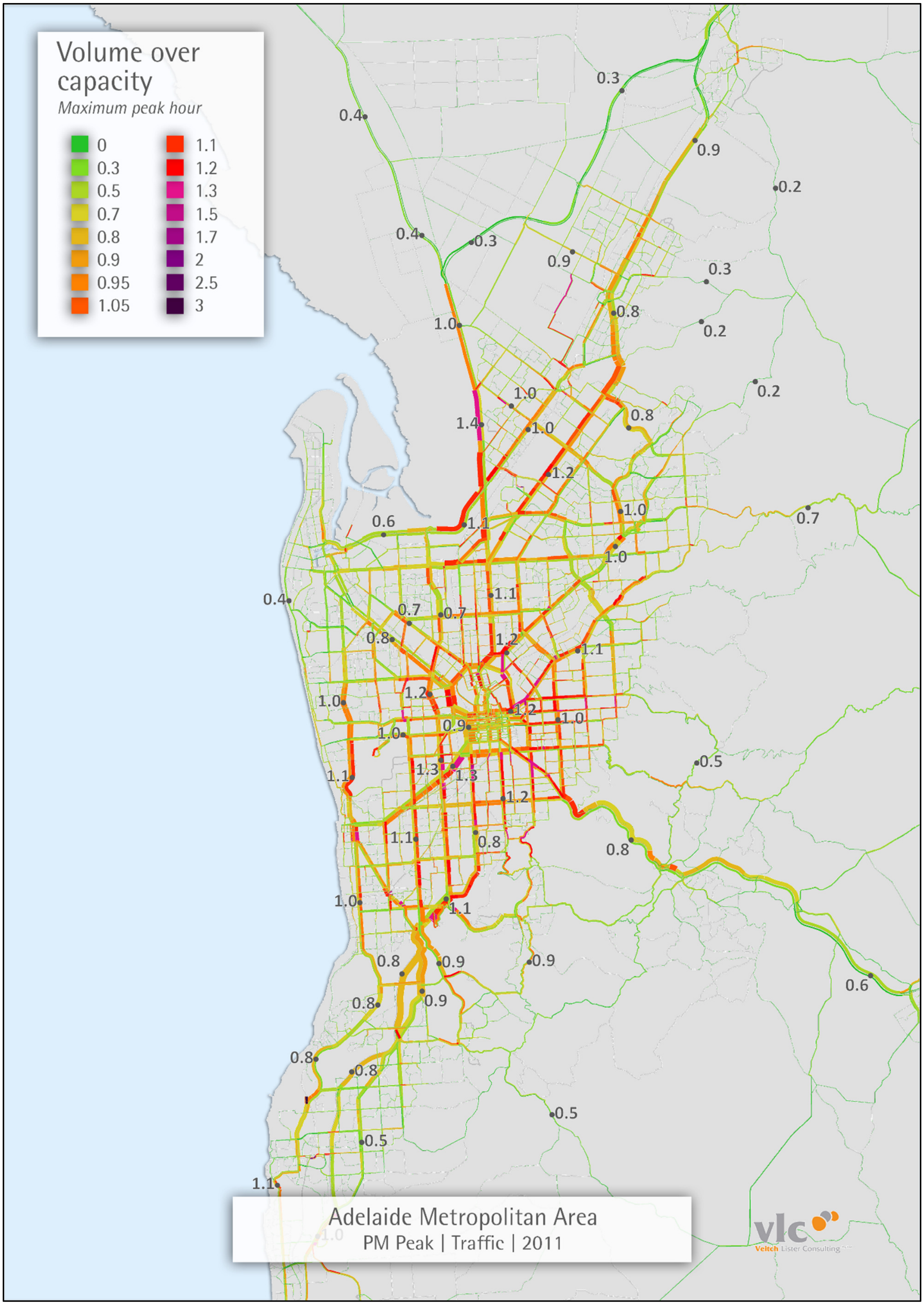

Figure 7-6: Road network volume/capacity ratios in 2011 - PM maximum peak hour

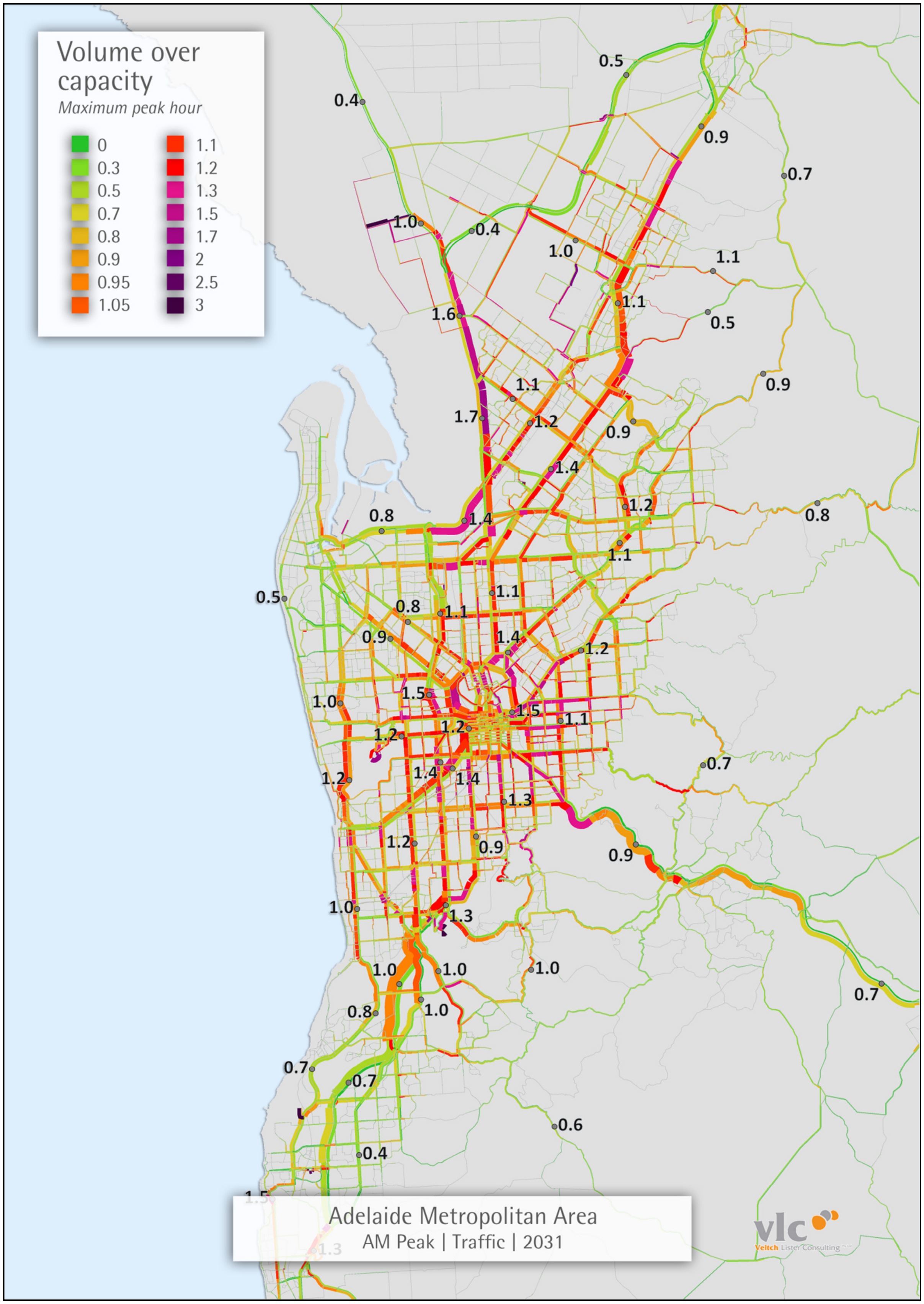

Figure 7-7: Road network volume/capacity ratios in 2031 - AM maximum peak hour

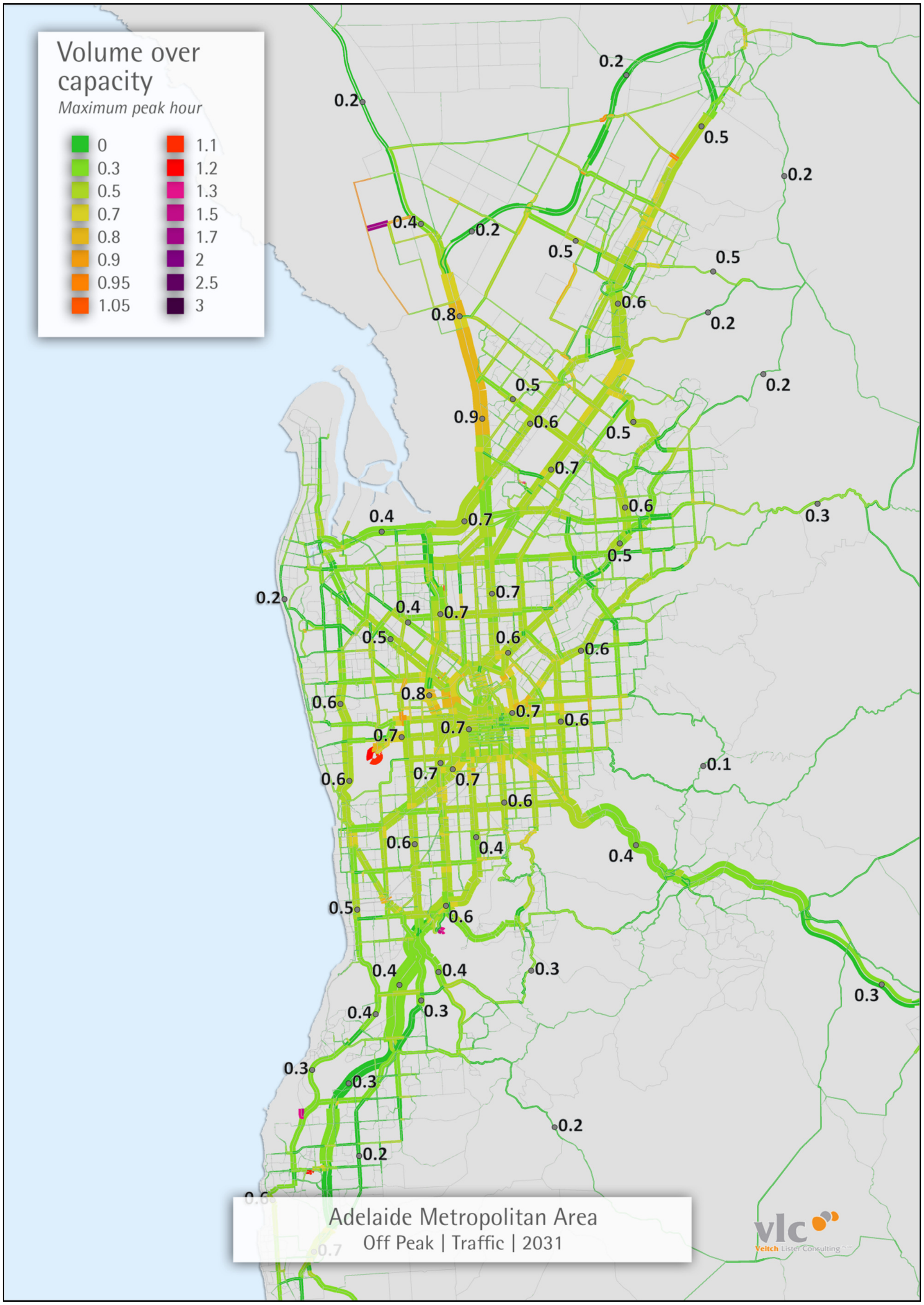

Figure 7-8: Road network volume/capacity ratios in 2031 - daytime off-peak

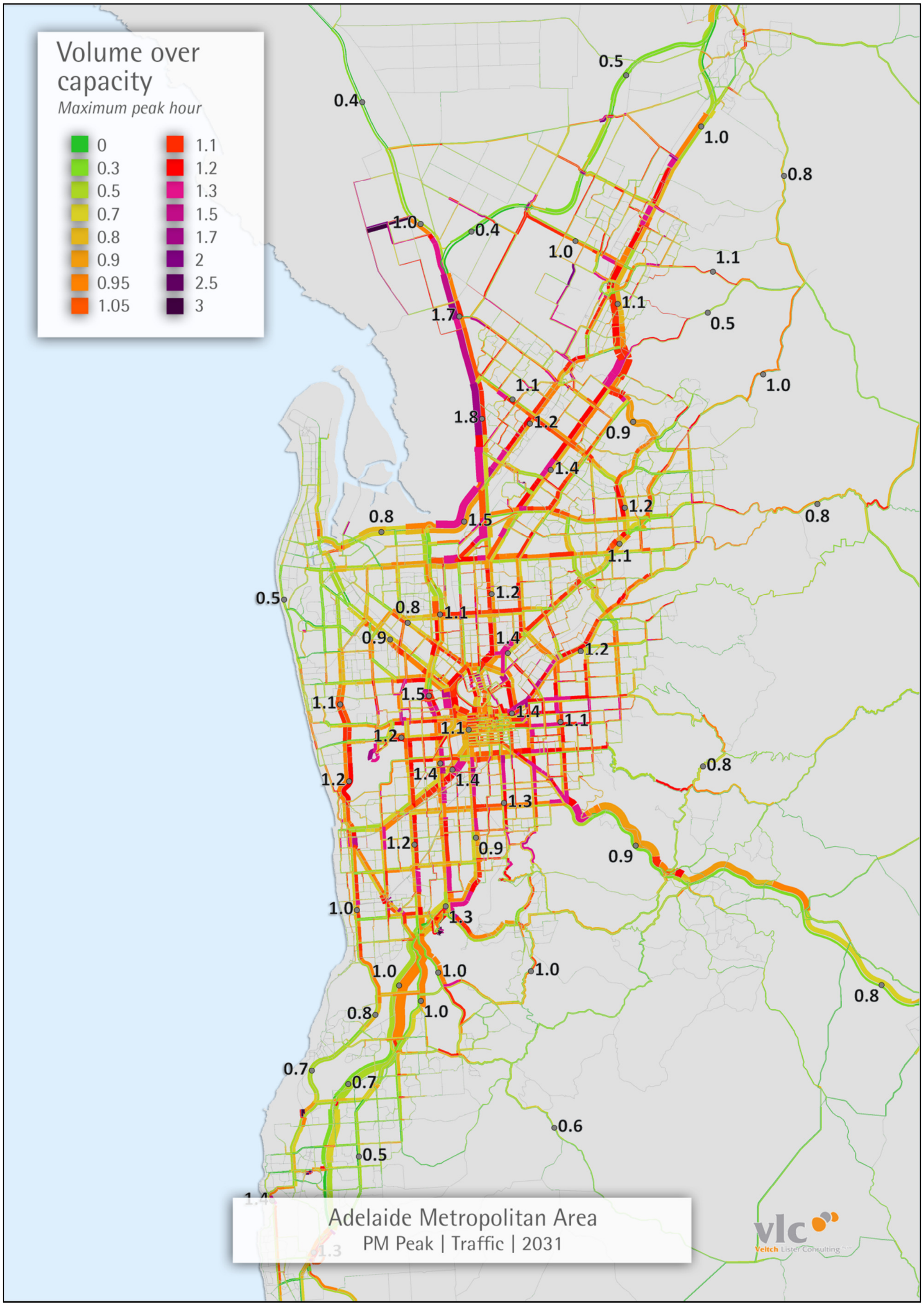

Figure 7-9: Road network volume/capacity ratios in 2031 - PM maximum peak hour

Figure 7-7 (previous) presents V/C ratios across the Adelaide road network using the Zenith model's 2031 AM peak traffic forecasts for the reference scenario.

It is not surprising to find that V/C ratios in the peak periods in 2031 exhibit excess of traffic over capacity on many roads in the Adelaide metropolitan area, with the PM peak hour, shown in Figure 7-9, a mirror image of the morning peak hour. The highest ratios are found on the major arterial roads through the northern suburbs (particularly Port Wakefield Road - A1), and on the north-south corridor route (South Road – A13) through the inner western suburbs of Thebarton, Mile End and Keswick.

In the daytime off-peak in 2031 (refer Figure 7-8) the Zenith model predicts that most of the major road network in Adelaide will still have spare capacity, with V/C ratios in the range 0.6 - 0.8 in the inner suburbs, and 0.4 - 0.6 in other eastern and western suburbs. V/C ratios in the outer northern suburbs (0.5 -0.6) are significantly higher than those in the outer southern suburbs, reflecting the level of industrial and commercial activity in the northern areas and the role of the arterial roads as major links to regional South Australia and interstate.

7.4 Change in travel times (2011-2031)

This section of the report translates the forecast increase in levels of congestion in Adelaide in 2031 (as described in Section 7.3) into the likely implications for AM peak car travel times to the Adelaide CBD and to Adelaide Airport.

Figures 7-10 and 7-11 provide 2011 and 2031 travel time contours for car travel to the CBD, and Figures 7-12 and 7-13 show the contours for car travel to the Airport in 2011 and 2031, under the reference scenario.

Referring to Figures 7-10 and 7-11, the Zenith model predicts increases of around five minutes in travel time by car from inner and middle suburbs to the CBD, e.g. from 20 to 25 minutes, but potentially greater increases in travel times (up to ten minutes) by car from outer northern and southern suburbs. Put another way, the area that can access the CBD by car in 20 minutes in 2011 will shrink considerably by 2031.

As Adelaide Airport is only six kilometres west of the CBD, similar increases in travel times by car might be expected to those forecast for travel to the CBD. However, the contours for travel to the Airport steepen even more sharply between 2011 and 2031, such that average travel times by car to the Airport in 2031 are expected to increase by ten minutes for travel from most Adelaide suburbs, e.g. a journey from an inner eastern suburb that takes 20 minutes by car in 2011 could take up to 30 minutes in 2031.

It should be noted that the morning peak period for journeys to Adelaide Airport is earlier than the maximum peak hour for traffic to the CBD, hence the relatively shorter travel times to the airport in 2011. Forecasts of extended trip times to the Airport in 2031 could presage an extension of both peaks in future years.

Much of the congestion that contributes to extended travel times in the Adelaide metropolitan area occurs at locations where the rectilinear (north-south/east-west) road network is intersected by the radial arterial roads running out from the City of Adelaide in all directions, creating complex intersections , e.g. at Gepps Cross (Main North Road/Port Wakefield Road/Grand Junction Road), and at Glen Osmond, where Portrush Road, Cross Road and Glen Osmond Road all merge to feed onto the South East Freeway. Other pinch points occur where the rectilinear road pattern is imperfect, e.g. a short stretch of the east-west Henley Beach Road is required to link Marion Road and Holbrooks Road, the A14 north-south route through the western suburbs.

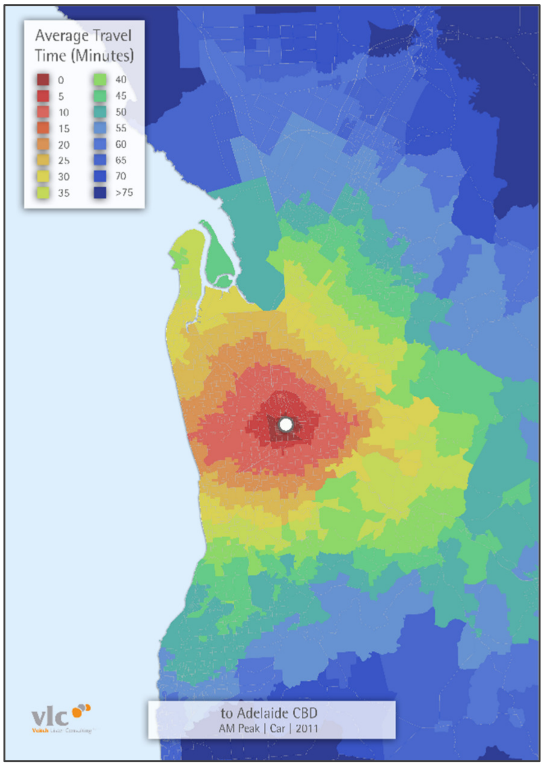

Figure 7-10: Adelaide CBD | Road | AM Peak | 2011

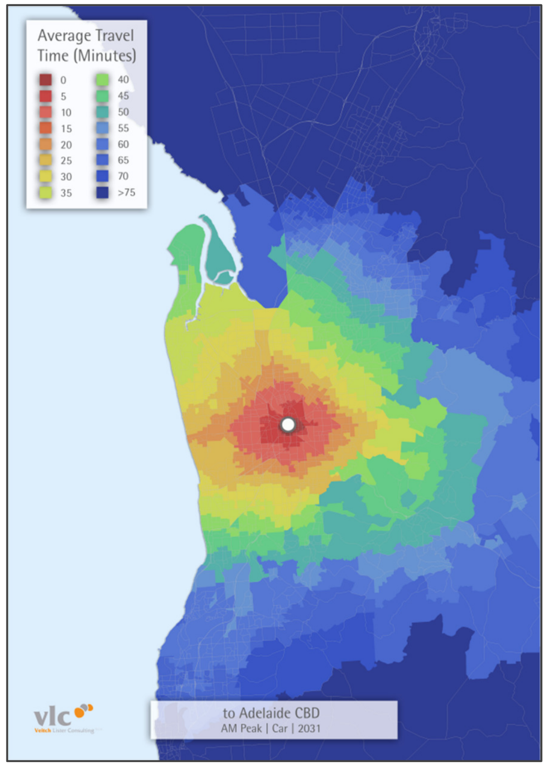

Figure 7-11: Adelaide CBD | Road | AM Peak | 2031

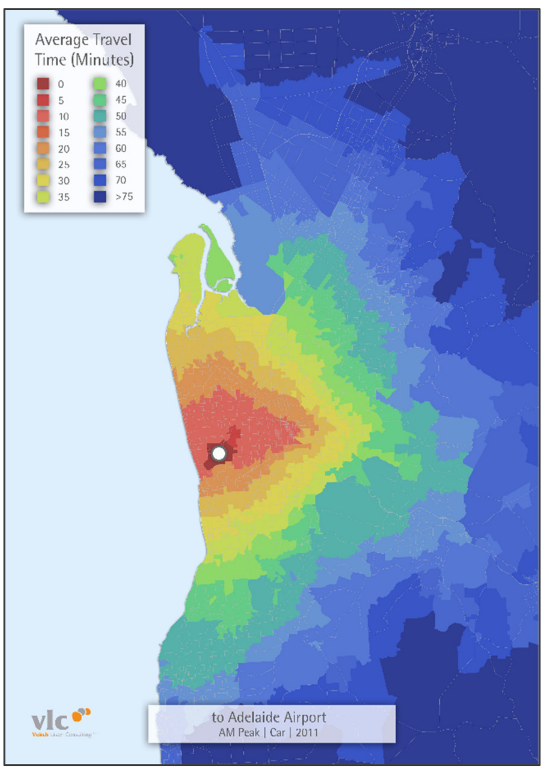

Figure 7-12: Adelaide Airport | Road | AM Peak | 2011

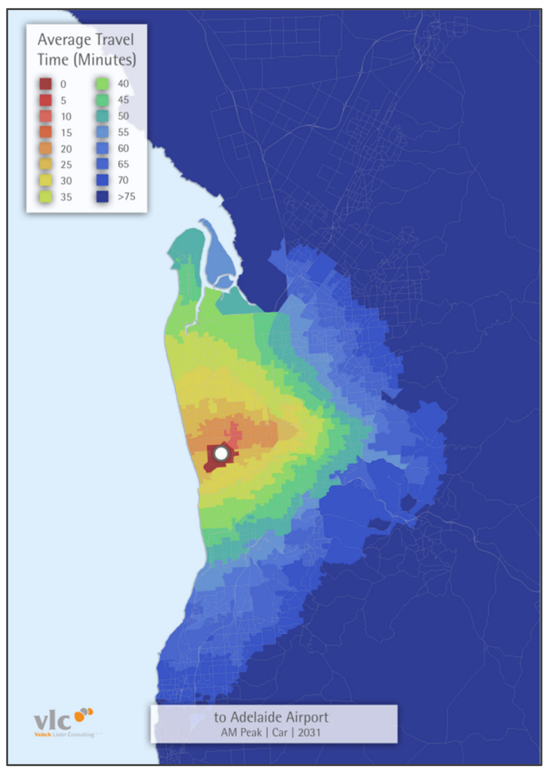

Figure 7-13: Adelaide Airport | Road | AM Peak | 2031

8. Public transport system performance

8.1 Introduction

This section of the report presents the Zenith model's predictions of increases in public transport ridership in Adelaide between 2011 and 2031, and how the predicted increases will affect the performance of the public transport system under an investment strategy that only includes committed and "highly likely" public transport projects.

A conservative assumption has been adopted regarding public transport service frequencies. While electrification of some rail lines has been included in the 2031 Adelaide metropolitan rail network, the current frequencies of existing rail services have not been increased, which accords with the service pattern adopted after electrification of the Noarlunga line and its extension to Seaford in 2013.

The single tram line, from Glenelg to the Adelaide CBD, was extended to the Entertainment Centre at Bowden in 2010. There are plans for the line's possible extension north-westwards to Port Adelaide and other north-west suburbs, and for a more extensive tram network serving some major radial routes, but none were committed at the time of this review.

The network of bus services in metropolitan Adelaide extends from Gawler in the north to Sellicks Beach in the south and to communities in the Adelaide Hills, and carries over 80% of public transport patrons. The services are contracted out to three companies: Torrens Transit (east-west routes and some intra-city services); Light City Buses (north-south routes and the O-Bahn guided busway services); and SouthLink (services to, from and within the far northern and southern suburbs and Adelaide Hills communities.)

8.2 Forecast increase in demand for public transport (2011 2031)

Figure 8-1 shows the Zenith model's forecast increase in daily passenger loading on the Adelaide metropolitan rail network between 2011 and 2031.

The largest forecast increases in daily rail loadings in 2031 are on the north line between Gawler and Adelaide, where patronage could more than double by 2031. The line is expected to be electrified in the near future, initially between Adelaide and Salisbury. Significant increases in patronage are also forecast on the newly electrified line to Seaford. Growth in patronage on the Adelaide network is from relatively low 2011 figures; the forecast growth of up to 7000 passengers per day on the Gawler line through the northern suburbs mainly reflects continued population growth in outer suburban areas.

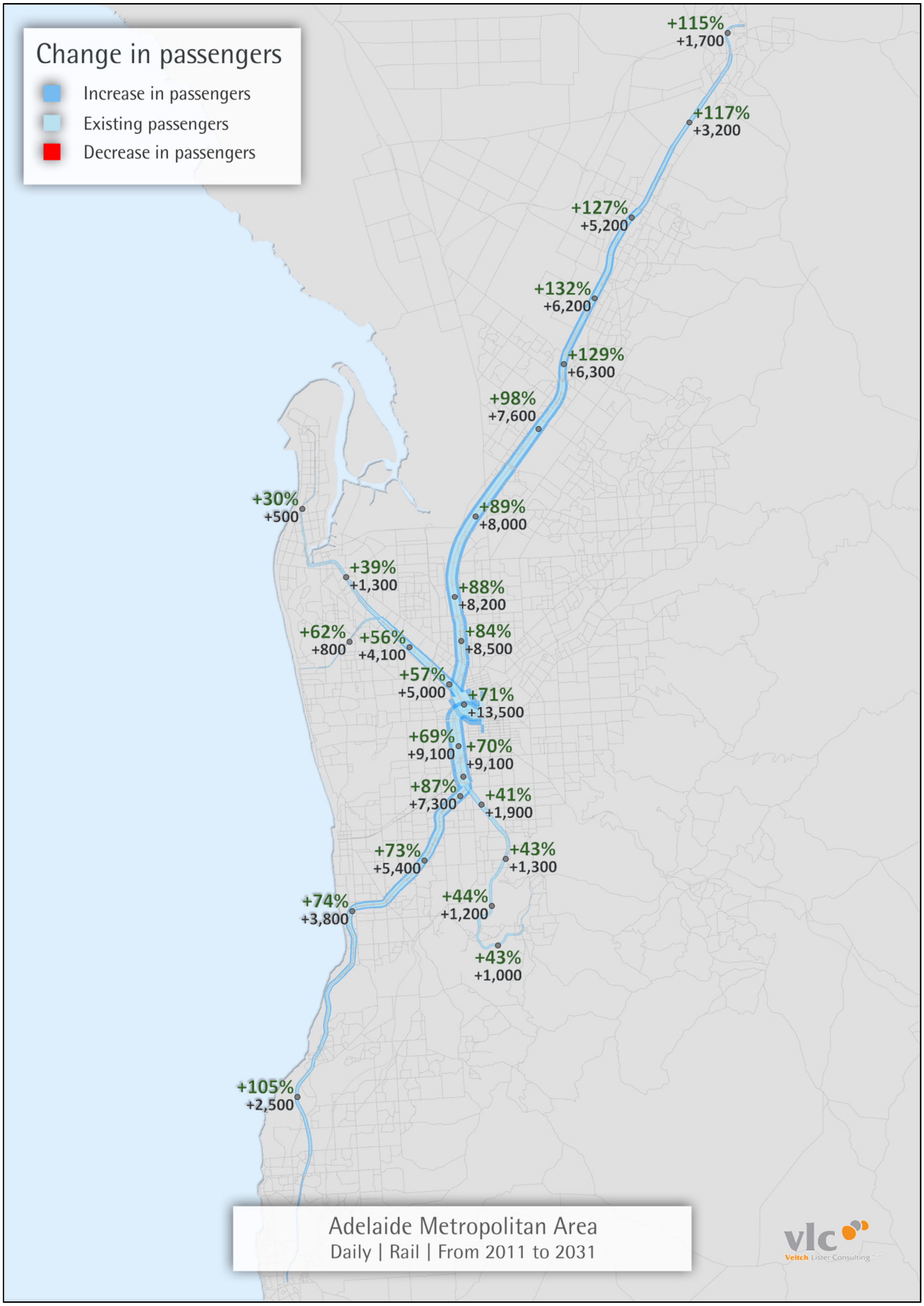

Figure 8-1: Increase in weekday Adelaide Metro passenger loading (2011-2031)

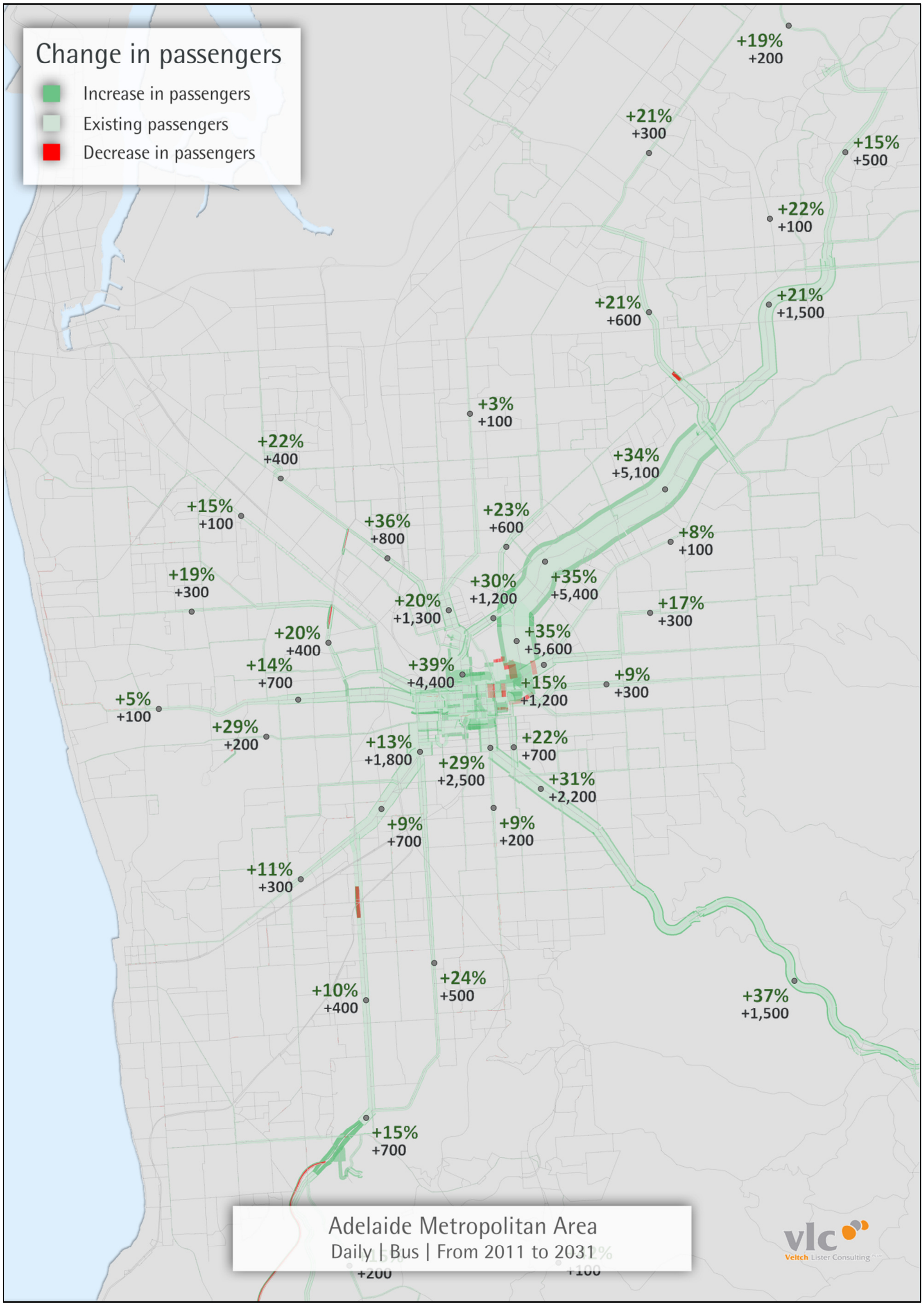

Figure 8-2: Increase in weekday bus passenger loading (2011-2031)

Figure 8-2 shows the Zenith model's forecast increase in daily passenger loading on a representative bus network serving the inner and north-eastern suburbs of Adelaide. Increases in the range 15% - 35% are forecast for many routes, depending on the quality and reliability of service, which is likely to be affected by increased congestion on the arterial and other roads used by bus services. Patronage on the O-Bahn guided busway is forecast to increase at the high end of the range (35%), off a relatively high 2011 ridership of over 25,000 passengers per day.

Adelaide's only tram line operates, mainly on exclusive right-of-way, through long-established suburbs to the south-west of the City. Increases of around 40% are forecast for the Glenelg service between 2011 and 2031, partly due to congestion on roads in the inner suburbs, such as Anzac Highway (A5 - which runs parallel to the tram line), Marion Road and South Road (A13). The short extension along North Terrace to Bowden is relatively new, to a park-and-ride facility at the Adelaide Entertainment Centre. High levels of patronage on the tram line through the City of Adelaide are partly due to free travel accorded all passengers between the Entertainment Centre and South Terrace, which includes the section linking Adelaide Railway Station, the CBD and the Victoria Square/Central Market precinct. The increase in daily loadings is depicted in Figure 8-3.

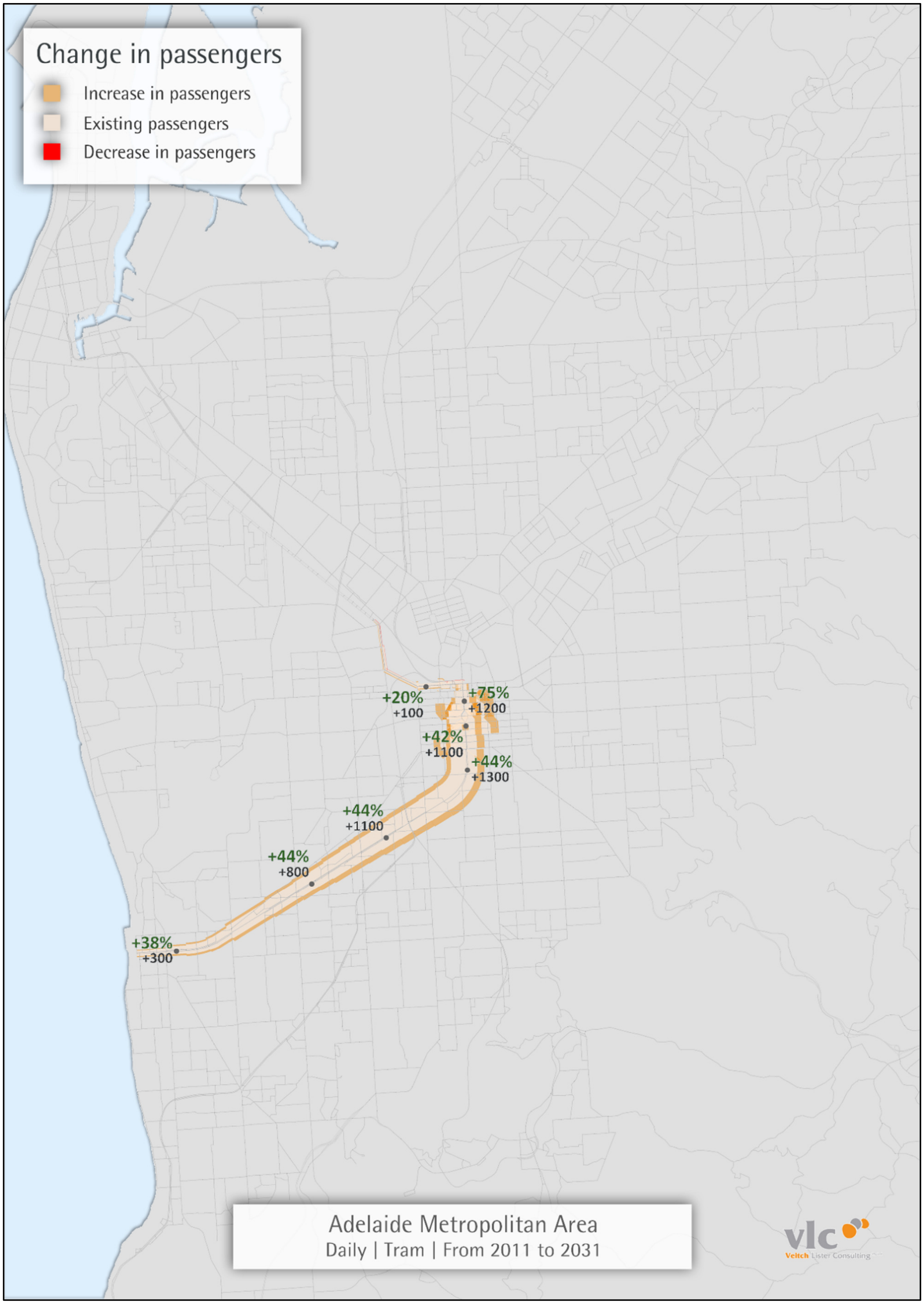

Figure 8-3: Increase in Tram weekday passenger loading (2011-2031)

8.3 Adelaide rail loadings relative to seating and crush capacity

Figure 8-4 shows the Zenith model's weekday AM maximum peak hour passenger load on the Adelaide suburban rail network relative to the available seating capacity in 2011 and 2031, while Figure 8.5 plots the maximum AM peak hour load relative to the "crush" capacity, calculated to be about 64% above the seating capacity.

Referring to Figure 8-4, the Zenith model's estimated 2011 passenger demand exceeds the seating capacity between Elizabeth and Adelaide on the Gawler line, between Brighton and Adelaide on the Seaford line, and from inner suburban stations on the Port and Belair lines. However, the Zenith model predicts that by 2031, if train frequencies and/or numbers of railcars per consist operating services in the peak are not increased above the current car replacement program, then the distance that some passengers would have to stand would apply from all but the outermost stations on the Gawler, Seaford and Belair lines, and from Woodville to the City on the Port line.

Figure 8-5 shows that all passenger loads across the AM peak hour in 2011 were below the defined crush capacity, though this does not mean that individual trains are not operating at or above crush capacity, depending on the number of cars making up the train. If frequencies are not increased or consists lengthened, sections of the Gawler line (from Elizabeth inbound) and Seaford line (from Hove inbound) are forecast to experience loads in the AM peak in excess of crush capacity by 2031.

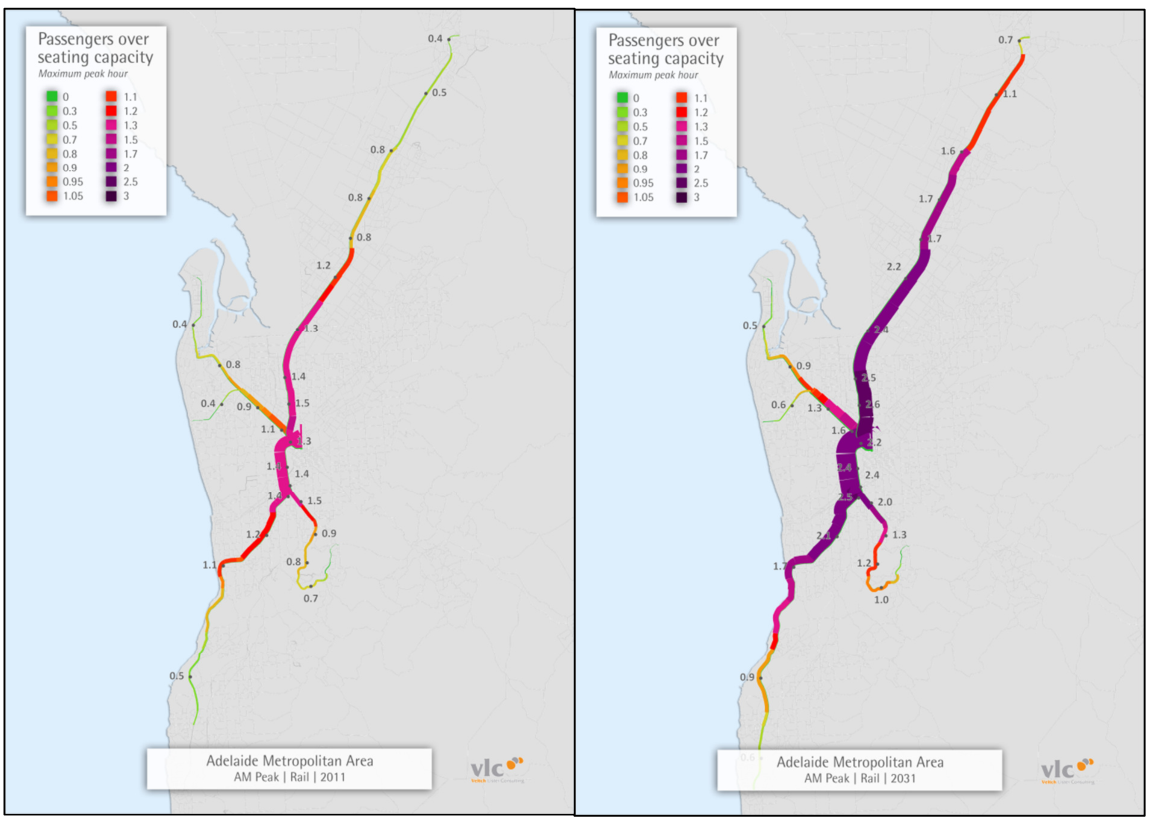

Figure 8-4: Adelaide Metro weekday passenger demand relative to seating capacity (2011 and 2031)

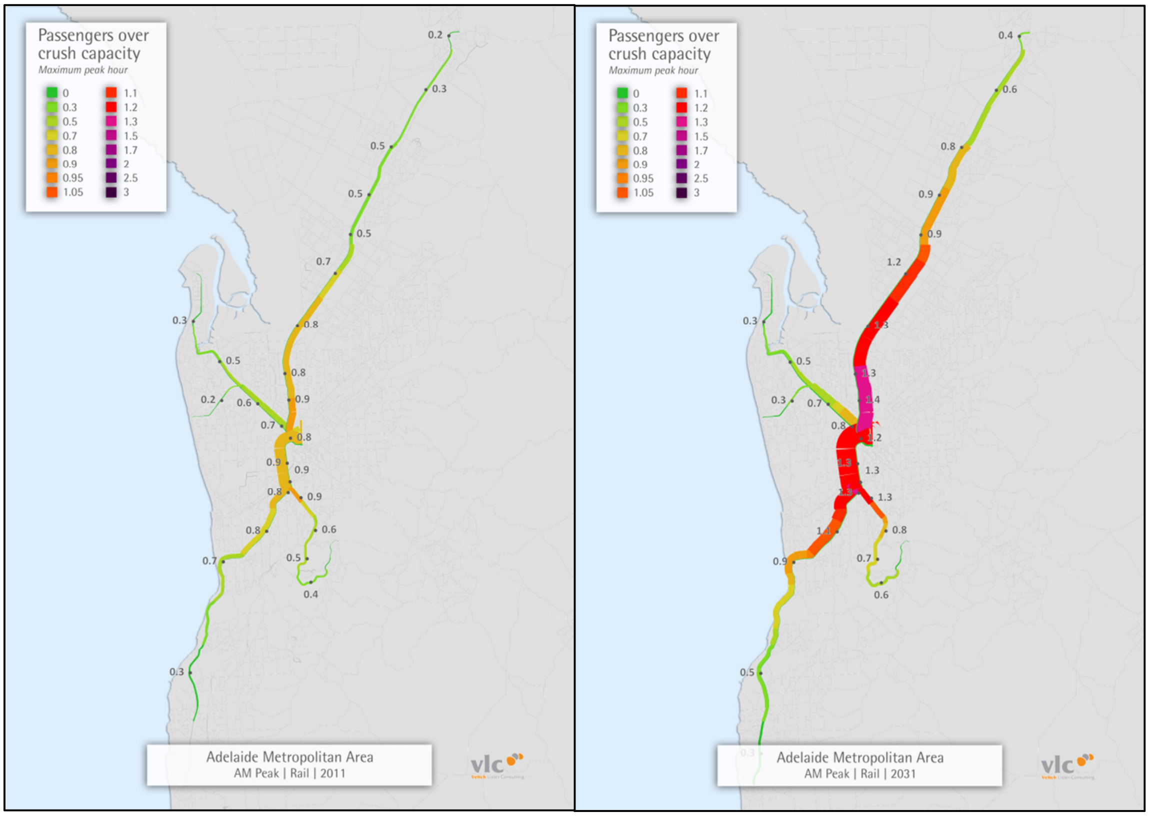

Figure 8-5: Adelaide Metro weekday passenger demand relative to crush capacity (2011 and 2031)

8.4 Adelaide bus loadings relative to seating and crush capacity

Figures 8-6 and 8-7 indicate passenger loads in the peak hour relative to seating and crush capacity respectively in 2011 and 2031. In 2011, the network is generally operating at a level below seating capacity (on average) with the exception of the O-Bahn (1.1) and the Hills routes (1.3). The quality of the ride and the length or the trip on the O-Bahn service is such that this would not be of concern. This is less so on the Hills routes (longer trips are involved) but still within acceptable limits for the peak hour.

In 2031, in terms of seating capacity, much of the network operates well within capacity with the exception of the O-Bahn (at 1.5) and the Hills routes (1.9). Both levels are straining the friendship a bit (particularly the Hills routes) however keeping in mind the unchanged frequencies in this reference scenario. At such loading levels demand spreading would also occur.

In terms of crush capacity (Figure 8-7) in 2031 problems are predicted to occur on the O-Bahn (1.0) and Hills routes (1.3) and a policy of maintaining existing frequencies would not be sustainable.

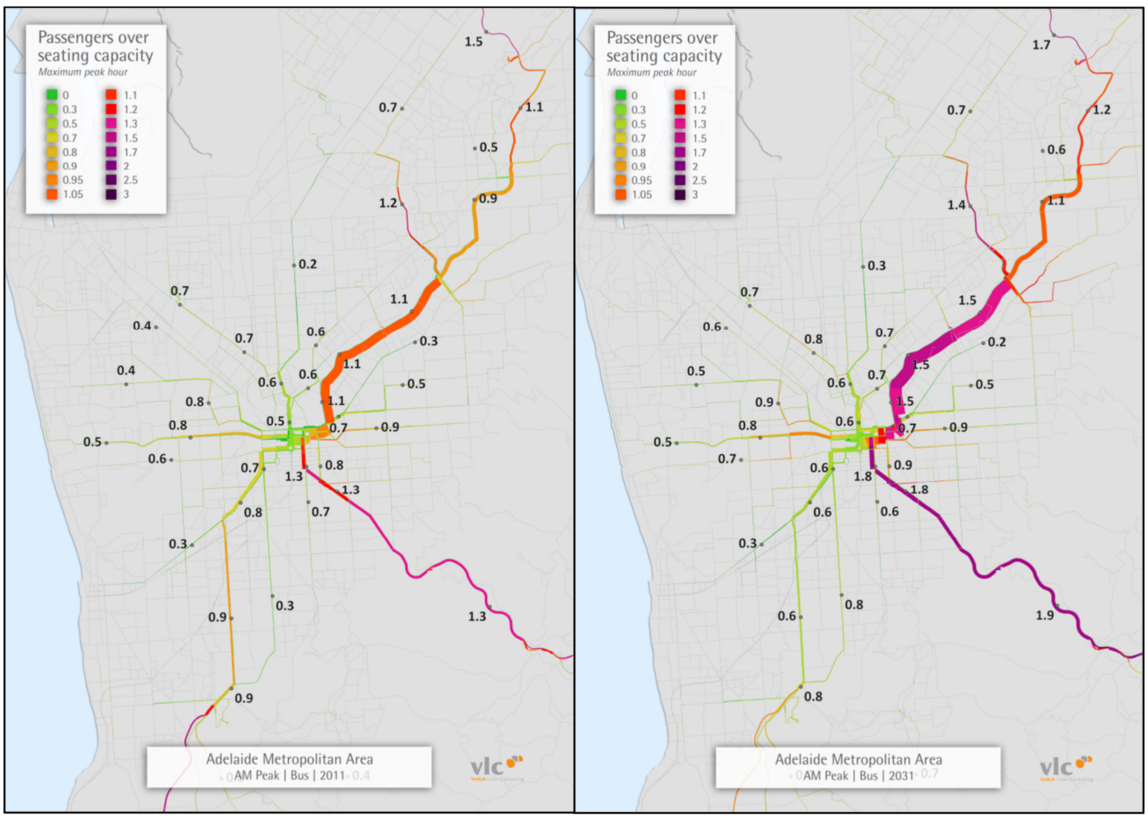

Figure 8-6: Bus weekday passenger demand relative to seating capacity (2011 and 2031)

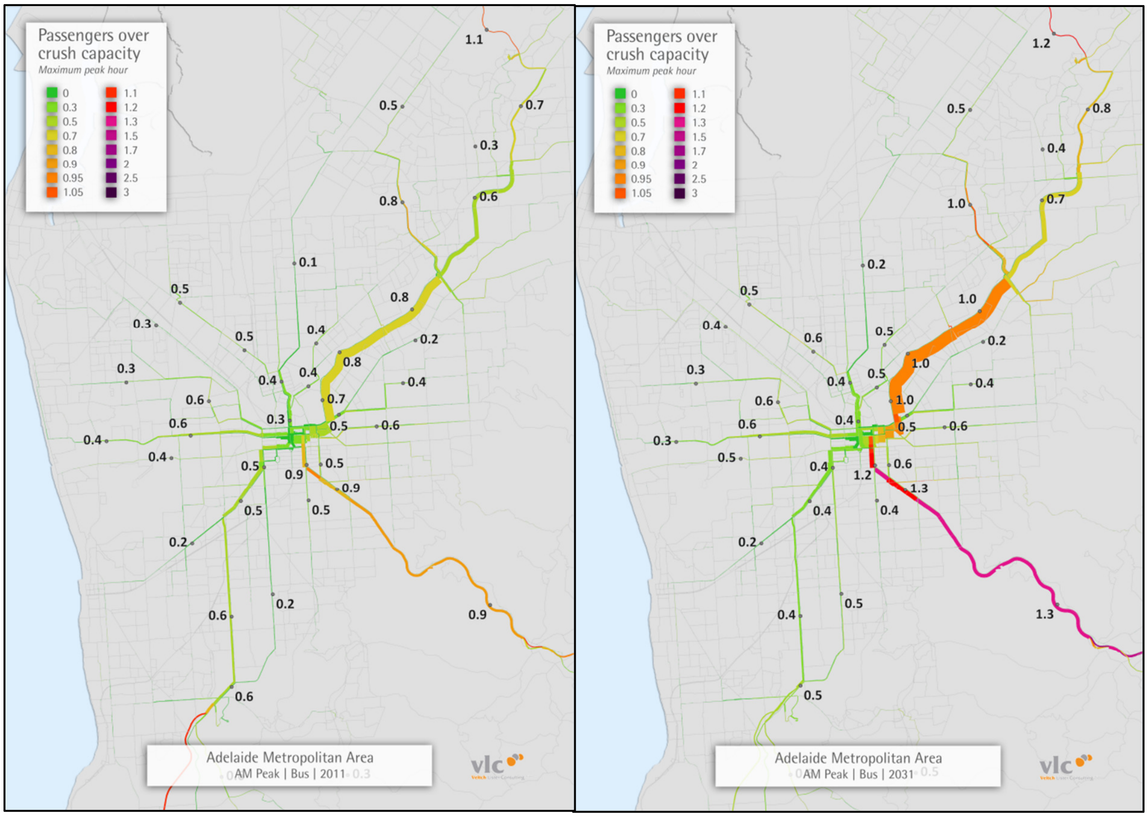

Figure 8-7: Bus weekday passenger demand relative to crush capacity (2011 and 2031)

Appendix A:
Public transport capacity assumptions

	Seating	Crush
Rail	205	336
Bus	45	65
Light Rail	60	140

Appendix B: ABS Statistical Areas level 3

Adelaide Metropolitan Area SA3s

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