Melbourne and Geelong

6.1 Melbourne has grown, and so has the time and effort it takes to get to the city and to move around

Melbourne's transport network performance over the past decade

Melbourne is Australia's second largest population centre. Between 2006 and 2016 Melbourne's population increased from approximately 3.6 million to just under 4.5 million. Melbourne's population is skewed towards its south-east, with the city's south-eastern suburbs extending much further than the western and northern suburbs.[74]

The number of people living in Melbourne, and the location of their homes and workplaces, are the key drivers of the pattern and size of the transport task in the city. Over the past decade the distance travelled by people on Melbourne's roads has increased by 9%. Furthermore, the percentage of people using public transport to travel to work in Melbourne has increased from 16% in 2011 to 18% in 2016.[75]

6.2 There are variations between the 2015 and 2019 Audit forecasts

There have been substantial changes to the 2019 Audit inputs and assumptions

Since the 2015 Audit, Melbourne and Geelong's forecast cost of road congestion has increased by 15% (Table 15 and Figure 31). This is largely the result of increased vehicle kilometres travelled due to better roads and lower fuel prices.

The 2031 population forecast used the 2019 Audit expects 4% more people to live in Melbourne and Geelong than the forecast used in the 2015 Audit. Population is also distributed slightly differently. Forecast population is higher in most areas. The 2019 Audit predicts that Geelong will have 12,000 more residents by 2031. Compared to the last audit, the number of people living in inner areas is assumed to be higher such as Port Phillip, Melbourne City, Maribyrnong, Yarra and Port Phillip.

Table 15: The cost of road congestion and public transport crowding in Melbourne and Geelong, 2016 and 2031

	Cost of public transport crowding ($ millions)	Cost of road congestion ($ millions)	Total ($ millions)
2016 (2019 Audit)	75	5,485	5,560
2031 (2019 Audit)	352	10,379	10,731
2031 (2015 Audit)	N/A	9,006	N/A
2031 (change from 2015 Audit)		1,373 (+15%)	

Source: Infrastructure Australia (2015) and Veitch Lister Consulting (2019)[76]

Outer areas, such as Casey are also expected to have higher populations. Tullamarine, Broadmeadows, Melton and Bacchus Marsh are too, although this is partially offset by a substantial decrease in Sunbury. A limited number of areas are forecast to have slightly smaller populations than in the 2015 Audit.

Table 16 reflects changes in model inputs and key outputs between the 2015 and 2019 Audit modelling.

A note on Melbourne's demographic projections

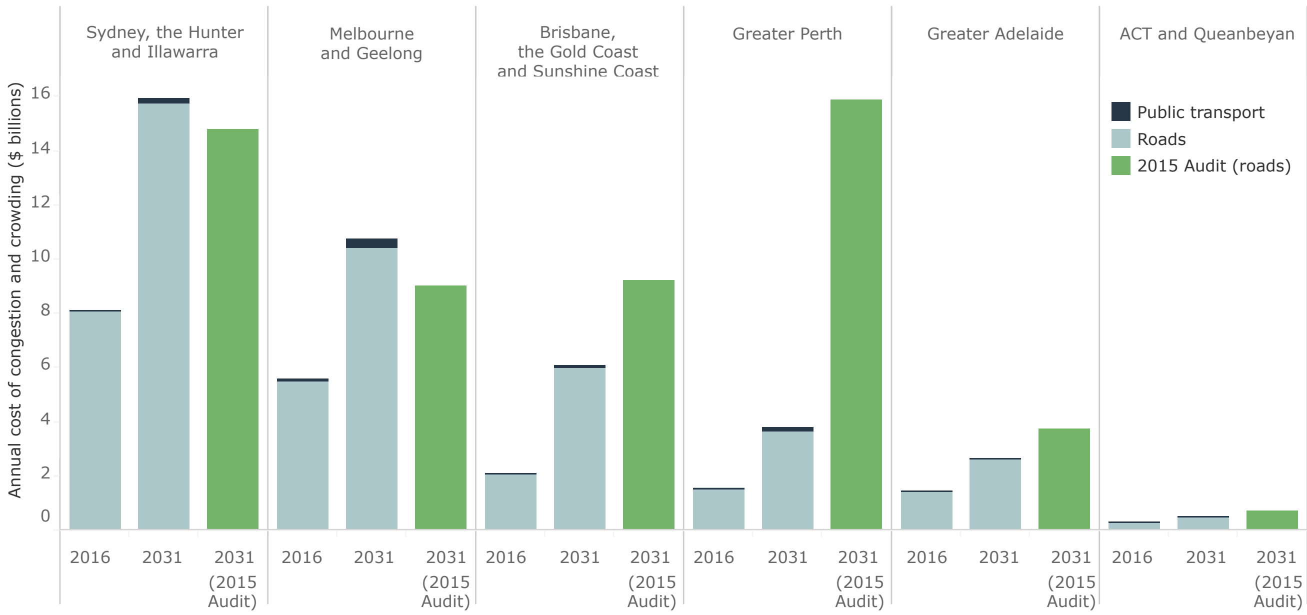
The Audit's transport modelling for Melbourne has largely relied on population and employment projections from the Victorian Government's *Victoria in Future 2016* report.[77]

Some projections for areas outside the Melbourne metropolitan area, which fed into regional rail forecasts, are similar, but not exactly the same as projections from *Victoria in the Future 2016*.

In addition, the 2016 ABS Census revealed that in that year, Victoria's population was 120,000 people higher than the estimate in *Victoria in the Future 2016*.

As a consequence it should be noted that the transport modelling that has informed this section could underestimate the number of trips on Melbourne's road and public transport networks in both the 2016 base and the 2031 forecast years.

Figure 31: The cost of road congestion and public transport crowding, 2016 and 2031



Source: Infrastructure Australia (2015) and Veitch Lister Consulting (2019)[78]

Table 16: Changes in key model inputs and outputs between 2015 and 2019 modelling in Melbourne and Geelong

		Demographic assumptions		Network assumptions		Travel cost assumptions			
		Population	Jobs	Road investment	Public transport investment	Fuel	PT fares	Parking	Tolls
Change in inputs		⇧ Population forecasts have increased slightly (+4%)	⇧ Employment forecasts have increased slightly (+4%), however the proportion of jobs in Melbourne City SA3 remains stable	⇧ More investment in the road network (+9% network lane km)	⇧ More investment in the PT network* *While service kilometres are 14% lower compared to the 2015 Audit, this is purely due to more conservative bus service assumptions. Rail service kms increase by +15% and Tram by +17%	⇩ Reduction in fuel price (140 c/L to 104 c/L AUD 2011)	— No change in other transport costs		— Tolls grown at CPI. New toll roads with similar costs
Impact on output (AM peak)	Total trips (no change)	— Slight increase in total population does not substantially change total modelled trips	— Total trips are generated by population assumptions and model parameters only						
	Car trips (+4%)	— Slight increase in total population does not substantially change the number of card trips	— The distribution of employment is similar between the audits, as such a decline in overall employment does not substantially alter the balance between car and PT travel	⇧ Better roads encourage car travel	⇩ Better PT can encourage more PT travel and fewer car trips	⇧ Lower fuel prices encourage car travel	— No change = no impact		— Negligible impact
	Car vehicle kms travelled (+20%)	— Slight increase in total population does not substantially affect car vehicle kms	— The distribution of employment is similar between the audits, as such a decline in overall employment does not substantially alter the balance between car and PT travel	⇧ Better roads encourage car travel	⇩ Better PT can encourage more PT travel and fewer car kms	⇧ Lower fuel prices encourage car travel	— No change = no impact		— Negligible impact
	Public transport trips (+1%)	— Slight increase in total population does not substantially change number of PT trips	— The distribution of employment is similar between the audits, as such a decline in overall employment does not substantially alter the balance between car and PT travel	⇩ Better roads encourage car travel and fewer PT trips	⇧ Better PT can encourage more PT travel	⇩ Lower fuel prices encourage car travel and reduce PT travel	— No change = no impact		— Negligible impact

Source: Veitch Lister Consulting (2019)[79]

New network assumptions

Both audits use a similar approach to developing network assumptions that assumes only projects with funding or significant levels of political commitment will be completed by 2031. For Melbourne, there are seven key differences in network assumptions. North East Link, Melbourne Metro, Melbourne Airport Rail Link, West Gate Tunnel/Monash Freeway upgrade, Mernda Rail extension, Citylink widening and Fishermans Bend Tram Extension are all included in the 2019 Audit, but not the 2015 Audit.

Variation between road network capacities in 2031

Traffic volumes on Melbourne's major roads are not consistent between the 2015 and 2019 Audits. However, higher traffic volumes are forecast in the 2019 Audit as a result of population growth and an increase in vehicle kilometres travelled.

The largest increases in traffic are driven by upgrades on the Monash and Princes Freeways and Eastern Freeway Corridor to Ringwood. The widening of the Monash Freeway increases traffic volumes on this corridor and the delivery of the North East Link increases traffic on the Eastern Freeway during those works.

There are congestion decreases to sections of the M2 near the airport, but increases on the M2 nearer to the Melbourne CBD as a result of the widening of Citylink. Alongside this there are also congestion increases to sections of the M80 and the Nepean Highway.

Increased congestion is largely limited to arterial and local roads, which often corresponds to higher population growth. Arterial roads and local roads to the east of the CBD, including Hawthorn, Hawthorn East, Richmond, Toorak and Mount Waverley are forecast to have more congestion.

Higher vehicle delays are forecast on the key corridors in the 2019 Audit relative to those in the 2015 Audit. In percentage terms the increase in delay hours is larger than the corresponding change in traffic volumes. This is a function of the nature of traffic flow, where delays grow more rapidly with each additional vehicle added to an otherwise congested network. Table 17 compares corridor-level average traffic and delay hours for the AM peak for the ten most delayed corridors in the 2019 Audit.

Variation between public transport capacities in 2031

The proportion of public transport trips forecast in this Audit are similar those forecast in the 2015 Audit. This is despite substantial additional investment in public transport infrastructure. New projects make both car and public transport travel more attractive. As a result, there is not a significant shift in the balance between car and public transport trips. Relative to the 2015 Audit, car vehicle kilometres travelled increases. This is mostly a function of the reduction in fuel cost.

In the 2019 Audit at AM peak, almost all train services reach a moderate volume of suburban rail passengers as they approach the CBD. Despite this, none of the lines reach crush capacity. The highest volume to capacity is on South East lines approaching the city, and eastern lines approaching the city. This is similar to levels of demand within the 2015 Audit.

Table 17: Most congested roads ranked by total delay hours, 2031 AM Peak and ranking in 2015 Audit in Melbourne and Geelong

City rank (2019 Audit)	Corridor	Direction	Average peak hour traffic volumes			Total delay hours			City rank (2015 Audit)
			2015 Audit	2019 Audit	Difference	2015 Audit	2019 Audit	Difference	
1	Princes Freeway / West Gate Freeway corridor	E/B	5,600	6,100	8%	11,500	16,800	47%	1
2	Princes Freeway / Monash Freeway corridor	W/B	5,400	7,500	39%	9,500	15,900	67%	2
3	Metropolitan Ring Road (western section)	S/B	6,600	6,800	3%	5,700	8,500	49%	6
4	Calder Freeway corridor	E/B	4,000	4,700	18%	6,400	8,200	28%	4
5	Princes Highway / Monash Freeway corridor	W/B	2,500	2,800	13%	5,100	7,500	46%	7
6	Metropolitan Ring Road (western section)	N/B	6,500	6,400	-2%	4,400	7,000	58%	8
7	Western Freeway corridor	E/B	3,500	3,200	-10%	6,600	5,700	-13%	3
8	Hume Freeway corridor	S/B	4,400	4,800	9%	6,000	5,700	-5%	5
9	Outer metropolitan ring corridor (Werribee–Sunbury–Wallan–Mernda)	S/B	-	900	-	-	4,300	-	-
10	Sydney Road corridor	W/B	2,500	2,400	-7%	4,300	4,500	4%	9

Note: N/B, S/B, W/B and E/B represent northbound, southbound, westbound and eastbound, respectively. The outer metropolitan ring corridor was not defined in the 2015 Audit.

Source: Veitch Lister Consulting (2019)[80]

6.3 Commuters in Melbourne experience high levels of road congestion and public transport crowding every day

Snapshot of Melbourne's road network in 2016

As at 2016, Melbourne's drivers already experience high levels of congestion. Our modelling indicates the annualised cost of road congestion and public transport crowding in Melbourne and Geelong was approximately $5.5 billion in 2016, of which $5.4 billion was in Melbourne. This congestion is at its worst in the AM peak period, as demonstrated in Figure 32. However, Melbourne's major roads also experience similar levels of congestion in the PM peak period.

Melbourne's most congested roads are those that provide access to the inner city from the western and eastern suburbs, notably the Princes and Monash Freeways. Some key north-south routes also experience significant congestion during peak periods.

Melbourne's most congested roads in 2016: what the driver experiences

Infrastructure Australia has highlighted the most congested roads in Melbourne based on a variety of metrics that relate directly to the users' experience, including estimating the percentage of journey time that is spent in congestion. Table 18 and Figure 33 feature the ten most congested corridors in the AM and PM peak periods.

The city's most congested roads radiate from Melbourne's CBD to the north, east and west. These roads provide vital access for residents in outer suburbs to reach central employment clusters.

Melbourne's major motorways from the south-east, the Princes and Monash Freeways, experience significant traffic in both peak periods. The Princes Freeway westbound is particularly congested in the morning peak period, experiencing similar eastbound congestion in the evening peak period. Similarly, congestion levels are high westbound on the Monash Freeway in the morning peak period, with the opposite direction highly congested in the evening. The high demand for use of these roads illustrates their role as both important access routes for eastern and western outer suburbs residents and facilitators of cross-city travel.

Congestion on key sections of Melbourne's road network during peak periods causes problems for the movement of traffic within and around the city centre and surrounding suburbs. Sections of CityLink are highly affected by congestion. In particular, the Tullamarine Freeway corridor to Melbourne Airport experiences high levels of congestion in both peak periods. Drivers on this corridor can expect delays of up to 24 minutes in the AM peak period and 16 minutes in the PM peak period. In addition, the western section of the Eastern Freeway is significantly congested, as a consequence of demand for city access and cross-city travel.

However, unlike Sydney, Melbourne's congestion is largely limited to motorway, freeways and arterials. Local streets remain accessible and amenity is high.

Figure 32: Melbourne weekday traffic volume / capacity ratio, 2016 AM peak

Note: Volume / capacity ratios show the quantity of traffic relative to a road's capacity. Any link operating at a VCR above 1.0 is coloured red, indicating that more vehicles are using the road than it was designed to accommodate under free-flow conditions.

Source: Veitch Lister Consulting (2019)[81]

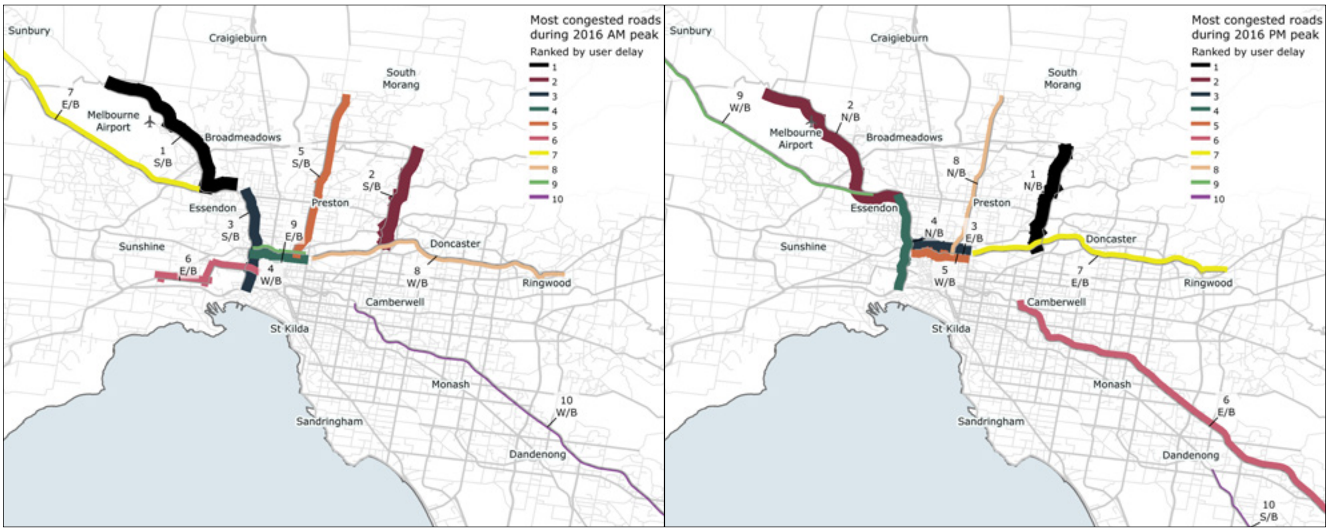
Table 18: Melbourne's most congested roads (user experience), 2016

City rank	Corridor including origin / destination connected (direction)	Length (km)	Share of journey time due to congestion	Delay per vehicle (mins)	Cost of congestion for a car	Cost of congestion for a heavy commercial vehicle
AM peak						
1.	Airport to city via Tullamarine Freeway (S/B)	17	67%	24	$6.63	$28.55
2.	Metropolitan Ring Road to Eastern Freeway via Greenborough Road / Rosanna Road (S/B)	11	63%	21	$5.80	$24.98
3.	Tullamarine Freeway to West Gate Freeway via CityLink Western Link (S/B)	10	61%	10	$2.76	$11.90
4.	Eastern Freeway to CityLink via State routes 29 and 38 (W/B)	5	60%	10	$2.76	$11.90
5.	Epping to city via High Street / St Georges Road (S/B)	17	59%	31	$8.56	$36.88
6.	Brooklyn to South Melbourne via Docklands Highway (E/B)	10	59%	18	$4.97	$21.41
7.	Gisborne South to Tullamarine Freeway via Calder Freeway (E/B)	31	59%	29	$8.01	$34.50
8.	City to Ringwood via Eastern Freeway (W/B)	23	59%	22	$6.08	$26.17
9.	CityLink to Eastern Freeway via State routes 38 and 29 (E/B)	5	58%	9	$2.49	$10.71
10.	Pakenham to city via Princes Freeway / Monash Freeway (W/B)	57	57%	49	$13.53	$58.29
PM peak						
1.	Eastern Freeway to Metropolitan Ring Road via Rosanna Road / Greenborough Road (N/B)	11	57%	17	$4.69	$20.22
2.	City to Airport via Tullamarine Freeway (N/B)	18	56%	16	$4.42	$19.03
3.	CityLink to Eastern Freeway via State routes 38 and 29 (E/B)	5	52%	7	$1.93	$8.33
4.	West Gate Freeway to Tullamarine Freeway via CityLink Western Link (N/B)	10	52%	7	$1.93	$8.33
5.	Eastern Freeway to CityLink via State routes 29 and 38 (W/B)	5	51%	7	$1.93	$8.33
6.	City to Pakenham via Monash Freeway / Princes Freeway (E/B)	58	50%	36	$9.94	$42.83
7.	Ringwood to city via Eastern Freeway (E/B)	23	50%	15	$4.14	$17.85
8.	City to Epping via St Georges Road / High Street (N/B)	17	49%	21	$5.80	$24.98
9.	Tullamarine Freeway to Gisborne South via Calder Freeway (W/B)	32	46%	19	$5.25	$22.60
10.	Monash Freeway to Tooradin via South Gippsland Highway (S/B)	32	45%	22	$6.08	$26.17

Note: N/B, S/B, W/B and E/B represent northbound, southbound, westbound and eastbound, respectively.

Source: Veitch Lister Consulting (2019)[82]

Figure 33: Melbourne's most congested roads (user experience), 2016 AM (left) and PM (right) peak periods



Source: Veitch Lister Consulting (2019)[83]

Melbourne's most congested roads in 2016: the cost to the community of total vehicle delays

As a measure of the whole-of-system impacts of congestion, Infrastructure Australia has also identified the most congested road corridors in Greater Melbourne based on aggregating the total delay hours experienced by all vehicles using the congested road during the modelled period. The ten most congested corridors under this approach as shown in Table 19 and Figure 34, for the AM and PM peak respectively.

In 2016, Melbourne's most delayed corridors by this aggregate metric were the Westgate Freeway / Princes Freeway and Monash Freeway / Princes Freeway corridors, as displayed in Table 19. These roads provide access to the inner city from the east and west. The aggregate delay incurred on these corridors was significantly larger than on the other high-ranking corridors. Delays on key Melbourne roads not only delay private vehicles but disrupt public transport services as Melbourne's trams and buses largely mix with general traffic.

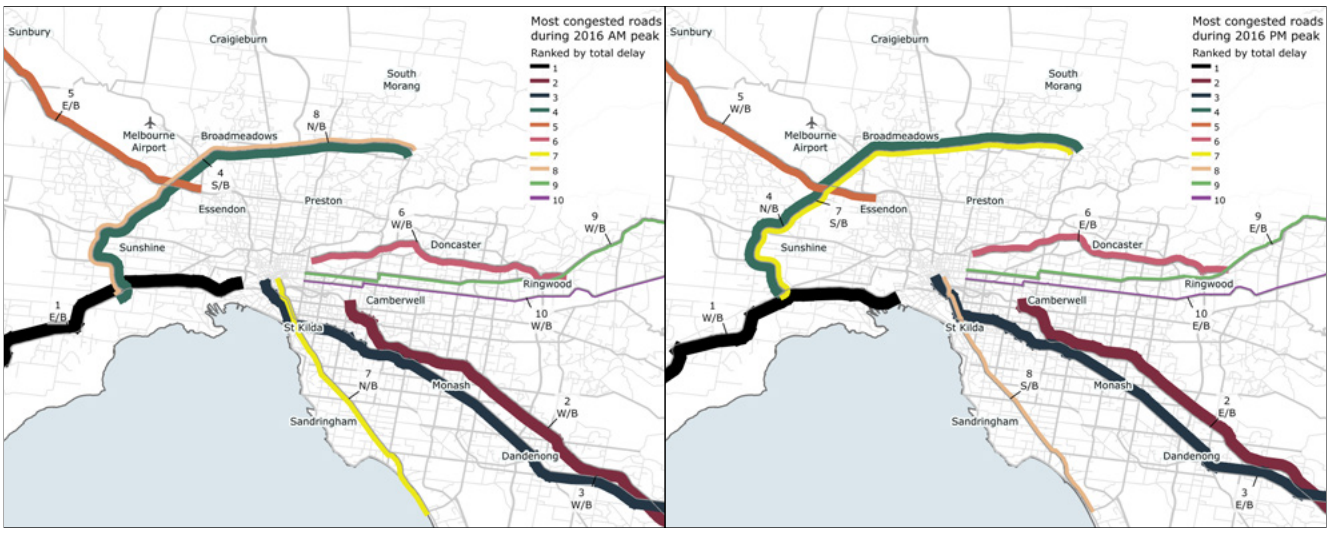
Table 19: Melbourne's most congested roads (total vehicle delays), 2016

City rank	Corridor	Direction	Total delay hours	Cost of congestion (daily)
AM peak				
1.	Princes Freeway / West Gate Freeway corridor	E/B	10,800	$218,000
2.	Princes Freeway / Monash Freeway corridor	W/B	8,500	$172,000
3.	Princes Highway / Monash Freeway corridor	W/B	5,300	$105,000
4.	Metropolitan Ring Road (western section)	S/B	4,400	$85,000
5.	Calder Freeway corridor	E/B	3,600	$74,000
6.	Eastern Freeway corridor from Ringwood	W/B	3,300	$64,000
7.	Inner beachside suburbs corridor (Nepean Highway)	N/B	2,900	$55,000
8.	Metropolitan Ring Road (western section)	N/B	2,700	$51,000
9.	East-west arterial corridor (Maroondah Highway)	W/B	2,600	$55,000
10.	East-west arterial corridor (Canterbury Road)	W/B	2,400	$45,000
PM peak				
1.	West Gate Freeway / Princes Freeway corridor	W/B	7,100	$145,000
2.	Monash Freeway / Princes Freeway corridor	E/B	6,200	$125,000
3.	Monash Freeway / Princes Highway corridor	E/B	3,800	$74,000
4.	Metropolitan Ring Road (western section)	N/B	3,100	$64,000
5.	Calder Freeway corridor	W/B	2,400	$47,000
6.	Eastern Freeway corridor to Ringwood	E/B	2,400	$46,000
7.	Metropolitan Ring Road	S/B	2,200	$47,000
8.	Inner beachside suburbs corridor (Nepean Highway)	S/B	1,900	$36,000
9.	West-east arterial corridor (Maroondah Highway)	E/B	1,700	$33,000
10.	West-east arterial corridor (Canterbury Road)	E/B	1,600	$31,000

Note: N/B, S/B, W/B and E/B represent northbound, southbound, westbound and eastbound, respectively.

Source: Veitch Lister Consulting (2019)[84]

Figure 34: Melbourne's most congested roads (total vehicle delays), 2016 AM (left) and PM (right) peak periods



Source: Veitch Lister Consulting (2019)[85]

Melbourne's public transport system in 2016

Melbourne's public transport system is comprised of rail, buses and trams. Melbourne's suburban rail provides access to the CBD from the outer, middle and inner suburbs, while buses and trams primarily service the inner city. Melbourne's SmartBus routes service major roads, providing express services to the CBD, while buses at the local level provide a coverage role. Victoria's regional rail networks (V/Line) service Melbourne's outer growth and regional areas.

The demand for public transport in Melbourne has grown substantially in recent years. This is partially due to congestion on the road network, but also because of increased residential densities around transport interchanges and progressive improvements to service levels and frequencies.

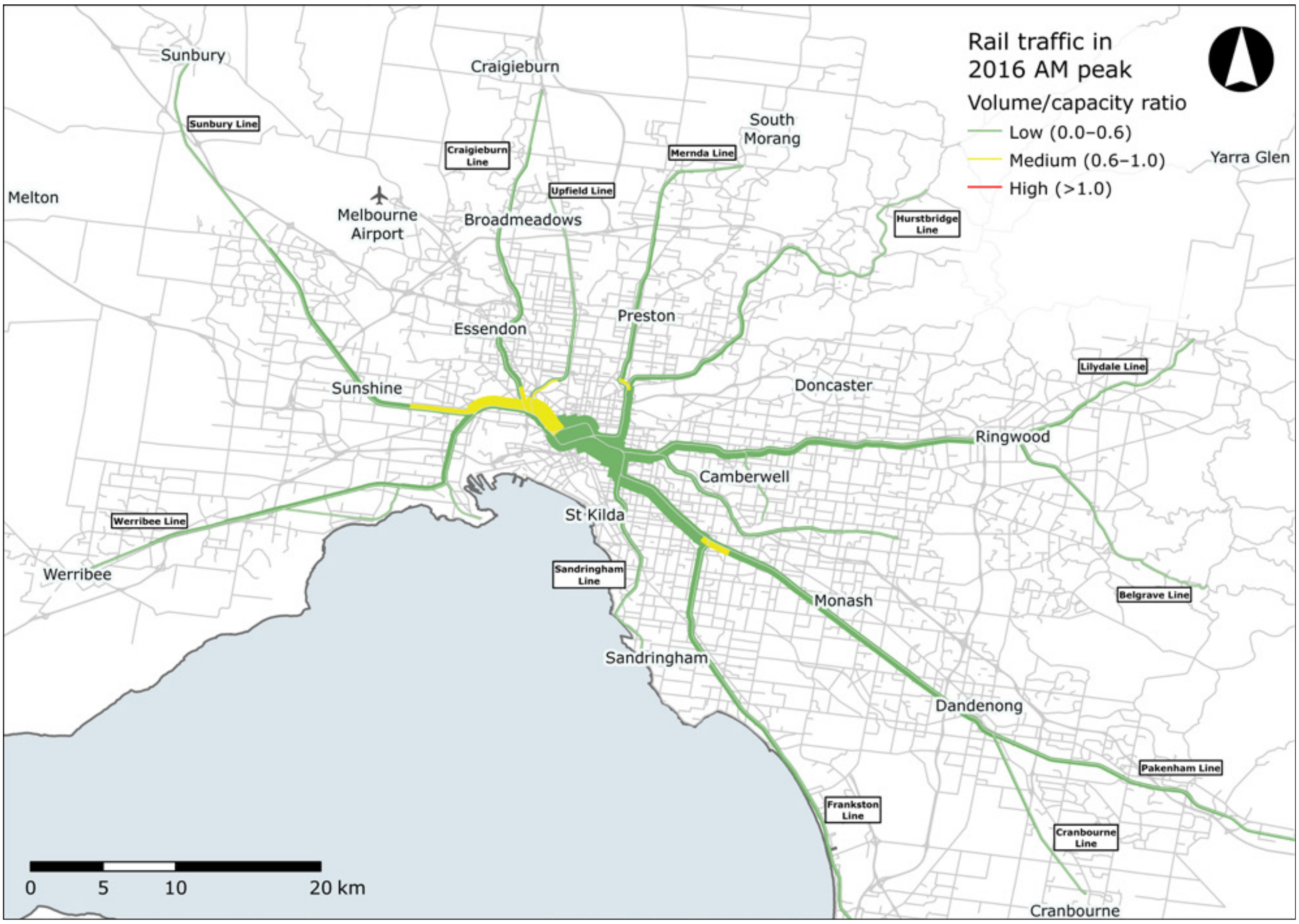
The demand on Melbourne's suburban rail network is highly peak directional. Melbourne's most crowded train services in the AM and PM peaks are on western lines (Figure 35). Rail crowding is highest in the AM peak period on the south-west and north-west lines to the CBD from Werribee and Sunbury respectively. As they reach the city, trains on these lines exceed or have reached their seated capacity while on average are still operating under their maximum (i.e. crush-laden) capacity. This means that train users must stand for longer and services are often delayed by extended boarding and alighting times. The rail network sees comparatively less crowding in the PM peak as travellers tend to depart the city at more diverse times.

Demand on Victoria's regional rail network is also peak directional. Like the suburban rail network, the most crowded sections are on the western lines (Figure 36). Unlike the suburban rail network, medium levels of crowding also occur in the north of the city on the North East Line.

In 2016 Melbourne's bus networks generally witnessed low levels of crowding (Figure 37). SkyBus, serving Melbourne Airport, is identified as Melbourne's most crowded bus corridor in peak periods. Crowding on the SkyBus service is representative of the lack of diversity in public transport available to access the airport. This crowding also occurs in suburbs to the east of Melbourne CBD such as Taylors Lake and Sunshine.

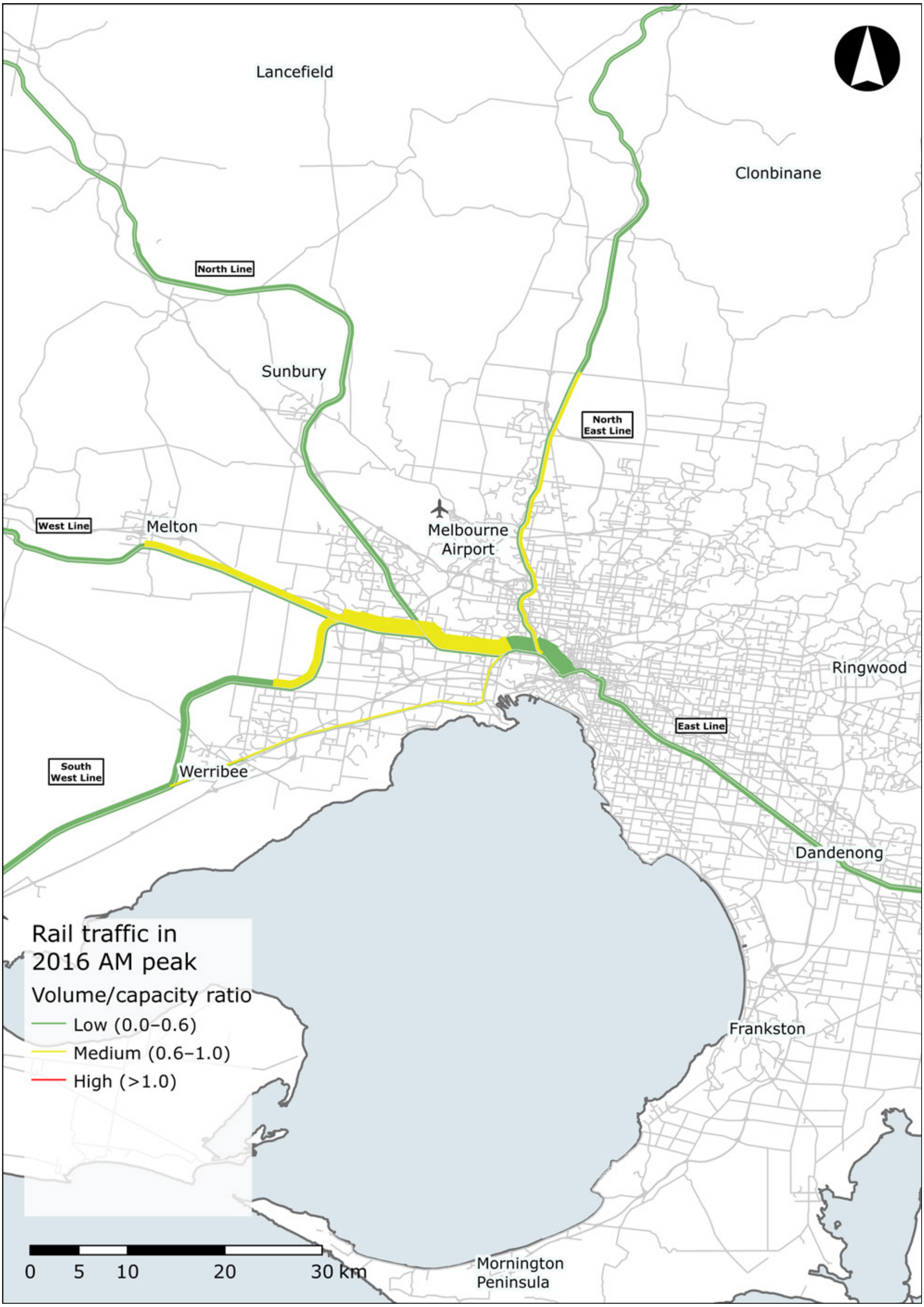
Additionally, buses serving the key activity centres of Monash and Dandenong in the south-eastern suburbs had moderate levels of crowding in peak periods.

Figure 35: Melbourne weekday train passenger volume / capacity ratio, 2016 AM peak



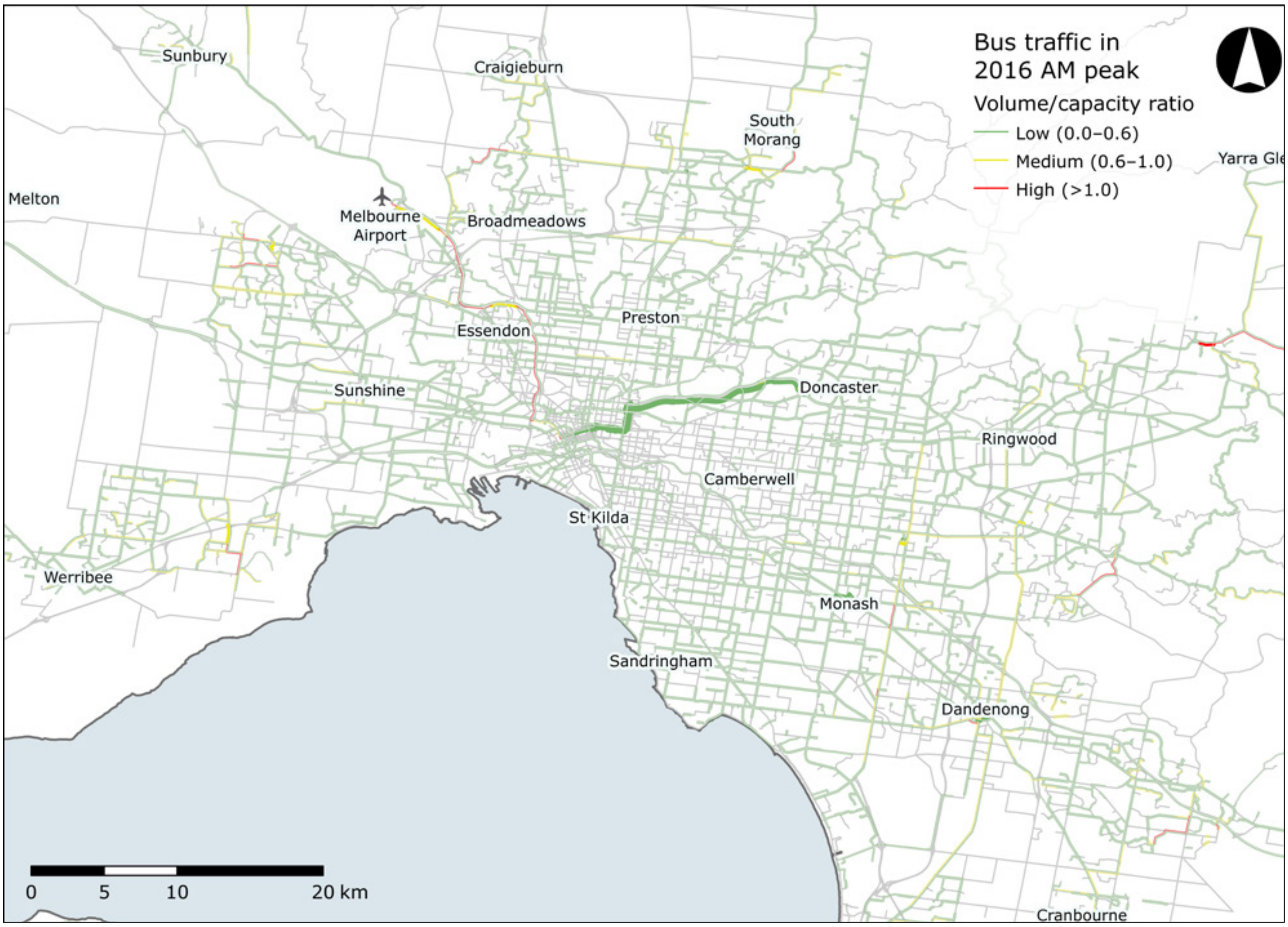
Source: Veitch Lister Consulting (2019)[86]

Figure 36: Melbourne weekday regional train passenger volume / capacity ratio, 2016 AM peak



Source: Veitch Lister Consulting (2019)87[87]

Figure 37: Melbourne weekday bus passenger volume / capacity ratio, 2016 AM peak

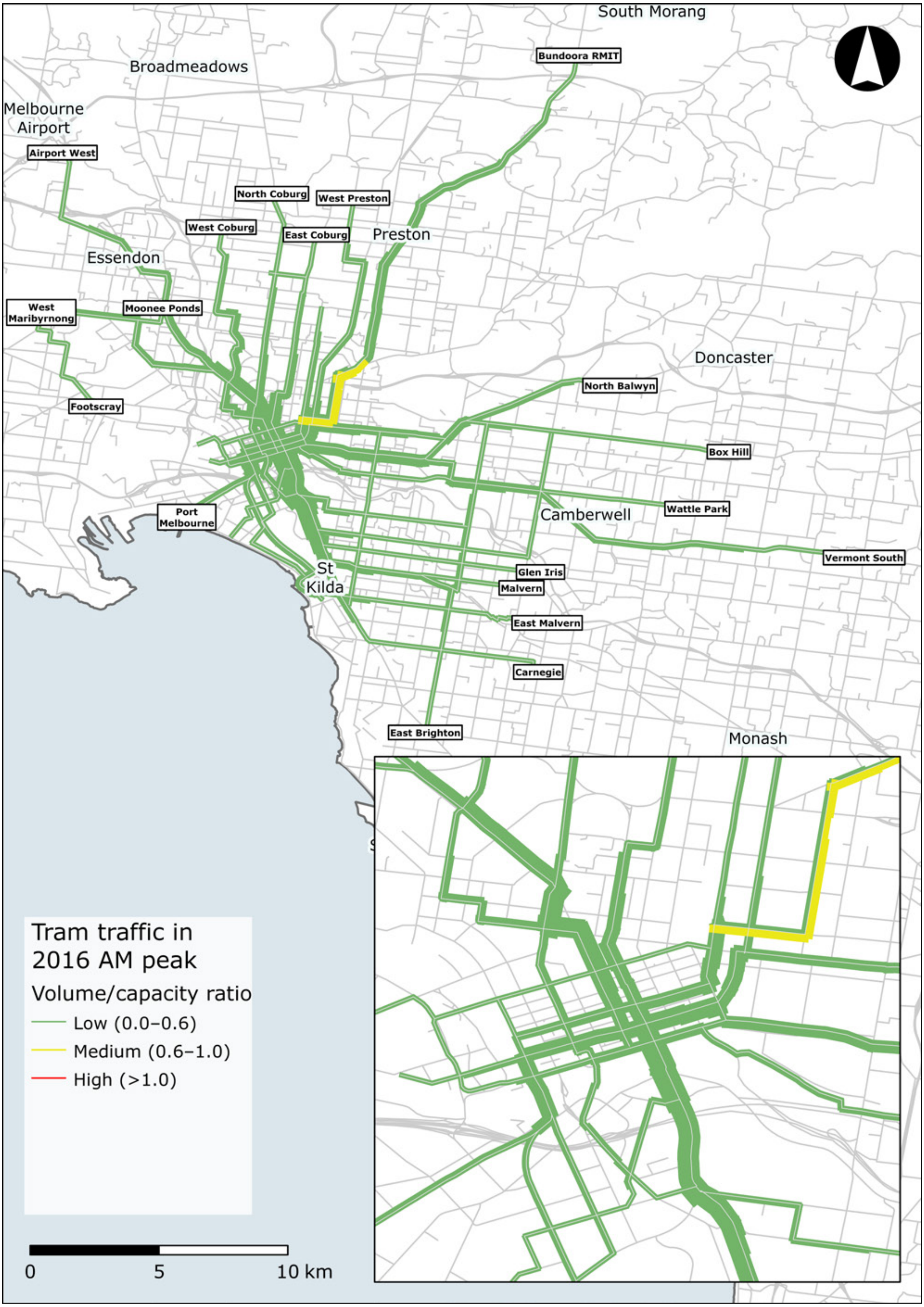


Source: Veitch Lister Consulting (2019)[88]

Melbourne's tram network primarily runs along the major roads of the inner city's established suburbs. Trams facilitate citybound travel, as well as travel within and between these local neighbourhood corridors. Crowding on Melbourne's tram network is relatively low (Figure 38). However, due to the low number of seats on trams, a volume / capacity ratio (VCR) in the 'low' range may still mean that passengers are required to stand. In 2016, the highest level of crowding is observed on the Bundoora line, which is one of the longest routes and serves RMIT and La Trobe universities. In peak periods, passenger loads on this route approach crush capacity.

The improvement of public transport flows on existing corridors has become a focus for the Victorian Government. The Level Crossing Removal Project aims to eliminate 75 level crossings across Metropolitan Melbourne by 2025, in order to reduce the conflict between rail and road users.[89]

Figure 38: Melbourne weekday tram passenger volume / capacity ratio, 2016 AM peak



Source: Veitch Lister Consulting (2019)[90]

Findings

- Key roads providing access to the inner city from surrounding suburbs are subject to the most significant congestion, affecting drivers travelling in peak periods.
- The route between Melbourne Airport and the city is among the worst performing in both peak periods by this measure. As well as being one of its most congested roads, this is Melbourne's busiest bus route.
- The worst three performing corridors from the perspective of total delays to all vehicles, in both AM and PM peak periods, are the major links in the Greater Melbourne motorway network: the West Gate, Princes and Monash Freeways. The Calder and Eastern Freeways are also on this 'top 10' list.
- Melbourne's arterial roads are most congested in the city's growth areas and at river crossings.
- Increased congestion on Melbourne's roads significantly impacts the city's wider transport network, as buses and trams mix with general traffic. This is especially the case in the inner north of the city, for instance at the western end of the Eastern Freeway where congestion is the result of demand for city access and cross-town travel.
- Population growth in Melbourne's outer suburbs has driven higher passenger volumes on the outer section of many rail lines, including the Sunbury, Werribee, Craigieburn, Mernda, Pakenham and Cranbourne lines. The first two of these experience the highest degree of crowding.

6.4 Even with programmed investment, Melbourne's road networks are forecast to become more congested

Snapshot of Melbourne's transport networks in 2031

By 2031, Melbourne's population is projected to have grown to just over 6 million people (a net increase from 2016 of 90,000 people each year on average) both through densification in established areas and through greenfield development. The highest increase in residential density is forecast for Melbourne's inner-city suburbs, with slower population growth forecast for middle ring suburbs, particularly in the east. Population in Melbourne's outer western and northern areas is forecast to grow strongly. For example, in the west Melton-Bacchus Marsh and Wyndham will house approximately 260,000 extra residents, accommodating almost 20% of Melbourne's total growth.

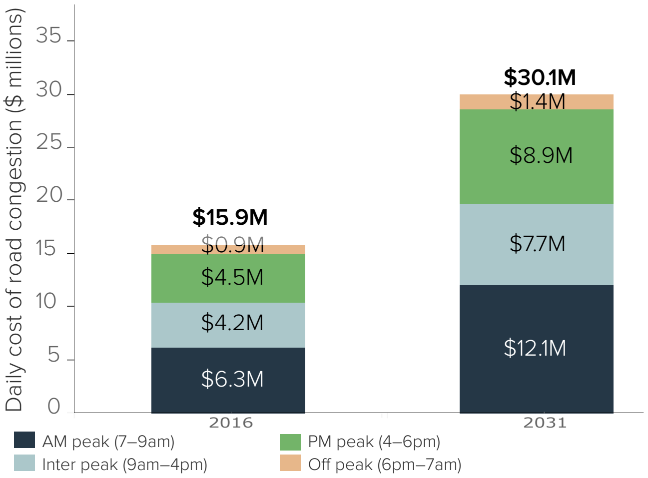
In light of the nature and location of the forecast growth, by 2031 more people will live on Melbourne's periphery. This will increase the pressure on transport infrastructure in these growth areas, as well as on the corridors which link them to major activity centres. Trips on Melbourne's transport network are expected to increase by approximately 25%, totaling almost 18 million daily trips. Despite efforts to improve public transport and roads to meet demand, commuters in 2031 can expect increasingly crowded public transport as well as more congested roads.

Trips on public transport are forecast to grow significantly faster than by car, continuing recent shift towards public transport. The move to public transport is an expected result of the increased time and monetary costs of driving due to congestion and parking cost rises, as well as public transport improvements. Trips on public transport will increase by 52% while car use will increase by 24%.

Despite ongoing mode shift from cars to public transport, congestion on Melbourne's roads will continue to grow substantially. Our modelling indicates the annualised cost of road congestion in Melbourne and Geelong will be approximately $10.4 billion in 2031, of which $10.1 billion is in Melbourne

The proportion of travel time attributable to congestion is forecast generally to increase from 55–65% in 2016 to 65–75% in 2031. This means that drivers on certain corridors during peak periods in 2031 could spend up to three-quarters of their journey duration in congestion. The average weekday cost of road congestion in Melbourne and Geelong is expected to almost double, from about $16 million in 2016 to $30 million in 2031 (Figure 39).

Figure 39: Melbourne and Geelong average weekday cost of road congestion, 2016 and 2031



Source: Veitch Lister Consulting (2019)[91]

While the forecast total cost of public transport crowding is significantly less than for road congestion, this is expected to increase at a greater rate between 2016 and 2031. The annualised cost of Melbourne and Geelong's public transport crowding is shown to increase by over four times, from $75 million in 2016 to $352 million in 2031.

These forecast outcomes account for projects that were either under construction, under procurement or had funding for construction committed from all relevant governments at the time of modelling for the Audit.[92]

Major projects included in Melbourne's 2031 forecast are:

- North East Link
- Melbourne Metro
- West Gate Tunnel
- Monash Freeway Upgrade
- Mernda Rail Extension
- Fishermans Bend Tram Link
- Melbourne Airport Rail Link
- CityLink Tulla Widening
- Mordialloc Bypass.

Melbourne's most congested roads in 2031: what the driver will experience

In 2031, car travel is forecast to remain the most popular form of travel, accounting for approximately 77% of average weekday kilometres. Melbourne's most congested roads will remain broadly the same as today (Table 20, Figure 40 and Figure 41), with some additions.

Strong population growth forecast for Melbourne's outer suburbs particularly in the north by 2031 mean corridors serving growth areas will become the most congested. Increased pressure on the city's radial freeways is forecast. The Hume Freeway, which is only lightly congested in 2016, tops the list in 2031, demonstrating the effect of increased demand to access the city from outer suburbs. The Western Freeway will become congested due to growth of the corridor to Bacchus Marsh. The CityLink-Eastern Freeway connection across Melbourne's inner north is predicted to remain one of the city's worst performers in 2031. The Monash, Princes and Eastern Freeways, as well as the north and southbound CityLink (Western Link) sections, are all expected to witness increased traffic volumes. In some cases this congestion will affect what has previously been regarded as the counter peak direction of travel.

Monash and Princes Freeway impacts are forecast in spite of capacity expansion through the Monash Freeway Upgrade (which will widen and upgrade both freeways). Similarly, congestion on the Eastern Freeway and CityLink (Western Link) is forecast to worsen. This is despite the addition of lanes between Springvale Road and Chandler Highway on the Eastern Freeway through the M80 upgrade, as well as the CityLink Tulla Widening which will provide additional capacity between the city and Melbourne Airport.

The collective effect of the forecast growth in congestion is that by 2031 drivers on these roads are expected to spend 70% of their trip duration in congestion, as opposed to 60% in 2016.

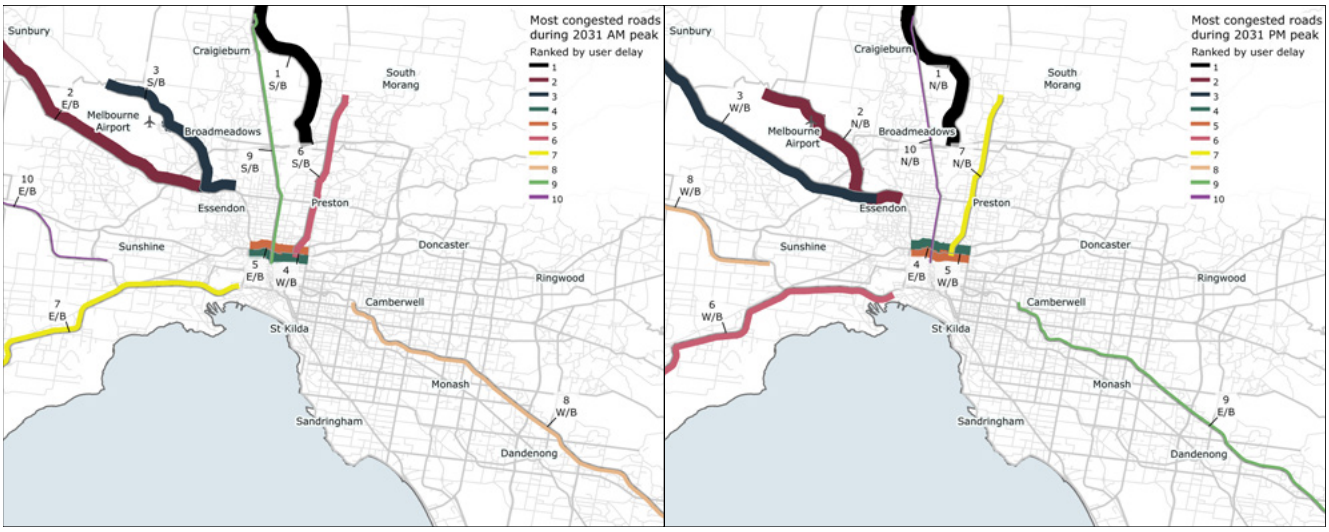
Table 20: Melbourne's most congested roads (user experience), 2031

City rank	Corridor including origin / destination connected (direction)	Length (km)	Share of journey time due to congestion	Delay per vehicle (mins)	Cost of congestion for a car	Cost of congestion for a heavy commercial vehicle
AM peak						
1.	Donnybrook to Metropolitan Ring Road via Hume Freeway (S/B)	18	77%	39	$10.77	$46.40
2.	Gisborne South to Tullamarine Freeway via Calder Freeway (E/B)	31	72%	51	$14.08	$60.67
3.	Airport to city via Tullamarine Freeway (S/B)	17	71%	32	$8.84	$38.07
4.	Eastern Freeway to CityLink via State routes 29 and 38 (W/B)	5	70%	16	$4.42	$19.03
5.	CityLink to Eastern Freeway via State routes 38 and 29 (E/B)	5	68%	14	$3.87	$16.66
6.	Epping to city via High Street / St Georges Road (S/B)	17	66%	42	$11.60	$49.97
7.	Geelong to city via Princes Freeway / Westgate Freeway (E/B)	57	65%	69	$19.06	$82.09
8.	Pakenham to city via Princes Freeway / Monash Freeway (W/B)	57	64%	67	$18.50	$79.71
9.	Craigieburn to city via Sydney Road (S/B)	27	64%	63	$17.40	$74.95
10.	Bacchus Marsh to Metropolitan Ring Road via Western Freeway (E/B)	41	64%	46	$12.70	$54.72
PM peak						
1.	Metropolitan Ring Road to Donnybrook via Hume Freeway (N/B)	18	73%	31	$8.56	$36.88
2.	City to Airport via Tullamarine Freeway (N/B)	18	66%	26	$7.18	$30.93
3.	Tullamarine Freeway to Gisborne South via Calder Freeway (W/B)	32	63%	37	$10.22	$44.02
4.	CityLink to Eastern Freeway via State routes 38 and 29 (E/B)	5	62%	11	$3.04	$13.09
5.	Eastern Freeway to CityLink via State routes 29 and 38 (W/B)	5	61%	11	$3.04	$13.09
6.	City to Geelong via West Gate Freeway / Princes Freeway (W/B)	56	59%	51	$14.08	$60.67
7.	City to Epping via St Georges Road / High Street (N/B)	17	57%	28	$7.73	$33.31
8.	Metropolitan Ring Road to Bacchus Marsh via Western Freeway (W/B)	41	57%	34	$9.39	$40.45
9.	City to Pakenham via Monash Freeway / Princes Freeway (E/B)	58	56%	47	$12.98	$55.91
10.	City to Craigieburn via Sydney Road (N/B)	26	55%	43	$11.88	$51.16

Note: N/B, S/B, W/B and E/B represent northbound, southbound, westbound and eastbound, respectively.

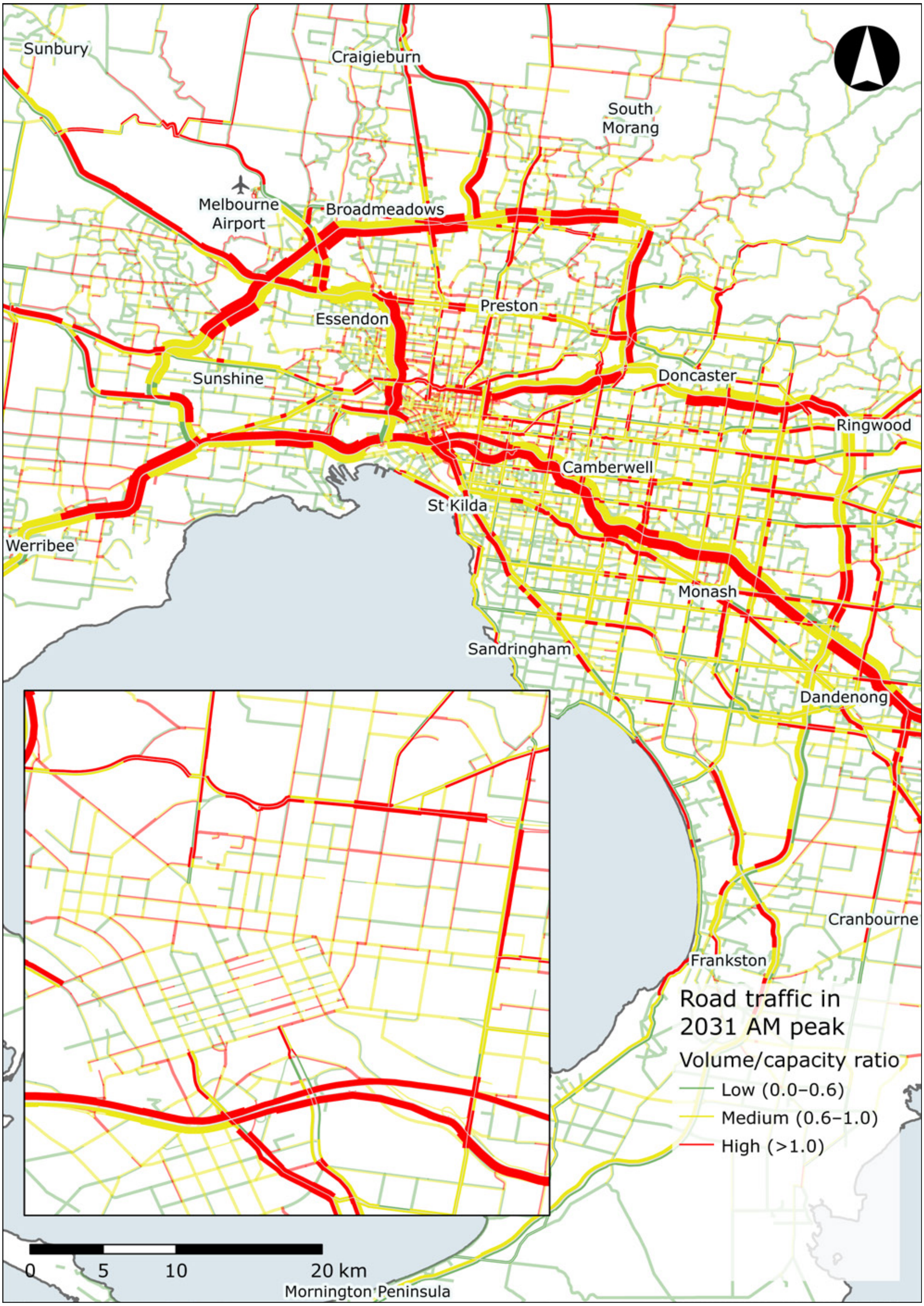
Source: Veitch Lister Consulting (2019)[93]

Figure 40: Melbourne's most congested roads (user experience), 2031 AM (left) and PM (right) peak periods



Source: Veitch Lister Consulting (2019)[94]

Figure 41: Melbourne weekday traffic volume / capacity ratio, 2031 AM peak



Source: Veitch Lister Consulting (2019)[95]

Strong population growth drives most of the modelled increases in congestion, given the limitations on modelling assumptions for the addition of capacity to Melbourne's strategic road network.[96] The modelling conservatively assumes a 'do minimum' scenario, meaning that the additional road projects added to the model for 2031 forecasting purposes are restricted to those with explicit funding commitments by government. It is expected that Melbourne's future road network will be further developed than assumed for the purposes of the Audit. However, until specific commitments are made, the 2031 forecast serves a critical purpose in highlighting where demand pressures for infrastructure investment and other solutions will be felt the most.

Melbourne's most congested roads in 2031: the forecast cost to the community of total vehicle delays

Infrastructure Australia has forecast the most congested road corridors in Greater Melbourne for 2031, as for 2016, based on aggregating the total delay hours experienced by all vehicles using the congested road during the modelled period. The ten most congested corridors in the AM and PM peak periods under this approach are shown in Table 21 and Figure 42.

Strong population growth in Melbourne's outer northern and western suburbs reflecting key radial roads leading from the north and west are ranked higher on the 2031 list. The aggregate delay incurred on the western section of the Metropolitan Ring Road is expected to be almost double southbound, and more than double northbound, compared to 2016. The addition of both the Hume Freeway and Sydney Road corridors to the 2031 forecast reflects the impact of increased traffic expected from Melbourne's northern growth corridor. Both roads are predicted to experience over 4,000 hours of aggregate delay in the AM peak period.

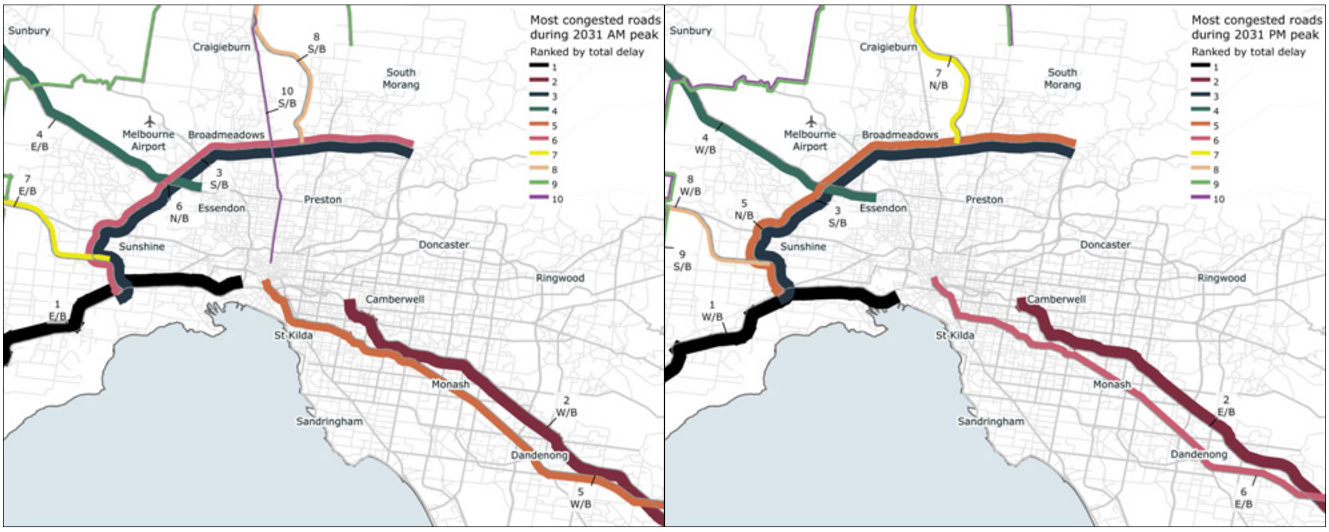
Table 21: Melbourne's most congested roads (total vehicle delays), 2031

City rank	Corridor	Direction	Total delay hours	Cost of congestion (daily)
AM peak				
1.	Princes Freeway / West Gate Freeway corridor	E/B	16,800	$334,000
2.	Princes Freeway / Monash Freeway corridor	W/B	15,900	$311,000
3.	Metropolitan Ring Road (western section)	S/B	8,500	$173,000
4.	Calder Freeway corridor	E/B	8,200	$160,000
5.	Princes Highway / Monash Freeway corridor	W/B	7,500	$144,000
6.	Metropolitan Ring Road (western section)	N/B	7,000	$144,000
7.	Western Freeway corridor	E/B	5,700	$112,000
8.	Hume Freeway corridor	S/B	5,700	$108,000
9.	Outer metropolitan ring corridor (Werribee–Sunbury–Wallan–Mernda)	N/B	5,100	$97,000
10.	Sydney Road corridor	S/B	4,500	$91,000
PM peak				
1.	West Gate Freeway / Princes Freeway corridor	W/B	12,300	$250,000
2.	Monash Freeway / Princes Freeway corridor	E/B	11,200	$224,000
3.	Metropolitan Ring Road (western section)	S/B	6,200	$128,000
4.	Calder Freeway corridor	W/B	6,200	$124,000
5.	Metropolitan Ring Road (western section)	N/B	6,100	$124,000
6.	Monash Freeway / Princes Highway corridor	E/B	5,200	$100,000
7.	Hume Freeway corridor	N/B	4,600	$88,000
8.	Western Freeway corridor	W/B	4,300	$87,000
9.	Outer metropolitan ring corridor (Mernda–Wallan–Sunbury–Werribee)	S/B	4,100	$78,000
10.	Outer metropolitan ring corridor (Werribee–Sunbury–Wallan–Mernda)	N/B	3,300	$62,000

Note: N/B, S/B, W/B and E/B represent northbound, southbound, westbound and eastbound, respectively.

Source: Veitch Lister Consulting (2019)[97]

Figure 42: Melbourne's most congested roads (total vehicle delays), 2031 AM (left) and PM (right) peak periods



Source: Veitch Lister Consulting (2019)[98]

Melbourne's public transport system in 2031

By 2031, the demand placed on Melbourne's public transport network is expected to have increased substantially. The forecast shift to public transport use in Melbourne is modelled as being primarily driven by service expansions, infrastructure improvements such as the Melbourne Metro and the Melbourne Airport Rail Link, as well as by increased road network congestion.

Melbourne's suburban rail patronage is expected to increase dramatically by 2031. Suburban rail passenger kilometres are expected to rise by 88% from 2016, while passenger kilometres for regional rail travel are forecast to triple (Figure 43). Most city-bound lines will be operating well above seated capacity in the AM peak. The high number of boarding on the outer sections of the Pakenham and Cranbourne lines will mean that passenger loadings are forecast to approach crush capacity along the majority of this these corridors by 2031. Similar outcomes are expected on the Mernda and Craigieburn lines, both of which serve growth areas. Outer ring passenger growth is modelled as resulting in passengers in middle ring suburbs facing longer standing times and potentially delayed services.

The construction of new rail tunnels through Melbourne's CBD as part of the Melbourne Metro project will allow more services and passengers to travel through the inner city. It is expected that 80,000 extra passengers in each direction will travel on lines serving the western suburbs, while 55,000 additional passengers will travel on lines serving Melbourne's south-eastern suburbs in each direction.[99]

Rapid population growth in the outer suburbs of Melbourne will place additional pressure on the regional rail (V/Line) network (Figure 44). The North, West and North East Lines will be particularly impacted and will reach crush capacity, with passengers being unable to board some services. The East line will also be impacted, particularly in areas east of Dandenong.

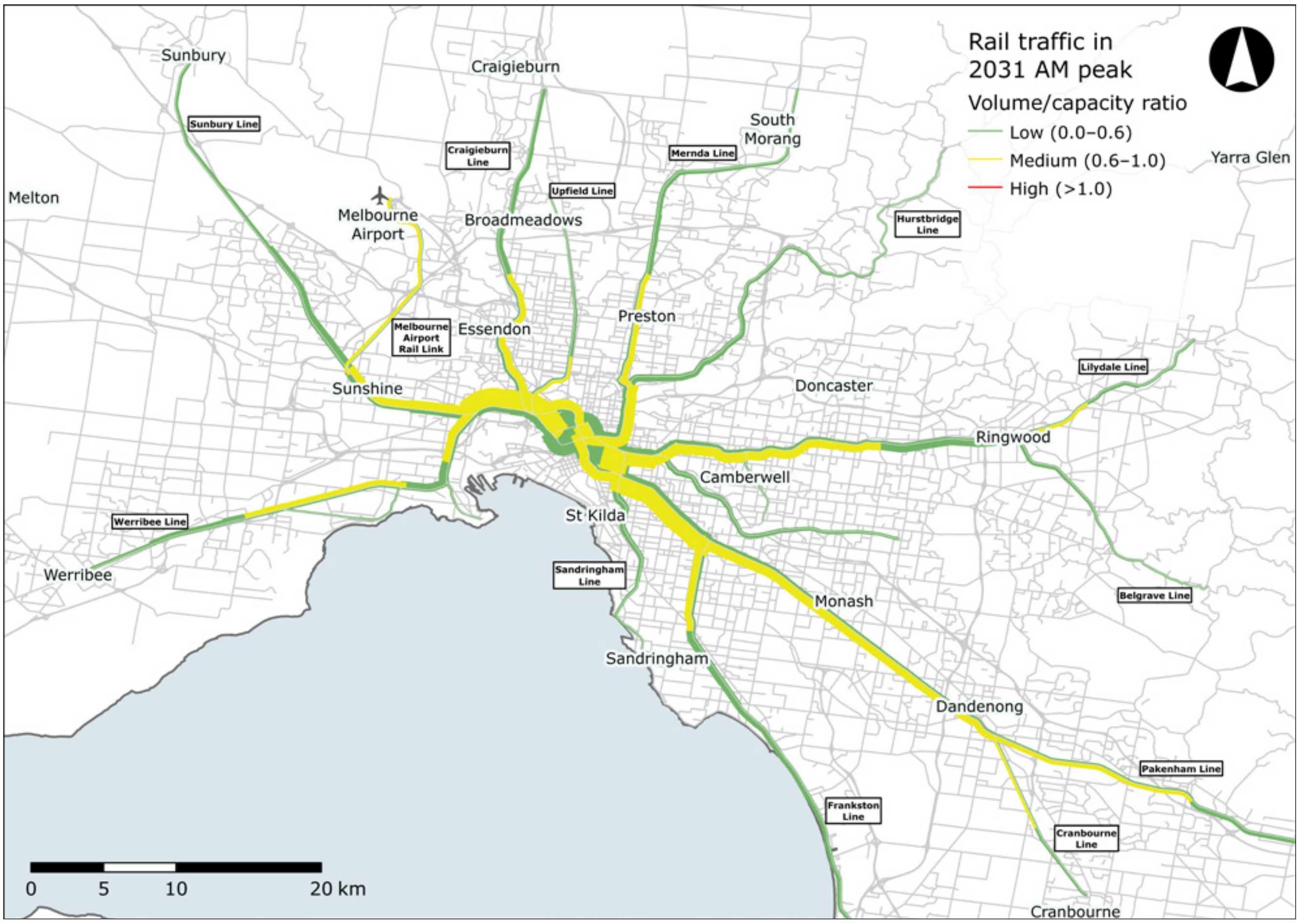
The impacts of crowding on the regional rail network may be overstated in the results, due to the capacity of rail services being understated in the model inputs. The selection and configuration of rolling stock, as well as timetabled service frequencies, can significantly impact the capacity of rail lines. Consequently, modelled crowding on the regional rail network may lead to a greater level of mode switching to parallel modes. As a result, crowding on those services and congestion on certain road corridors could be marginally overestimated.

Melbourne's bus routes are projected to become significantly more crowded by 2031 (Figure 45), especially in growth areas. Patronage in established suburbs is expected to stay relatively moderate, due to slower population growth and alternative modes of public transport. However, bus routes in growth areas are forecast to experience the most significant crowding by 2031, particularly feeder services to the rail network at Melbourne's northern and western fringes. Passenger loadings on the Eastern Freeway busway from Doncaster are also expected to increase, causing moderate levels of crowding. This focus of bus crowding is due to employment opportunities being centralised in the CBD, while population is widely dispersed.

The construction of Melbourne Airport Rail Link accounts for the largest reduction in bus passengers between 2016 and 2031. The Rail Link replaces the SkyBus to the airport and the Mernda Rail replaces the local bus feeder in this corridor.

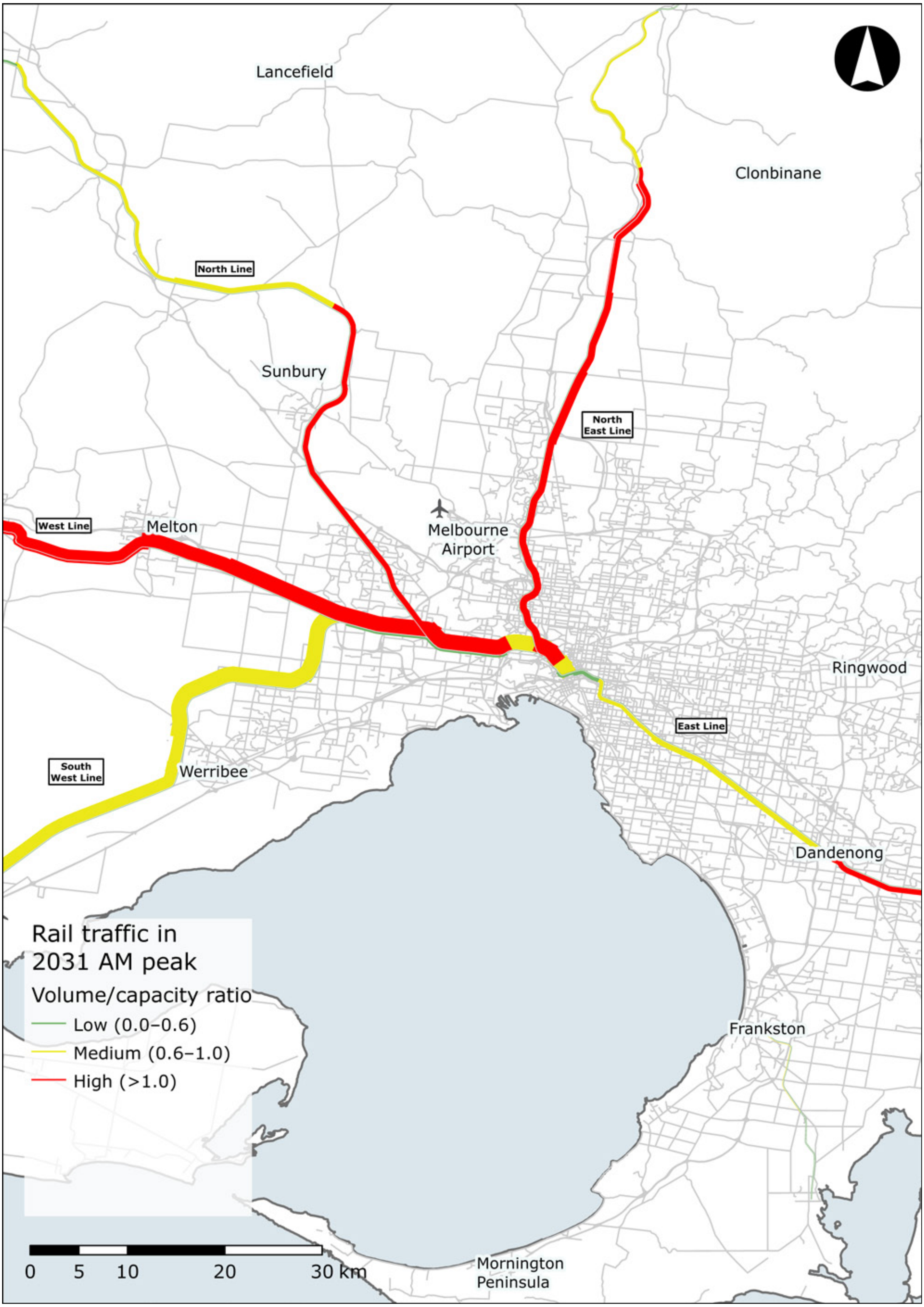
While crowding on the Melbourne's tram network is low to moderate in 2016, by 2031 crowding on the network is expected to have increased and spread (Figure 46). The crowding observed on the Bundoora route serving RMIT and La Trobe universities is expected to worsen. By 2031 passengers can expect high levels of crowding from Preston inbound in the AM peak period and to Northcote outbound in the PM peak period. In addition, crowding is expected to increase on routes serving the inner west. Increased crowding on Melbourne's tram network is predicted to be driven by strong population growth, particularly in Darebin North and Maribyrnong, as well as by more passengers using trams to access the rail system. It is expected that some sections of the 82 tram line (Footscray to Moonee Ponds) will exceed crush capacity, suggesting that assumed 2031 service levels will be insufficient to cater for growth.

Figure 43: Melbourne weekday train passenger volume / capacity ratio, 2031 AM peak



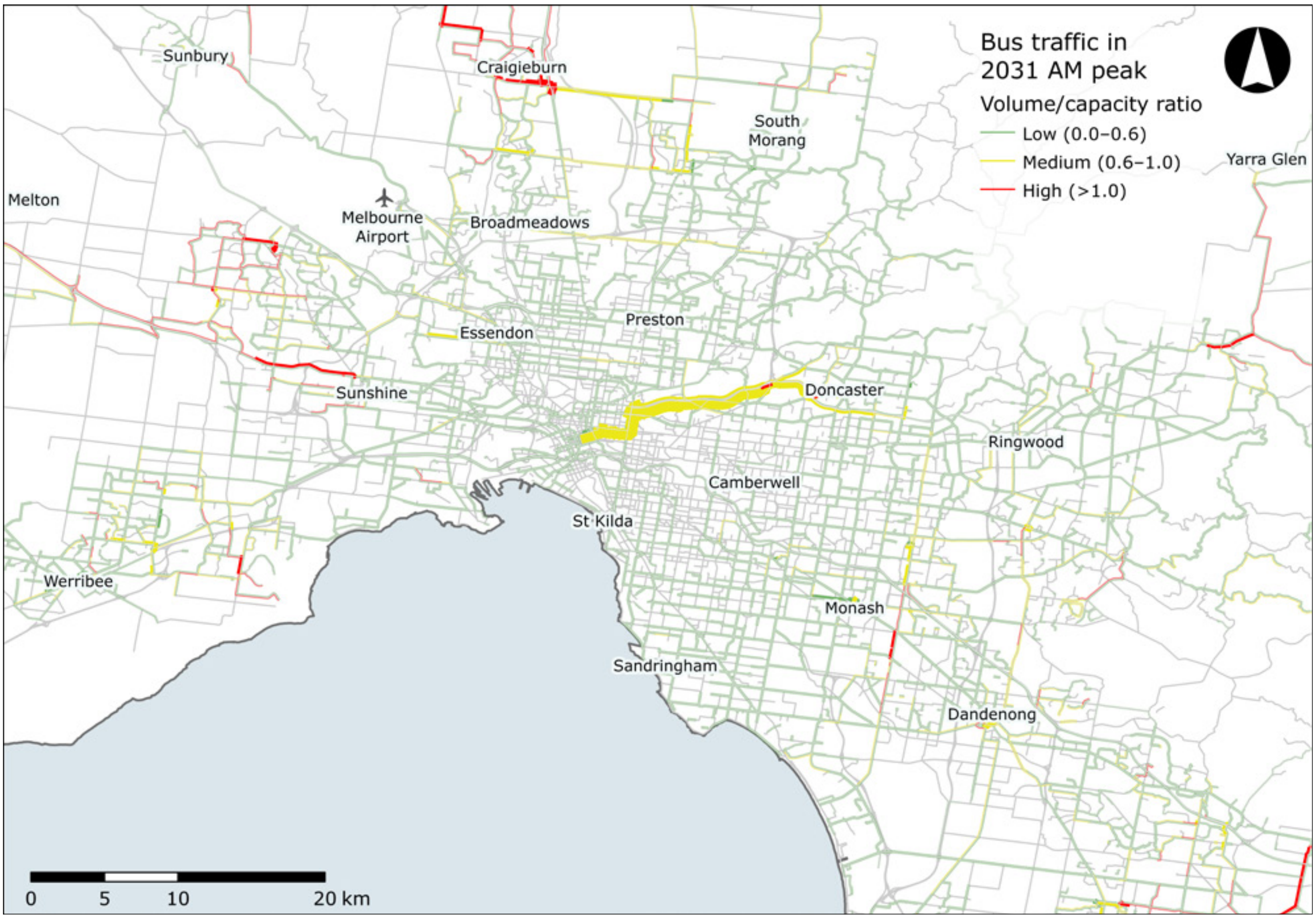
Source: Veitch Lister Consulting (2019)[100]

Figure 44: Melbourne weekday regional train passenger volume / capacity ratio, 2031 AM peak



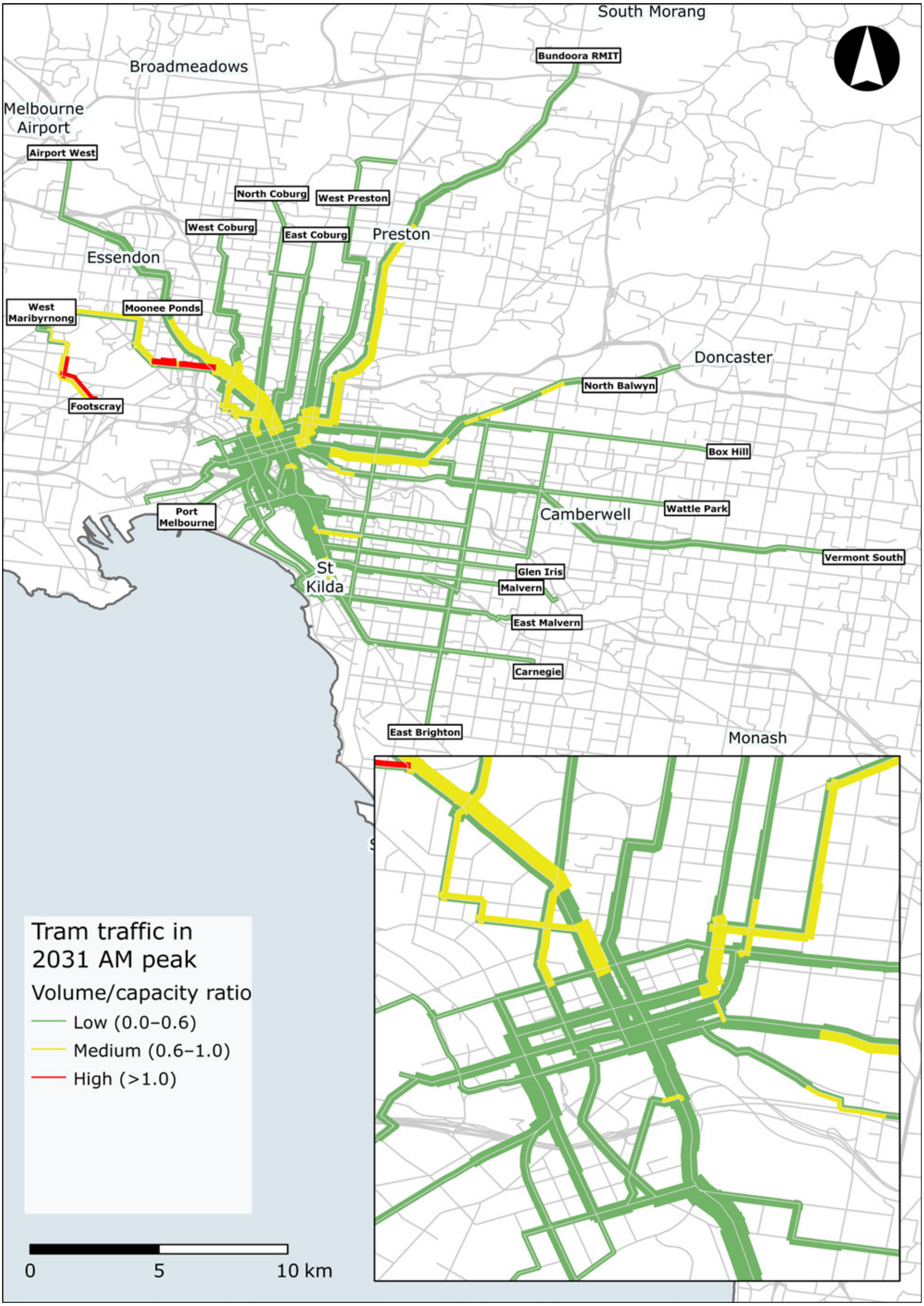
Veitch Lister Consulting (2019)[101]

Figure 45: Melbourne weekday bus passenger volume / capacity ratio, 2031 AM peak



Source: Veitch Lister Consulting (2019)[102]

Figure 46: Melbourne weekday tram passenger volume / capacity ratio, 2031 AM peak



Source: Veitch Lister Consulting (2019)[103]

Findings

- The 2019 Audit forecasts that the annualised cost of road congestion for Melbourne and Geelong will grow from approximately $5.5 billion in 2016 to $10.4 billion in 2031. This is 15% higher than the 2031 forecast cost of road congestion in the 2015 Audit.
- Despite major projects expanding Melbourne's road capacity, modelling shows widespread congestion in peak periods as travellers access employment opportunities concentrated in the inner city.
- Key radial freeways, which connect outer suburbs into the city centre, are expected to become significantly more congested by 2031. Worsened congestion on the Princes and Monash freeways will affect today's counter-peak direction. Bi-directional peak congestion will also delay traffic on the M80 Metropolitan Ring Road. Strong population growth is forecast to drive similar outcomes for the Hume, Calder and Western Freeways.
- In addition to freeways, arterial roads which serve Melbourne's fastest-growing areas will be affected by congestion. These include outer western corridors around Derrimut, Taylors Lakes and Bulla, northern arterial corridors parallel to the Hume Freeway, and outer south-eastern arterials, south of Doveton.
- Population growth in outer suburbs will mean that by 2031 trains will approach crush capacity as they reach Melbourne CBD, and take up the additional CBD capacity provided by Melbourne Metro. The Craigieburn Line serving Melbourne's northern growth corridor will see a particularly significant rate of growth, joining the Sunbury, Werribee, Mernda, Pakenham and Cranbourne lines in experiencing crowded conditions close to the city centre.
- Bus services acting as rail feeder services in the outer northern and western fringe growth areas are expected to experience the highest levels of bus crowding.
- High levels of tram crowding are forecast particularly for the Bundoora route serving RMIT and La Trobe University, as well as routes servicing the inner west.

6.5 Population growth in the Geelong regions is forecast to result in increased congestion

Transport in Geelong and its surrounding areas, today and in 15 years

Geelong city is forecast to increase its population by 48,000 residents, or 25%, by 2031, reaching a population of 240,000. There will also be significant growth in surrounding regions, such as Whittlesea-Wallan in the north, expected to accommodate 161,000 more people by 2031, and Melton-Bacchus Marsh and Wyndham in the west, expected to grow by 260,000 residents. Melton-Bacchus Marsh and Wyndham are expected to account for almost 20% of Greater Melbourne's total growth.

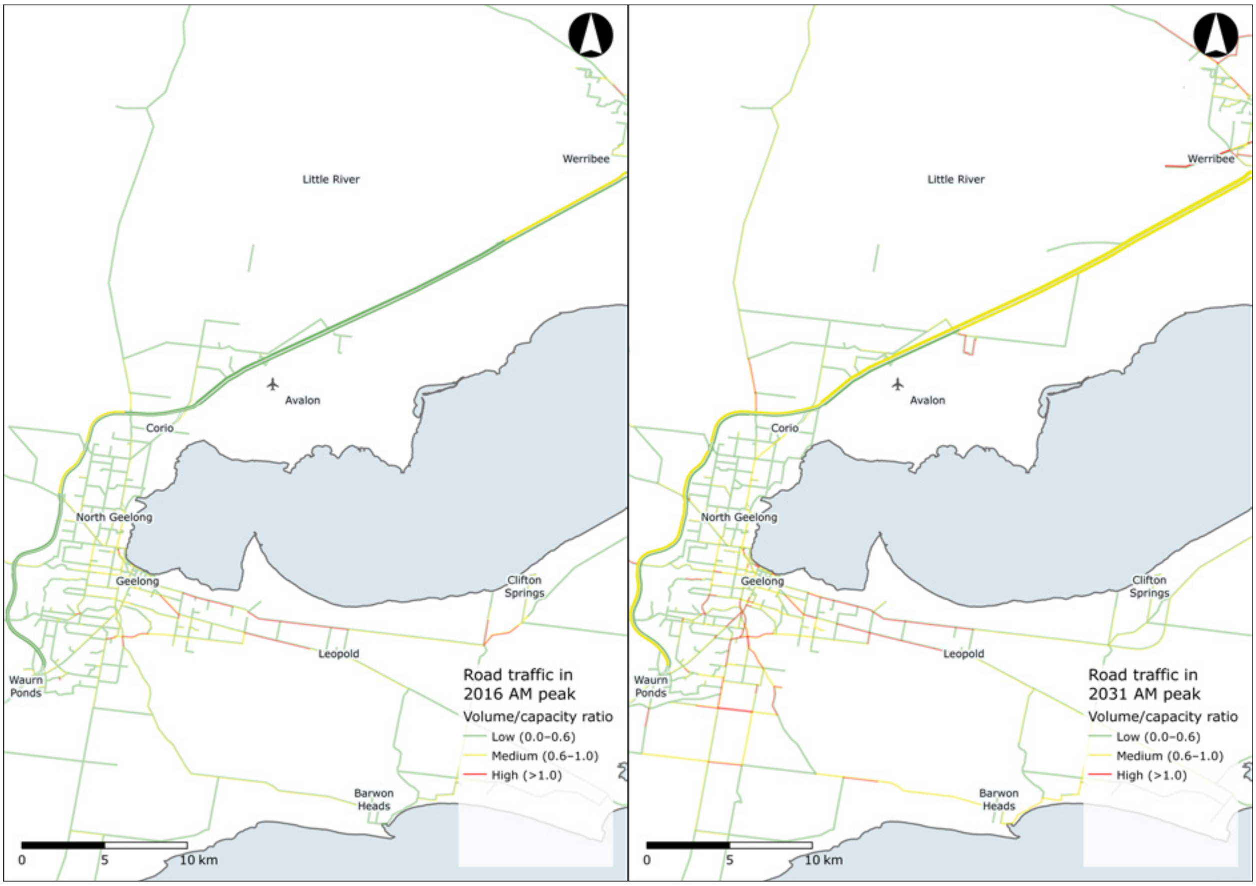
These growth rates will result in increased demand pressures on the region's transport network. In a similar manner to Melbourne, predicted growth in public transport will exceed car use growth. Trips by car are expected to increase by 32%, while trips on public transport will grow by 76%.

The result of Geelong's population growth will be, notwithstanding higher public transport use, increased road congestion (Figure 47). Between 2016 and 2031 the cost of congestion in this region is forecast to double. The annual cost of congestion is expected to grow from $127 million in 2016 to $297 million in 2031. Road congestion will particularly affect key access routes to Geelong from the surrounding region.

Passenger uplift for bus patronage is expected to be lower than for rail, although still greater than population growth. By 2031, there is forecast to be a 35% daily increase in bus passenger boardings in Geelong over 2016,[104] with modest expansion assumed for the bus network. This means that while bus passengers in Geelong primarily experience low to moderate levels of crowding in 2016, by 2031 key routes are forecast to exceed capacity (Figure 48).

Due to population growth in Geelong and strong employment growth in Melbourne, patronage on regional rail is expected to significantly increase. By 2031, daily regional rail passenger boardings in Geelong are forecast to increase by 28,000, a percentage change of 145% from 2016 (Figure 49). This will result in a substantial increase in crowding on trains travelling between Geelong and Melbourne's city centre in peak periods.

Figure 47: Geelong region weekday traffic volume / capacity ratio, 2016 and 2031 AM peak

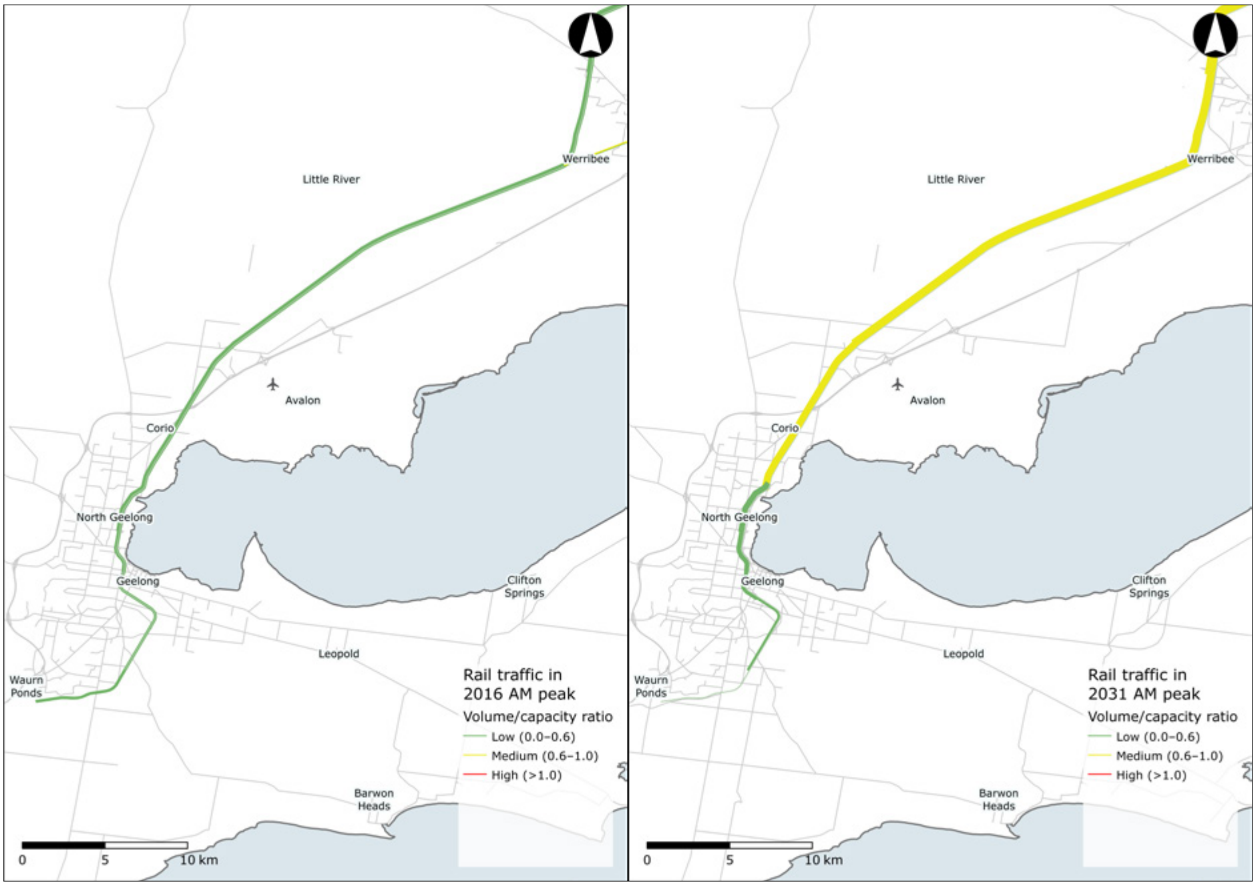


Source: Veitch Lister Consulting (2019)[105]

Figure 48: Geelong region bus passenger volume / capacity ratio, 2016 and 2031 AM peak

Source: Veitch Lister Consulting (2019)[106]

Figure 49: Geelong region train passenger volume / capacity ratio, 2016 and 2031 AM peak



Source: Veitch Lister Consulting (2019)[107]

Findings

- Strong population growth in Geelong is expected to cause higher levels of road congestion and public transport crowding.
- The cost of road and public transport congestion is expected to almost double between 2016 and 2031.
- The concentration of employment opportunities in Melbourne's city centre will increase congestion at the southern end of the Princes Freeway, an important access route to jobs to Geelong's north.
- Regional rail patronage is expected to increase by 145% between 2016 and 2031, resulting in higher levels of crowding on rail services between Geelong and central Melbourne.

6.6 Transport decisions impact access to jobs and services

Hospital access in Melbourne and Geelong – by car and public transport, in 2031

Greater Melbourne residents' access to critical healthcare is measured as the travel time to the nearest public hospital, or hospital with an emergency department, by car versus public transport (Figure 50).

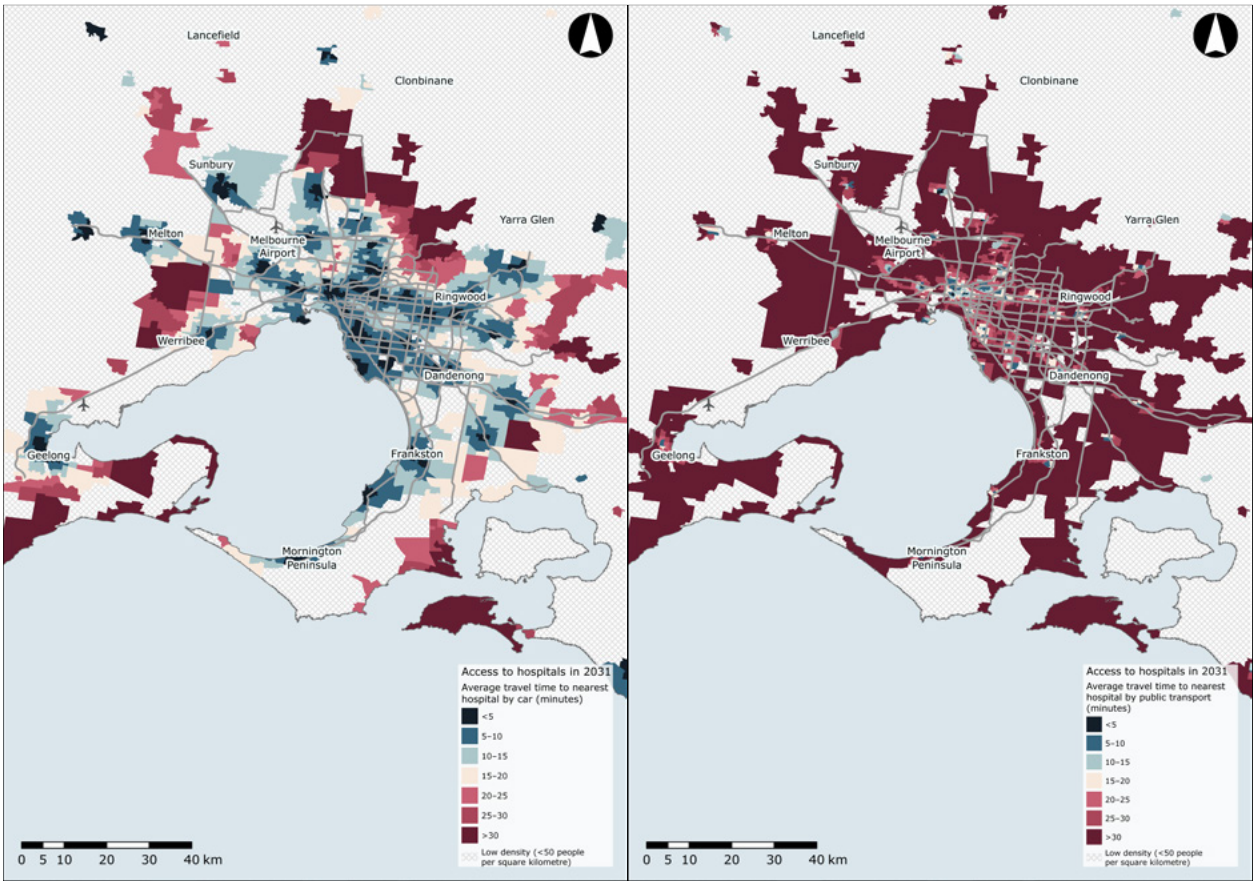
Residents with access to a car have much greater access to hospitals than residents who rely on public transport. By 2031 it is expected that average travel time to a public hospital in Greater Melbourne will be 13 minutes. However, by public transport, most residents of Greater Melbourne will need to spend upwards of 30 minutes to reach their nearest public hospital.

Access to childcare and schools in Melbourne and Geelong – by car and public transport, in 2031

The average resident of the Greater Melbourne region with access to a car can reach childcare services (Figure 51) and public primary schools (Figure 52) within a four-minute trip in 2016. This is expected to extend to a five-minute trip by 2031. Access to public secondary schools (Figure 53) is slightly longer, taking approximately six minutes in 2016, and extending to seven minutes in 2031.

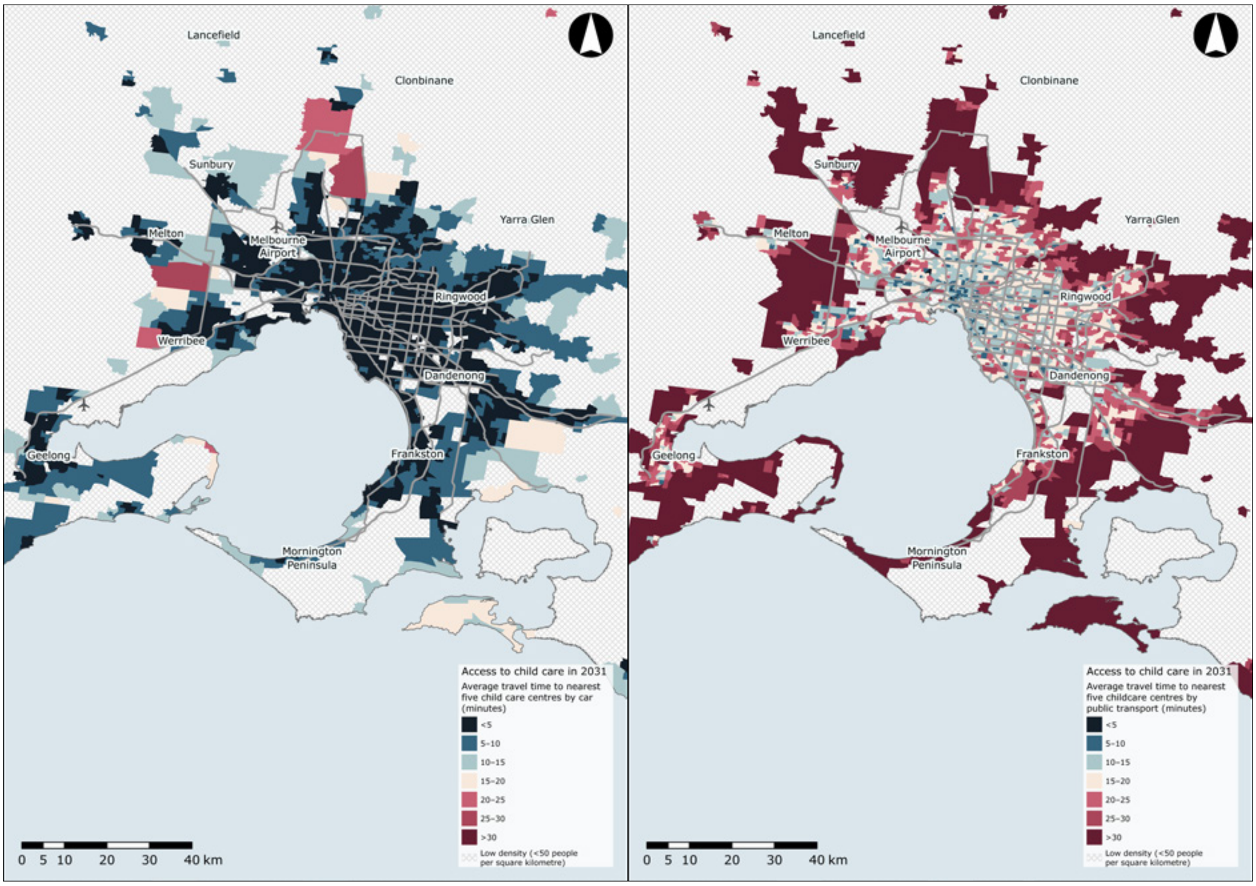
For residents without access to a car, public or active transport times are significantly longer to access these social infrastructure destinations. In 2016 these travel times are in excess of 30 minutes, and by 2031 are forecast to increase further. Areas with longer average travel times are those further away from the CBD where public transport does not offer a realistic alternative to car use. This highlights that public transport infrastructure in Melbourne is more effective at serving commuting to the CBD and immediate surrounding areas, while being less effective at catering to local travel needs.

Figure 50: Greater Melbourne average time to nearest hospital by car (left) and public transport (right), 2031 AM peak



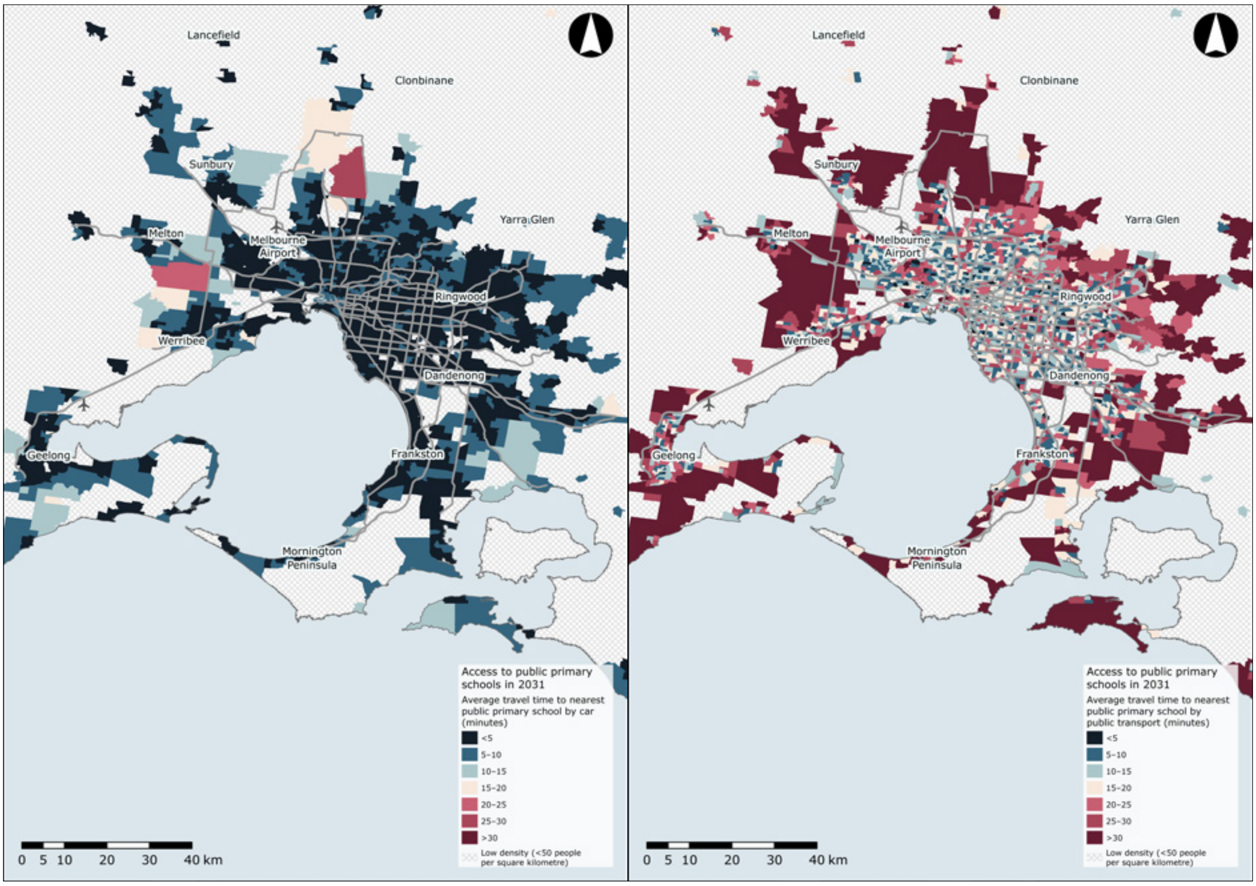
Source: Veitch Lister Consulting (2019)[108]

Figure 51: Greater Melbourne average time to nearest five childcare centres by car (left) and public transport (right), 2031 AM peak



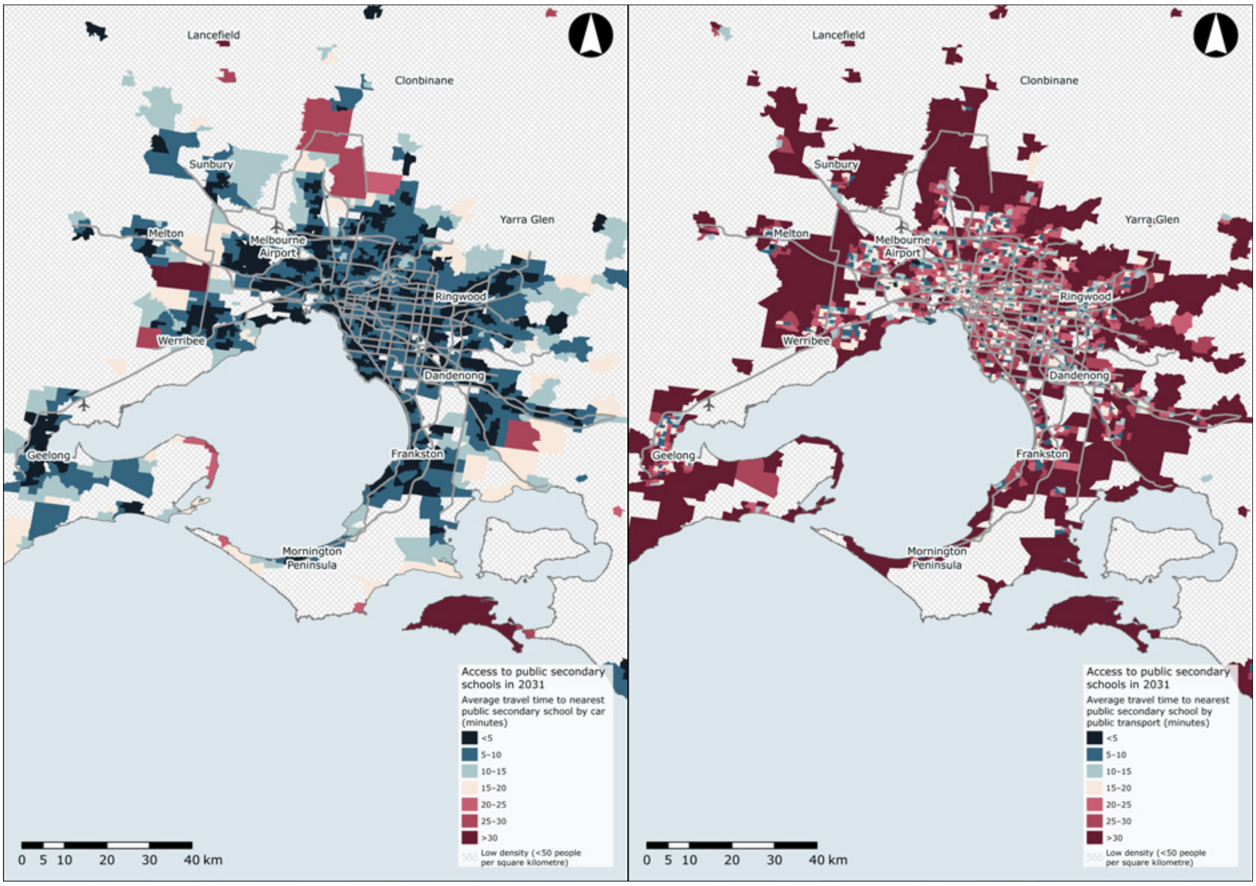
Source: Veitch Lister Consulting (2019)[109]

Figure 52: Greater Melbourne average time to nearest public primary school by car (left) and public transport (right), 2031 AM peak



Source: Veitch Lister Consulting (2019)[110]

Figure 53: Greater Melbourne average time to nearest public secondary school by car (left) and public transport (right), 2031 AM peak



Source: Veitch Lister Consulting (2019)[111]

Access to jobs in Melbourne and Geelong – by car and public transport, in 2016 and 2031

Access to employment opportunities varies considerably across Melbourne depending on residential location and mode of travel.

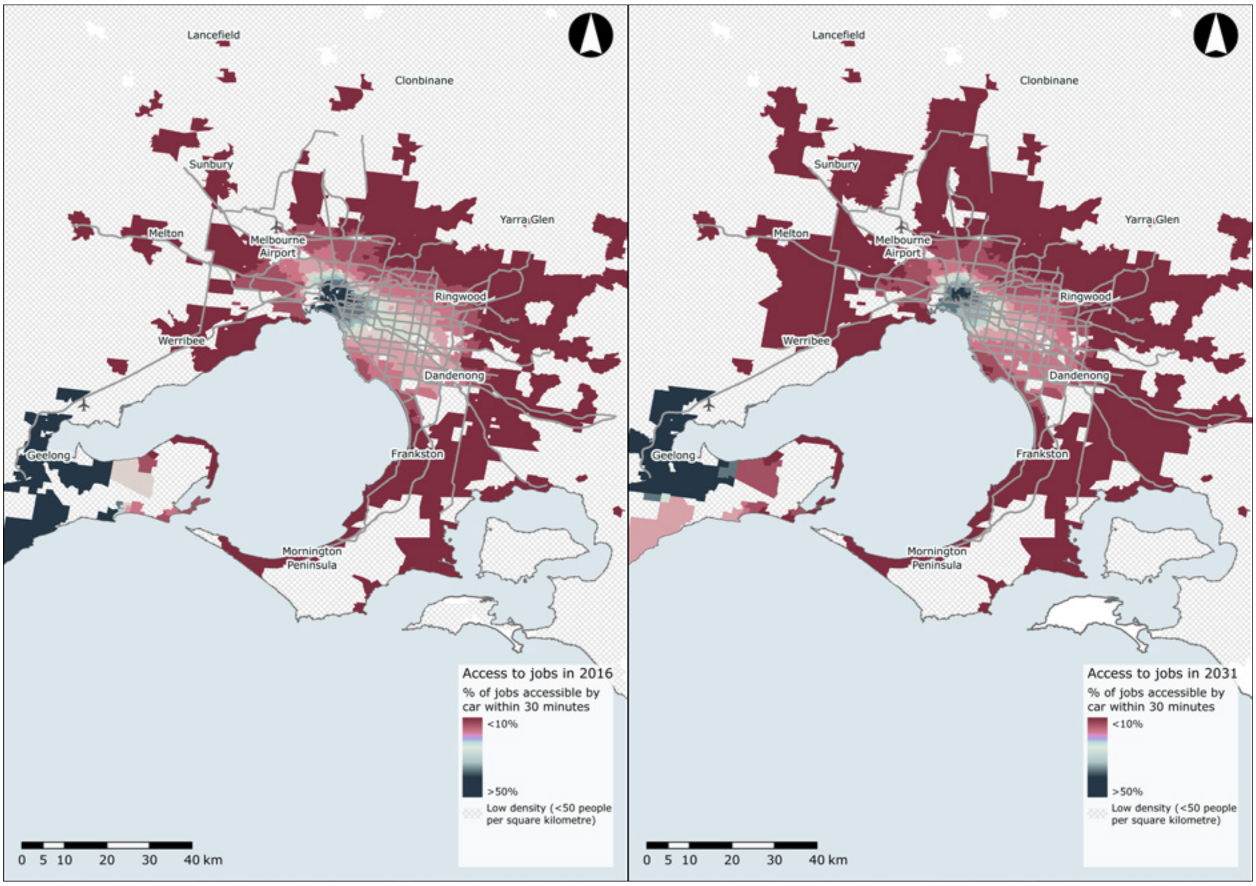
Employment accessibility has been measured as the percentage of jobs in two self-contained areas (Greater Melbourne and Geelong) that can be reached within 30 minutes, from homes in every travel zone, by car (Figure 54) and by public transport (Figure 55) in the two modelled years.

A large proportion of Greater Melbourne's employment opportunities are in the CBD and adjacent suburbs, meaning that ease of access to those areas is the primary driver of job accessibility. In 2016, residents of Melbourne city had access to 44.6% of the city's job market by car, reducing to 40.2% by 2031.

Job accessibility by public transport is forecast to be relatively stable between 2016 and 2031. Most Melbourne residents are unable to reach many jobs within a 30-minute commute. In both modelled years, Melbourne city has the best access to jobs via public transport due to the high concentration of jobs in that area, and its role as the centre of the region's public transport network. Outside of inner suburbs, most residents can access an extremely small proportion of the city's jobs within 30 minutes – typically less than half a percent or one out of 200 regional jobs.

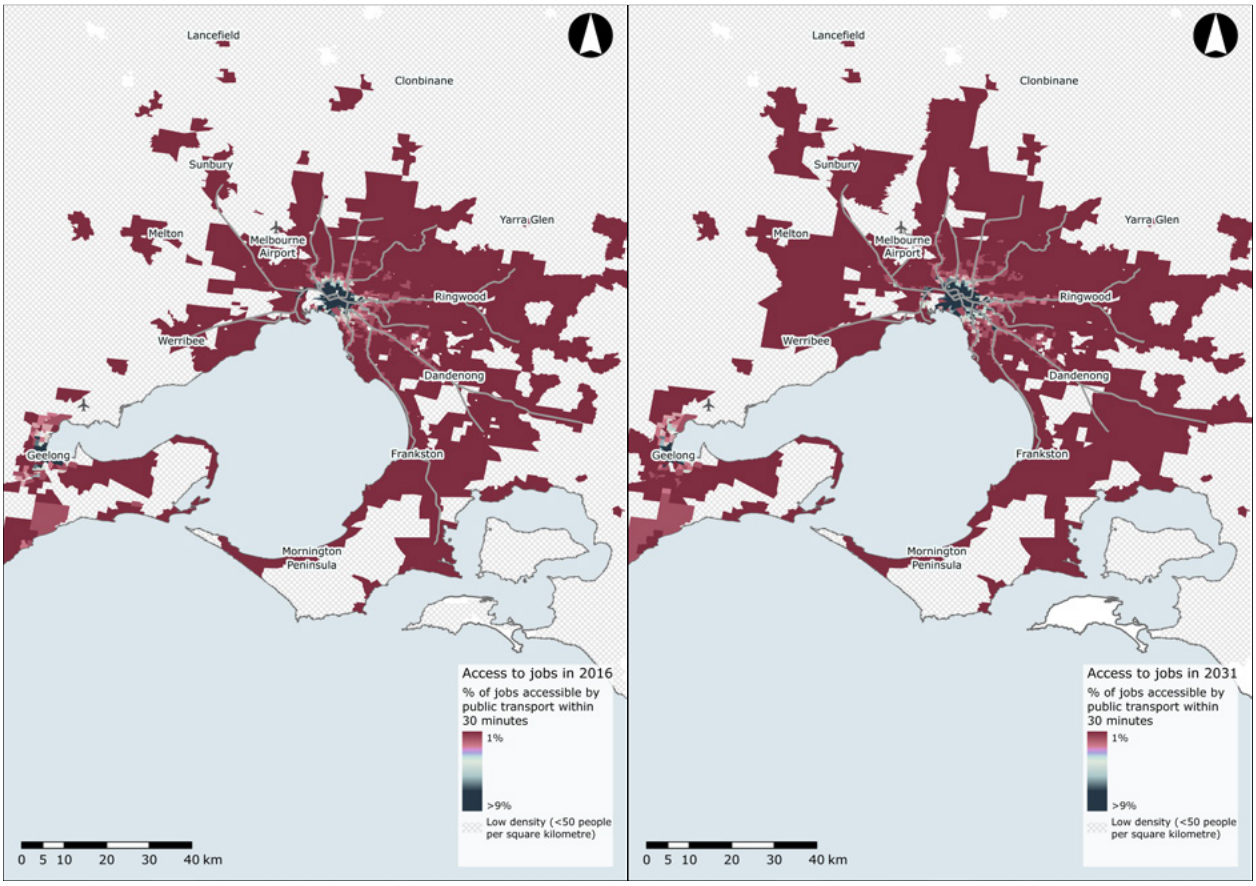
The percentage of jobs accessible is greater in Geelong than Melbourne. This does not mean that people in Geelong have access to a greater number of jobs, it simply means they have access to a higher percentage of the total jobs in the Geelong region. This is largely a function of the size of the area relatively to Melbourne.

Figure 54: Greater Melbourne access to jobs by car, 2016 and 2031 AM peak



Source: Veitch Lister Consulting (2019)[112]

Figure 55: Greater Melbourne access to jobs by public transport, 2016 and 2031 AM peak



Source: Veitch Lister Consulting (2019)[113]

Findings

- Greater Melbourne's employment opportunities are concentrated in its central areas. Outside the Melbourne City area most residents are unable to reach many jobs within a 30-minute commute.
- Even for commuters who drive, there are significant spatial variations in access to employment. To Melbourne's east, job clusters in middle-ring suburbs (e.g., Monash and Dandenong) are accessible by the city's freeway network. By contrast, areas a similar distance to the west of Melbourne have more limited local employment options.
- For residents with access to a car, accessibility to hospitals is generally good, with an average travel time of 13 minutes in 2031. By public transport, however, most residents of Greater Melbourne will need to travel for more than 30 minutes to reach their nearest public hospital in 2031.
- For the residents of Geelong, access to local jobs within the region are relatively high by either car or public transport.

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