8

Greater Perth

8.1 Perth has grown, and so has its transport task

Perth's transport network performance over the past decade

Between 2006 and 2016, Perth's population grew from just under 1.5 million to over 2 million people.[145] The mining boom years between 2007 and 2013 drove a significant amount of population growth, particularly around Perth and surrounding suburbs.[146] Since 2014 this rate of growth has slowed due to the end of the mining boom reducing the demand for residential settlement. While there has been a consequent loss of population in some inner suburbs,[147] in 2016 Perth's highest housing densities were still to be found in Perth City and South Perth.

Perth's population boom between 2007 and 2013 translated directly into a greater transport task. Between 2004–05 and 2014–15 passenger kilometres on Perth's road network increased by about 10%.

The impact of heightened demand on Perth's road network can be considered by comparing road speeds and travel reliability in Perth with average levels for all Australian cities since 2013.

8.2 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, Perth's forecast cost of road congestion has decreased by 77% (Table 30 and Figure 78). This is largely due to higher population projections used in the 2015 Audit.

In the 2015 Audit, 2031 population projections for Perth were derived from ABS Series B projections. In the latest work, projections have been provided by the Western Australian Government. The 2015 Audit used population and employment projections developed at the height of Western Australia's mining boom. This means that 2015 Audit's population projections for 2031 were 22% higher than those used for the 2019 Audit. As a result, forecast congestion in the 2015 Audit was significantly higher than the 2019 forecast.

Table 30: The cost of road congestion and public transport crowding in Greater Perth, 2016 and 2031

	Cost of public transport crowding ($ millions)	Cost of road congestion ($ millions)	Total ($ millions)
2016 (2019 Audit)	17	1,525	1,542
2031 (2019 Audit)	159	3,620	3,779
2031 (2015 Audit)	N/A	15,865	N/A
2031 (change from 2015 Audit)		-12,245 (-77%)	

Source: Infrastructure Australia (2015) and Veitch Lister Consulting (2019)[148]

The mapping also suggests the following key differences in demographic assumptions between 2015 and 2019 Audits:

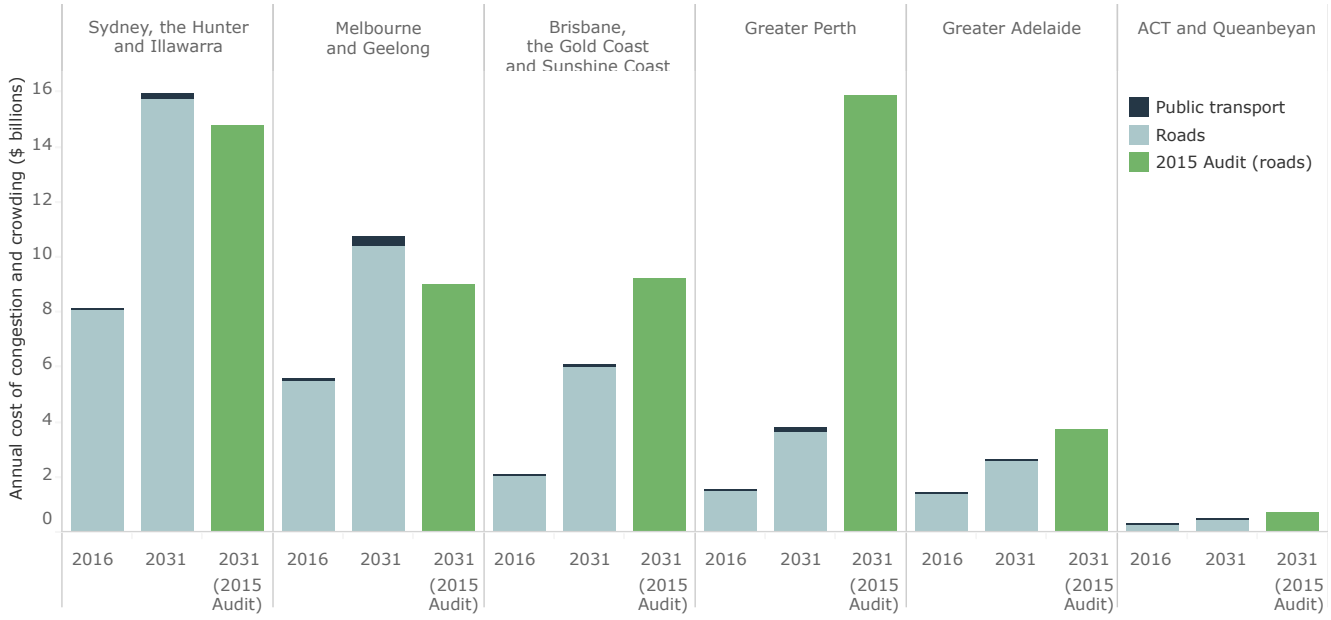
- The largest differences between audits are apparent in the outer statistical area levels 3s
- In the south, Rockingham has 107,000 fewer residents and Mandurah has 87,800 fewer residents
- In the north, Wanneroo has 101,500 fewer residents, Swan has 75,900 fewer residents, and Joondalup has 50,200 fewer residents
- Perth City shows the next largest reduction with 43,000 fewer residents.

Figure 79 provides a population forecast comparison between the 2015 Audit and the 2019 Audit.

Reduced population forecasts also decreased projected employment by 22% in the 2019 Audit.

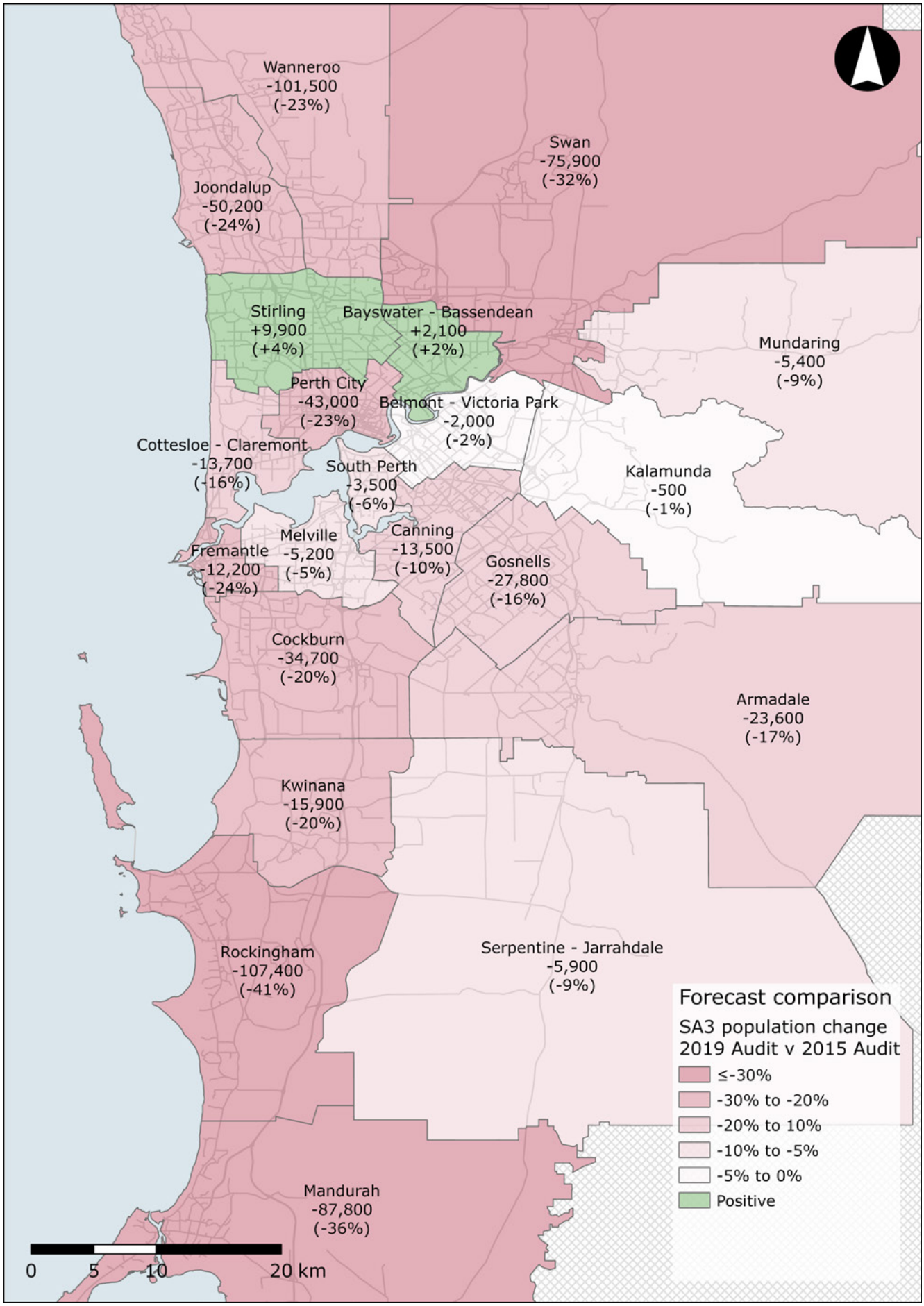
Table 31 reflects changes in model inputs and key outputs between the 2015 and 2019 Audit modelling.

Figure 78: The cost of road congestion and public transport crowding, 2016 and 2031



Source: Infrastructure Australia (2015) and Veitch Lister Consulting (2019)[149]

Figure 79: 2031 population forecast for Greater Perth: 2019 Audit compared to the 2015 Audit



Source: Veitch Lister Consulting (2019)[150]

Table 31: Changes in key model inputs and outputs between 2015 and 2019 modelling in Greater Perth

		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 reduced (-19%)	⇩ Employment forecasts have reduced (-22%), however the proportion of jobs in Perth City SA3 remains stable	⇧ More investment in the road network (+5% network lane km)	⇧ More investment in the PT network (+~30% service kms)	⇩ Reduction in fuel price (140 c/L to 104 c/L AUD 2011)	— No change in other transport costs		
Impact on output (AM peak)	Total trips (-40%)	⇩ Lower total population reduces total modelled trips	— Total trips are generated by population assumptions and model parameters only						
	Car trips (-37%)	⇩ Lower total population reduces total modelled car 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		
	Car vehicle kms travelled (-20%)	⇩ An overall reduction in population reduces car kilometres. Lower population growth at the urban fringe also causes a reduction in this metric	— 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		
	Public transport trips (-18%)	⇩ Lower total population reduces total modelled 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		

Source: Veitch Lister Consulting (2019)[151]

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 Perth, there are three key differences in network assumptions. The Roe Highway extension was included in the 2015 Audit but not the 2019 Audit. While being committed and partially funded at the time of modelling, and therefore not meeting the fully-funded requirement for inclusion, the Karnup and Midland Station projects within the METRONET program were included in the 2019 Audit but not the 2015 Audit. Additionally, the 2019 Audit includes Tonkin Highway Grade Separations as part of the NorthLink, but did not include the grade separations on Tonkin Highway south of Roe Highway, which have now been committed.

Variation between road network capacities in 2031

In the 2019 Audit, due to large reduction in population forecasts, traffic volumes and delays have decreased. However, the worst-performing corridors are largely consistent between the audits. Results for the AM and PM peak showed a similar outcome.

Traffic volumes on Kwinana Freeway, Graham Farmer Freeway, Mitchell Freeway, Marmion Avenue/West Coast Hwy Corridor and Roe Highway have decreased between the 2015 and 2019 Audits, however still remain high. Other arterial roads and highways such as Canning Road, Gnangara Road, Armadale Road, the West Coast Highway and the Stirling Highway have less traffic volume in the 2019 Audit, however still have sections that are high in the 2031 AM peak.

The 2019 Audit forecasts decreases to traffic volumes on arterial and local roads throughout Perth. However, high congestion is still forecast to occur on local and arterial roads in the Perth CBD. West Leederville, Subiaco, Leederville, North Perth and Lawley are also predicted to maintain high congestion forecasts on their local roads.

Vehicle delays are forecast to decrease by more than the corresponding change in traffic volumes in the 2019 Audit. This is a function of the underlying dynamics of traffic flow, when additional traffic is added to an already congested road, the resultant delay is disproportionately higher than in less congested conditions.

Table 32 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 revised population forecasts have lowered the projected public transport passenger volumes in the 2019 Audit.

However by 2031, all trains still reach a high to moderate volume of suburban rails passengers as they approach the Perth CBD in the 2019 Audit. In the 2019 Audit, the Mandurah line experiences high congestion from Kwinana Town Centre to Cockburn Central and from Brentwood to the CBD. Similarly, the Joondalup/ Butler line experience high congestion from Joondalup to the CBD.

Both audits indicate that bus crowding is predicted to worsen on major routes from 2031. However, the 2019 Audit shows that radial routes converging on the CBD will experience the greatest levels of crowding, as will routes running parallel to rail lines. The 2015 Audit forecasts wider network demand, including high instances of seating capacity and crush capacity on arterial roads, freeways and highways connected to the CBD.

8.3 Commuters in Perth experience substantial levels of road congestion and public transport crowding today

Snapshot of Perth's road network in 2016

Perth's drivers already experience congestion on their roads. Our modelling indicates the annualised cost of road congestion was approximately $1.5 billion in 2016.

This congestion is most significant in the AM peak period when commutes to schools and work overlap (Figure 80). The same roads experience congestion in the PM peak period, albeit to a lesser extent and over shorter sections. Perth's most congested corridors are major north-south freeways, and the arterial roads feeding those freeways, as well as key river crossings which act as pinch points in the network.

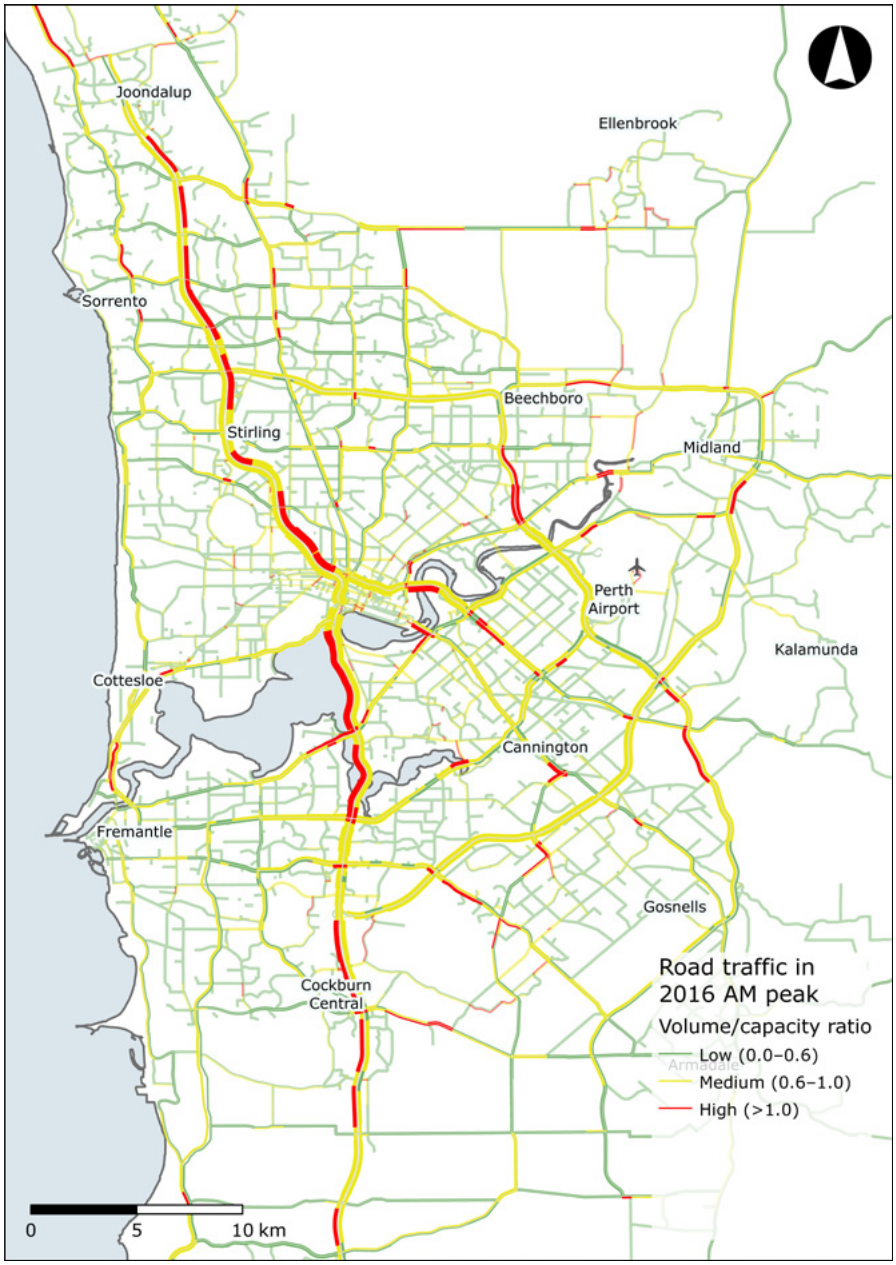
Table 32: Most congested roads ranked by total delay hours, 2031 AM Peak and ranking in 2015 Audit in Greater Perth

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	Kwinana Freeway corridor	N/B	3,700	3,500	-6%	12,800	8,600	-32%	1
2	Mitchell Freeway corridor	S/B	6,200	5,700	-9%	8,400	5,200	-38%	3
3	Marmion Avenue / West Coast Highway corridor	S/B	2,100	1,800	-13%	9,900	4,100	-59%	2
4	Old Coast Road / Mandurah Road / Stock Road / Stirling Highway corridor	N/B	2,600	1,800	-29%	8,200	3,200	-60%	4
5	Tonkin Highway corridor	N/B	3,700	3,200	-14%	6,200	3,100	-49%	6
6	Wanneroo Road corridor	S/B	2,100	1,700	-20%	7,800	2,500	-68%	5
7	Kwinana Freeway corridor	S/B	2,600	2,500	-3%	1,100	2,300	111%	25
8	Tonkin Highway corridor	S/B	2,500	2,500	3%	2,800	2,200	-23%	11
9	Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor	W/B	3,100	2,600	-16%	4,100	2,100	-49%	8
10	Albany Highway corridor	N/B	2,200	1,700	-21%	4,400	1,900	-56%	7

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

Source: Veitch Lister Consulting (2019)[152]

Figure 80: Perth 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)[153]

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

Infrastructure Australia has highlighted the most congested roads in Perth based on a variety of metrics that relate directly to the user's experience, including estimating the percentage of journey time that is accounted for by congestion. Table 33 and Figure 81 show the ten most congested corridors in the AM and PM peak periods, respectively.

Perth's most congested roads radiate from the city centre. These routes facilitate access to the city's major cluster of employment opportunities. In 2016 Perth's major motorways, the Mitchell and Kwinana Freeways, were highly congested, especially during peak periods. Sections of the Mitchell Freeway, a major access route from the north, were Perth's most congested corridor in both the AM and PM peak periods. Traffic volumes reached close to design capacity on this road from Woodvale through to the CBD. Similarly, the Kwinana Freeway, facilitating traffic movement from the south, was heavily congested in both peak periods. Arterial roads serving parallel routes throughout the city also experience moderate to high levels of congestion during peak periods, highlighting the demand for north-south movement in Perth.

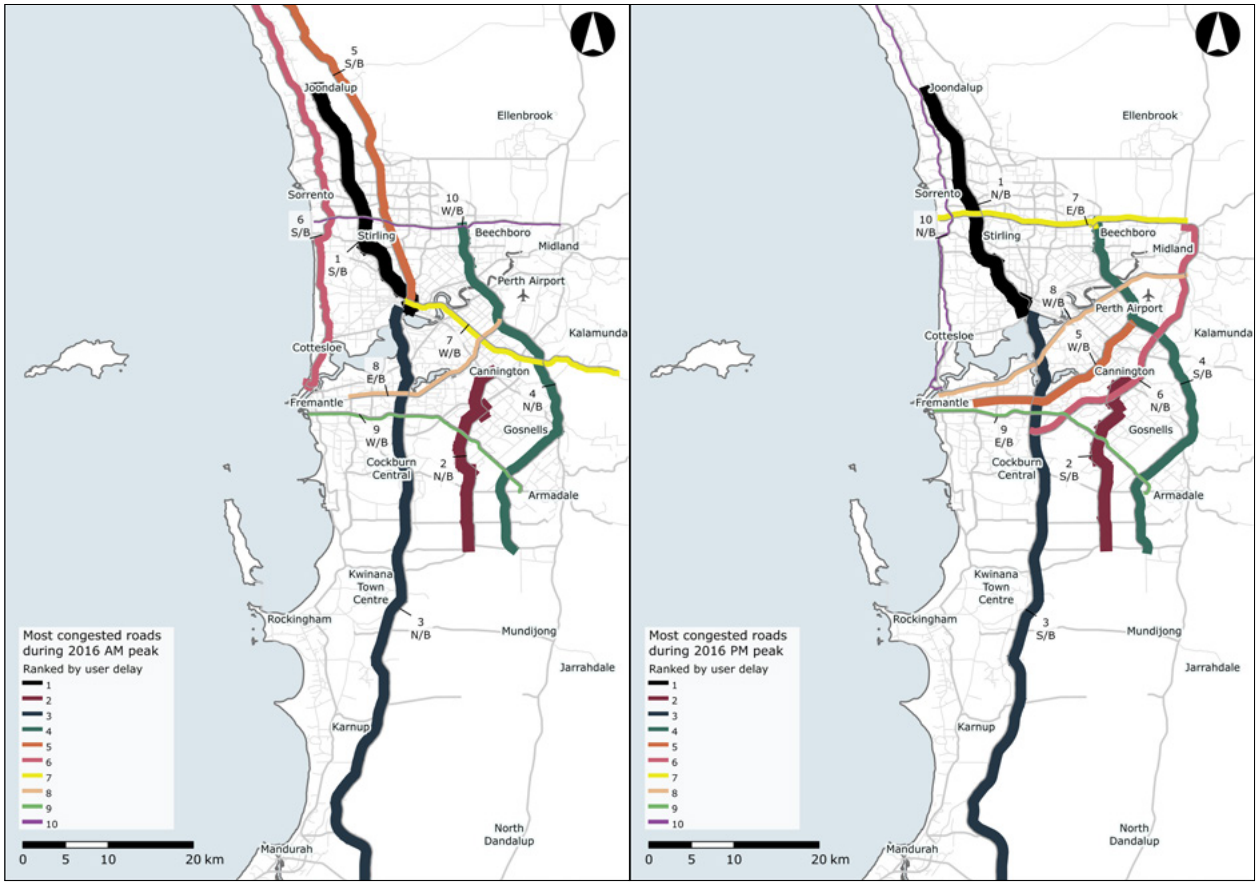
Table 33: Perth's most congested roads (user experience), 2016

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.	Mitchell Freeway corridor (S/B)	29	51%	20	$5.52	$23.79
2.	Nicholson Road corridor (N/B)	22	40%	12	$3.31	$14.28
3.	Kwinana Freeway corridor (N/B)	80	40%	32	$8.84	$38.07
4.	Tonkin Highway corridor (N/B)	44	36%	17	$4.69	$20.22
5.	Wanneroo Road corridor (S/B)	47	35%	22	$6.08	$26.17
6.	Marmion Avenue / West Coast Highway corridor (S/B)	61	34%	28	$7.73	$33.31
7.	Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor (W/B)	24	34%	12	$3.31	$14.28
8.	Leach Highway corridor (E/B)	19	33%	9	$2.49	$10.71
9.	Randford Road / South Street corridor (W/B)	26	33%	13	$3.59	$15.47
10.	Reid Highway corridor (W/B)	25	33%	10	$2.76	$11.90
PM peak						
1.	Mitchell Freeway corridor (N/B)	29	41%	13	$3.59	$15.47
2.	Nicholson Road corridor (S/B)	22	34%	9	$2.49	$10.71
3.	Kwinana Freeway corridor (S/B)	80	34%	25	$6.90	$29.74
4.	Tonkin Highway corridor (S/B)	44	31%	14	$3.87	$16.66
5.	Leach Highway corridor (W/B)	19	31%	8	$2.21	$9.52
6.	Roe Highway corridor (N/B)	34	31%	10	$2.76	$11.90
7.	Reid Highway corridor (E/B)	25	30%	9	$2.49	$10.71
8.	Great Eastern Highway (west) / Canning Highway corridor (W/B)	30	29%	13	$3.59	$15.47
9.	South Street / Ranford Road corridor (E/B)	26	29%	11	$3.04	$13.09
10.	West Coast Highway / Marmion Road corridor (N/B)	61	29%	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)[154]

Figure 81: Perth's most congested roads (user experience), 2016 AM (left) and PM (right) peak periods



Source: Veitch Lister Consulting (2019)[155]

Perth'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 by Infrastructure Australia has also identified the most congested road corridors in Greater Perth and Peel aggregating the total delay experienced by all vehicles using the congested road during the modelled period. The ten most congested corridors under this approach are shown in Table 34 and Figure 82, for the AM and PM peak respectively.

In 2016, Perth's most delayed road corridors were served by the Kwinana Freeway and the Mitchell Freeway. Significant delays on these roads contributed to traffic overspill to and increased delays on generally parallel arterial roads. The Marmion Avenue / West Coast Highway provides an alternative route for commuters travelling from the north, while the Old Coast Road / Mandurah Road / Stock Road / Stirling Highway route provides an alternative for commuters entering the city centre from the south. Both corridors incurred significant delays during peak periods. Other corridors facilitating orbital and radial movements through the city, including the Tonkin Highway, also significantly contributed to delays on Perth's road network.

Perth's public transport system in 2016

Demand for public transport in Perth has grown substantially over the past 10 years. A significant reason for this was the completion of the Mandurah rail line in 2007 (see Perth's railways: a network that has tripled in size over 30 years) and complementary redesign of the bus network. The new railway drew passengers into the network and resulted in a significant increase in patronage.

In the last few years, patronage has declined, likely due to the winding up of the mining boom.[156] Nevertheless, patronage is still significantly higher than a decade ago. The Mandurah and Joondalup lines carry the most passengers on Perth's rail network and are also the most crowded.

In the AM peak, both lines get busier as services approach the CBD (Figure 83), and passengers joining the train are generally required to stand. However, neither railway is currently at their maximum, or what would be considered crush capacity. Lines that carry fewer passengers, such as the Fremantle, Midland and Armadale lines, are not subject to such significant crowding.

Perth's busiest bus corridors are to the inner north, inner south and east of the city (Figure 84). They generally become more crowded as they approach the CBD.

There is also congestion in areas which are not directly served by a railway line, such as near Perth Airport and in the Beechboro / Bennett Springs district. We note the construction of the Forrestfield-Airport Link scheduled for a delayed completion in the second half of 2021.

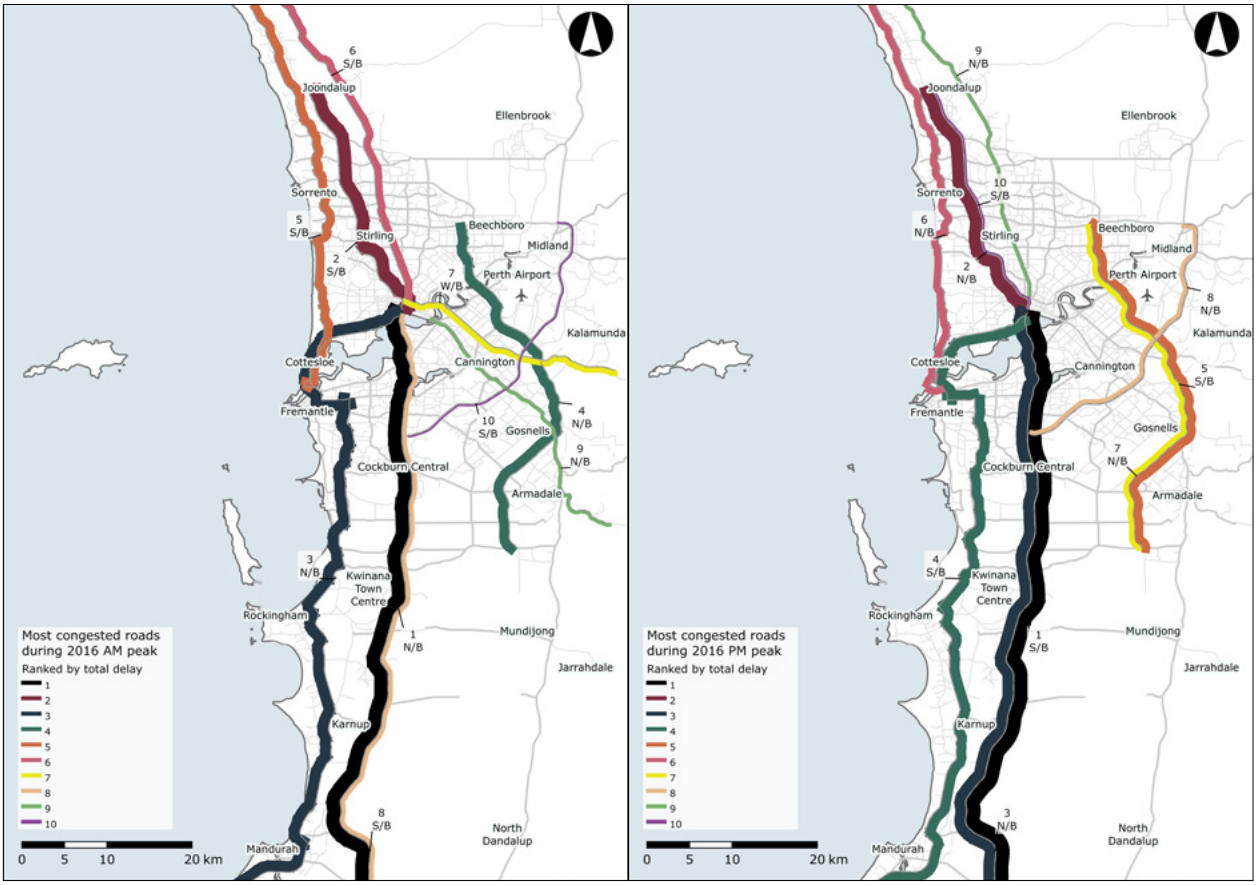
Table 34: Perth's most congested roads (total vehicle delays), 2016

City rank	Corridor	Direction	Total delay hours	Cost of congestion (daily)
AM peak				
1.	Kwinana Freeway corridor	N/B	4,600	$91,000
2.	Mitchell Freeway corridor	S/B	3,000	$58,000
3.	Old Coast Road / Mandurah Road / Stock Road / Stirling Highway corridor	N/B	1,500	$31,000
4.	Tonkin Highway corridor	N/B	1,400	$29,000
5.	Marmion Avenue / West Coast Highway corridor	S/B	1,300	$25,000
6.	Wanneroo Road corridor	S/B	1,100	$22,000
7.	Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor	W/B	1,100	$22,000
8.	Kwinana Freeway corridor	S/B	1,000	$22,000
9.	Albany Highway corridor	N/B	900	$17,000
10.	Roe Highway corridor	S/B	900	$19,000
PM peak				
1.	Kwinana Freeway corridor	S/B	4,000	$78,000
2.	Mitchell Freeway corridor	N/B	2,400	$44,000
3.	Kwinana Freeway corridor	N/B	1,700	$35,000
4.	Stirling Highway / Stock Road / Mandurah Road / Old Coast Road corridor	S/B	1,300	$26,000
5.	Tonkin Highway corridor	S/B	1,200	$24,000
6.	West Coast Highway / Marmion Avenue corridor	N/B	1,000	$19,000
7.	Tonkin Highway corridor	N/B	900	$18,000
8.	Roe Highway corridor	N/B	900	$18,000
9.	Wanneroo Road corridor	N/B	800	$15,000
10.	Mitchell Freeway corridor	S/B	800	$15,000

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

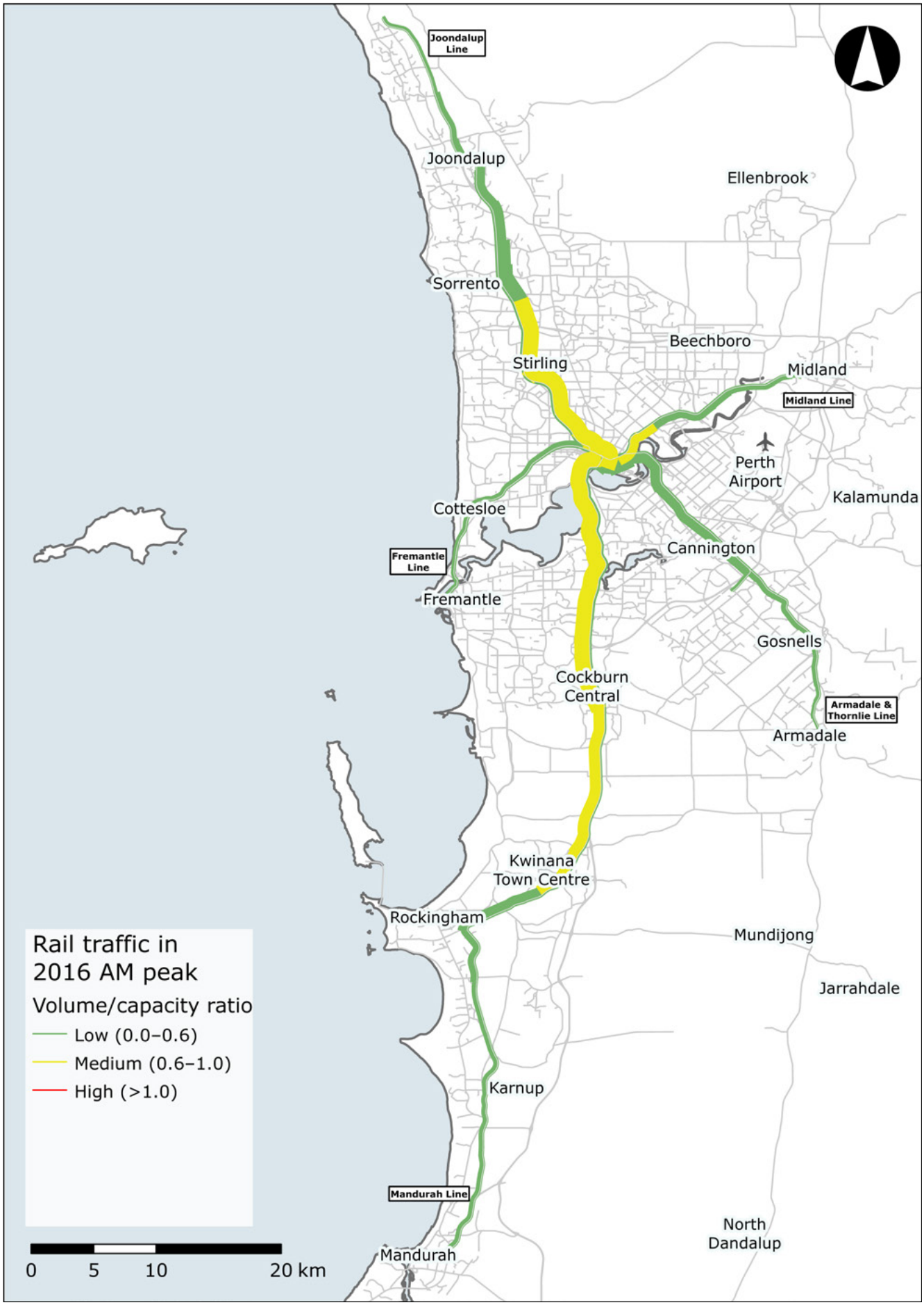
Source: Veitch Lister Consulting (2019)[157]

Figure 82: Perth's most congested roads (total vehicle delay), 2016 AM (left) and PM (right) peak periods



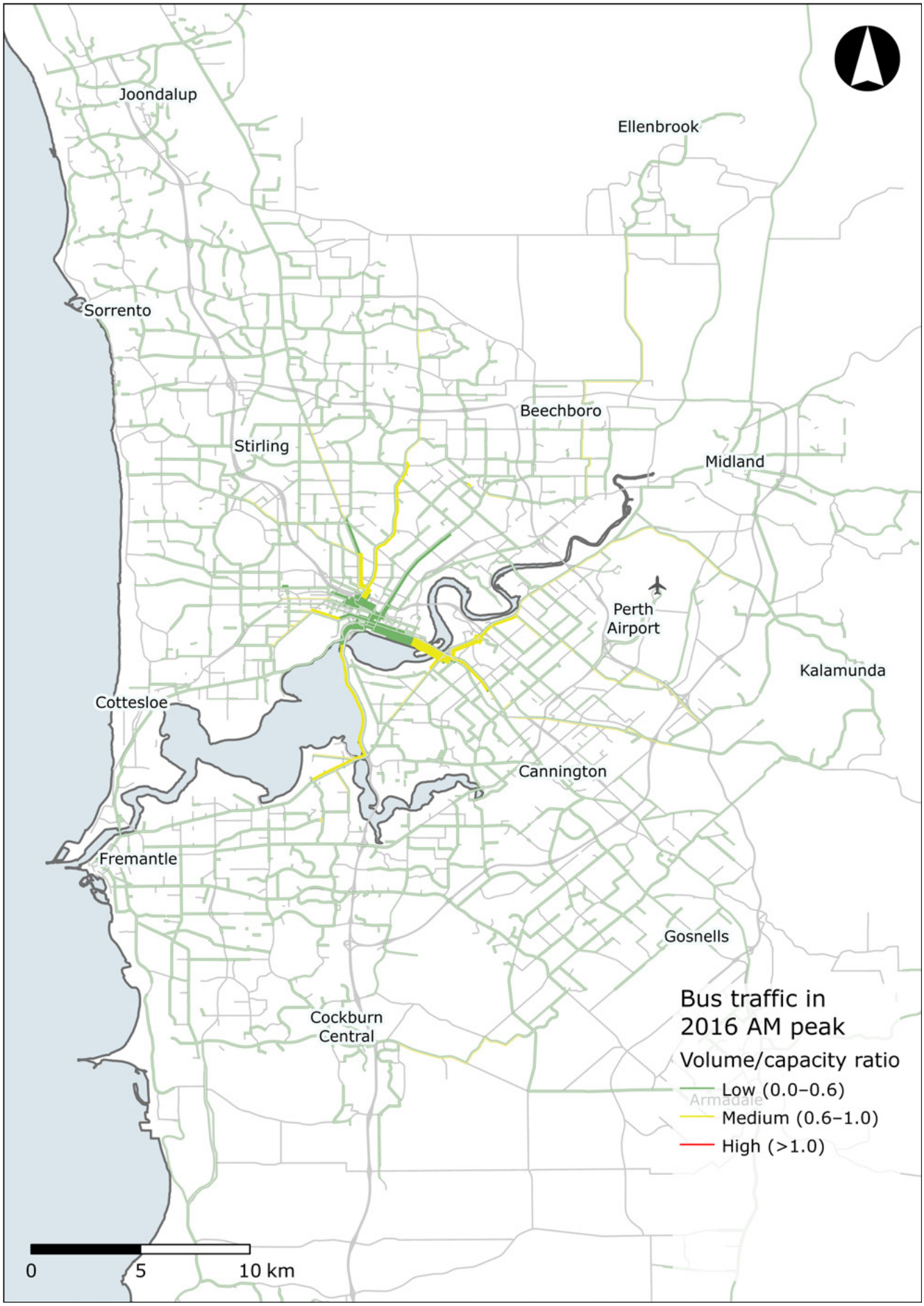
Source: Veitch Lister Consulting (2019)[158]

Figure 83: Perth weekday train passenger volume / capacity ratio, 2016 AM peak



Source: Veitch Lister Consulting (2019)[159]

Figure 84: Perth weekday bus passenger volume / capacity ratio, 2016 AM peak



Source: Veitch Lister Consulting (2019)[160]

Perth's railways: a network that has tripled in size over 30 years

Between 1985 and 2008 the Western Australian Government added over 100 km of railway to Perth's network. By 2012, the city's rail patronage had grown by a factor of 10 compared to 1981, from 6.5 million to 63 million annual passengers. One of the strongest performers was the Mandurah Line, running parallel to the coast 71 km south of Perth CBD. By one year after this line was completed in 2007 it was carrying 55,000 passengers per day compared to the 14,000 bus passengers that had previously travelled along the corridor.

Part of the success of Perth's newer train lines in converting passengers from car to public transport use is attributed to the decision to locate many track sections in the median of freeways radial to the CBD. Nearly half of the rail kilometres built since 1985 follow similar alignment. As well as having construction speed and cost advantages, trains running along freeways during peak periods are visibly attractive to car commuters sitting in congested traffic.

Given the low residential density typical of surrounding Perth's newer stations, a low proportion of train customers walk to rail relative to rail systems in Australia's south-eastern capitals. For first and last mile mass transit access, high-frequency feeder buses that are scheduled to integrate with the train timetable are comparatively important. These services meet the train line at interchanges that are designed to make the transfer experience as seamless as possible.

Additionally, extensive commuter car parking has been provided around most suburban train stations. This services commuters who find this travel choice faster than a feeder bus or need their car on the way to and from the station.

The resulting approach to station precinct design has enabled the rapid expansion of rail patronage in a low-density setting where there is a concentrated demand for travel towards the predominant centre of Perth CBD. However, it is in some tension with the aspiration to achieve high-density mixed used development around stations. At some locations this urban form has been delivered or is emerging. These locations include Subiaco, and the growing regional centre at Joondalup at the northern end of Perth's coastal rail corridor.

Some other stations present a more challenging environment for the achievement of a population of over 10,000 residents within a 1km radius – the density threshold that may be required to warrant a major, transit-oriented development redesign of the station precinct.

Findings

- Peak period road users can expect to spend a significant proportion of their journeys on the cities' worst roads in congested conditions.
- Perth's most congested corridors in 2016 are expected to worsen by 2031, including the Mitchell and Kwinana Freeways. By 2031 peak users of these corridors can expect to spend up to 60% of their travel time stuck in traffic, up from 40% in 2016 for the worst-performing corridors.
- Long delays are also forecast on key arterial corridors. Users travelling the length of the Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor can expect a travel time of nearly 45 minutes in 2031.
- In outer areas, significant population growth to 2031 will drive congestion on arterial roads. In the far north the Marmion Avenue / West Coast Highway and Wanneroo Road corridors will perform poorly. In the south a similar outcome is expected on the Nicholson Road corridor.
- The cost of public transport crowding in Perth will increase almost fivefold by 2031. The Joondalup and Mandurah lines will continue to see the most crowded services. Generally, population growth in emerging and established areas appears not to be adequately serviced by additional rail infrastructure and services by 2031.
- Buses will experience more significant crowding in 2031, due to increased population and travel demand, and as a result of more commuters choosing buses over crowded trains. Key bus routes will reach crush capacity close to the CBD, with Kwinana Freeway services particularly affected.

8.4 Perth's transport networks are forecast to become more congested

Snapshot of Perth's transport networks in 2031

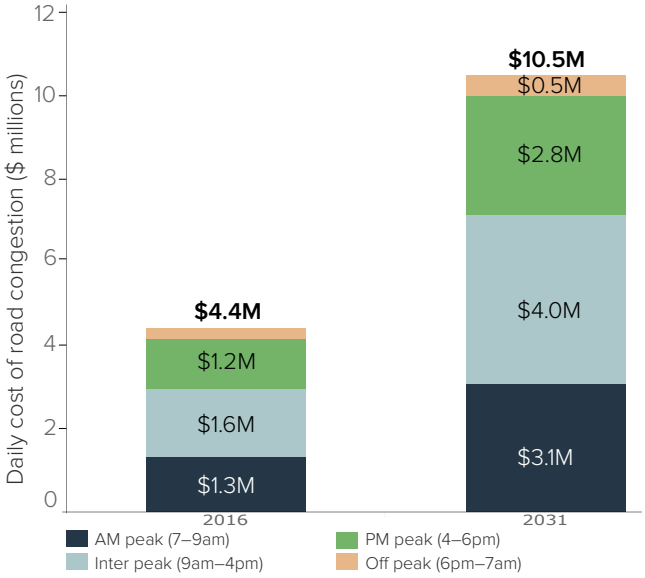
Demand for transport in Perth is predicted to increase roughly in line with population growth. Greater Perth's population is forecast to grow by about 30%, to just over 2.6 million, by 2031. Population is expected to grow most quickly on the urban fringe, with significant growth in Wanneroo (75%) and Mandurah (58%). There will also be some urban infill development, with significant growth in Perth City (33%) and Cockburn (34%).

As a result, trips on Perth's transport network are forecast to increase by 33%, to over 7 million daily trips. Trips by public transport are expected to grow at a faster rate than by car, continuing a shift towards public transport usage seen in the city over the last few years. Trips on public transport will increase by 42% and by car by 32%.

Despite the mode shift from cars to public transport, congestion on Perth's roads is forecast to grow substantially. Our modelling indicates the annualised cost of road congestion will be approximately $3.6 billion in 2031. Congestion will continue to be particularly acute on key north-south arterial roads, as well as on the Mitchell and Kwinana Freeways and the Tonkin Highway. The daily cost of road congestion on Perth's roads is expected to more than double as a result, from about $4.4 million in 2016 to $10.5 million in 2031 (Figure 85).

The cost of public transport crowding is also forecast to increase significantly, while totalling significantly less than the cost of road congestion. The annualised cost of public transport crowding in Perth is expected to increase almost ten fold, from $17 million in 2016 to $159 million in 2031, with the majority of the increase being associated with rail crowding.

Figure 85: Perth's average weekday cost of road congestion, 2016 and 2031



Source: Veitch Lister Consulting (2019)[161]

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 *Infrastructure Australia Audit*.[162]

Major projects included in Perth's 2031 forecast comprise:

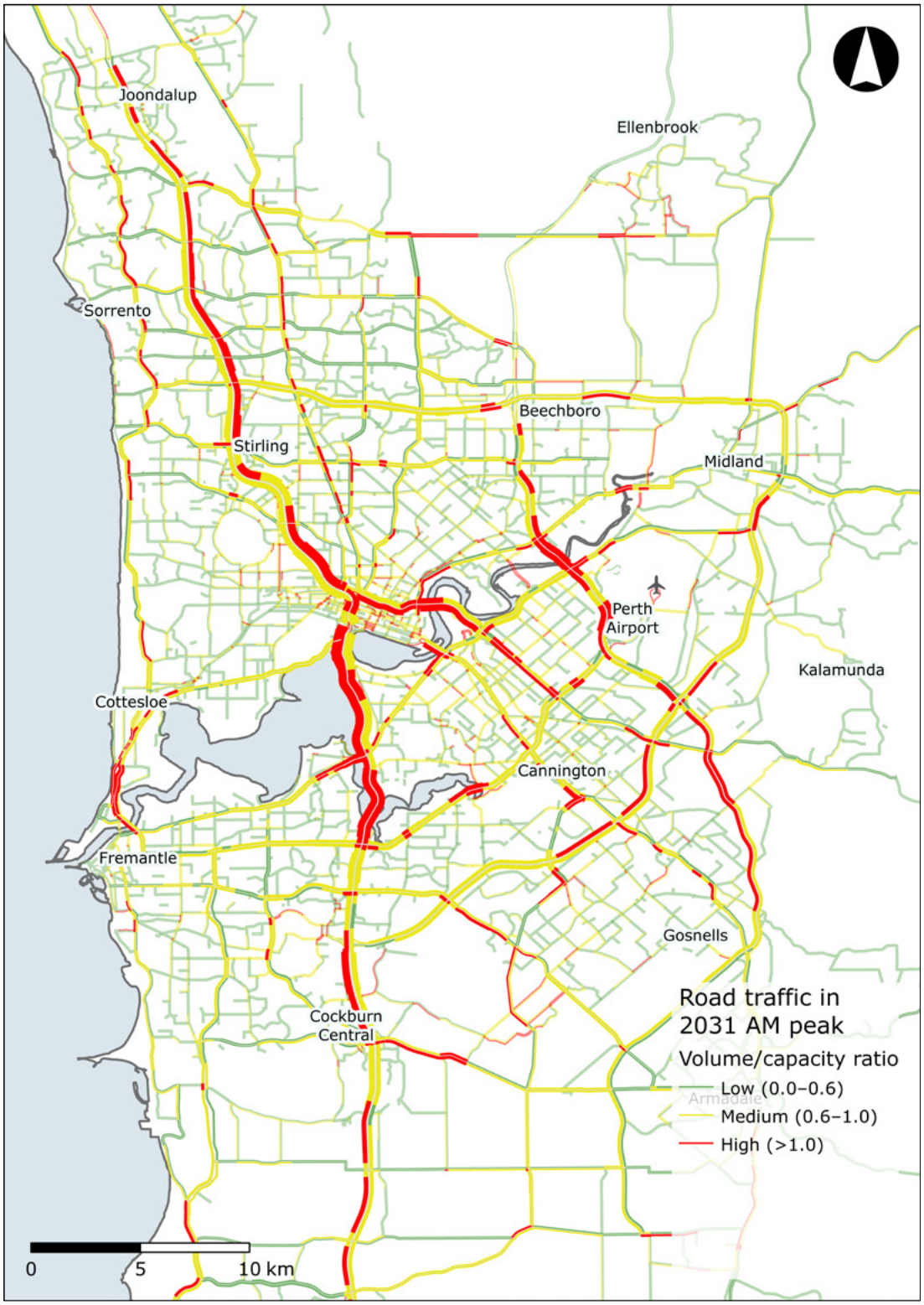
- NorthLink WA
- Tonkin Highway Grade Separation
- Forrestfield Airport Link
- Thornlie–Cockburn Link
- Yanchep Rail Extension
- Mitchell Freeway widening
- Kwinana Freeway widening.

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

In 2031, Perth's worst-performing roads will be broadly the same as today, but suffering greater congestion and delays (Figure 86). The north-south Mitchell and Kwinana Freeways, and their connecting routes, are expected to experience the city's worst traffic congestion in 2031.

Based on estimating the percentage of journey time that will be accounted for by congestion on Perth's road network in 2031, Table 35 and Figure 87 show the ten most congested corridors in the AM and PM peak periods, respectively.

Figure 86: Perth weekday traffic volume / capacity ratio, 2031 AM peak



Source: Veitch Lister Consulting (2019)[163]

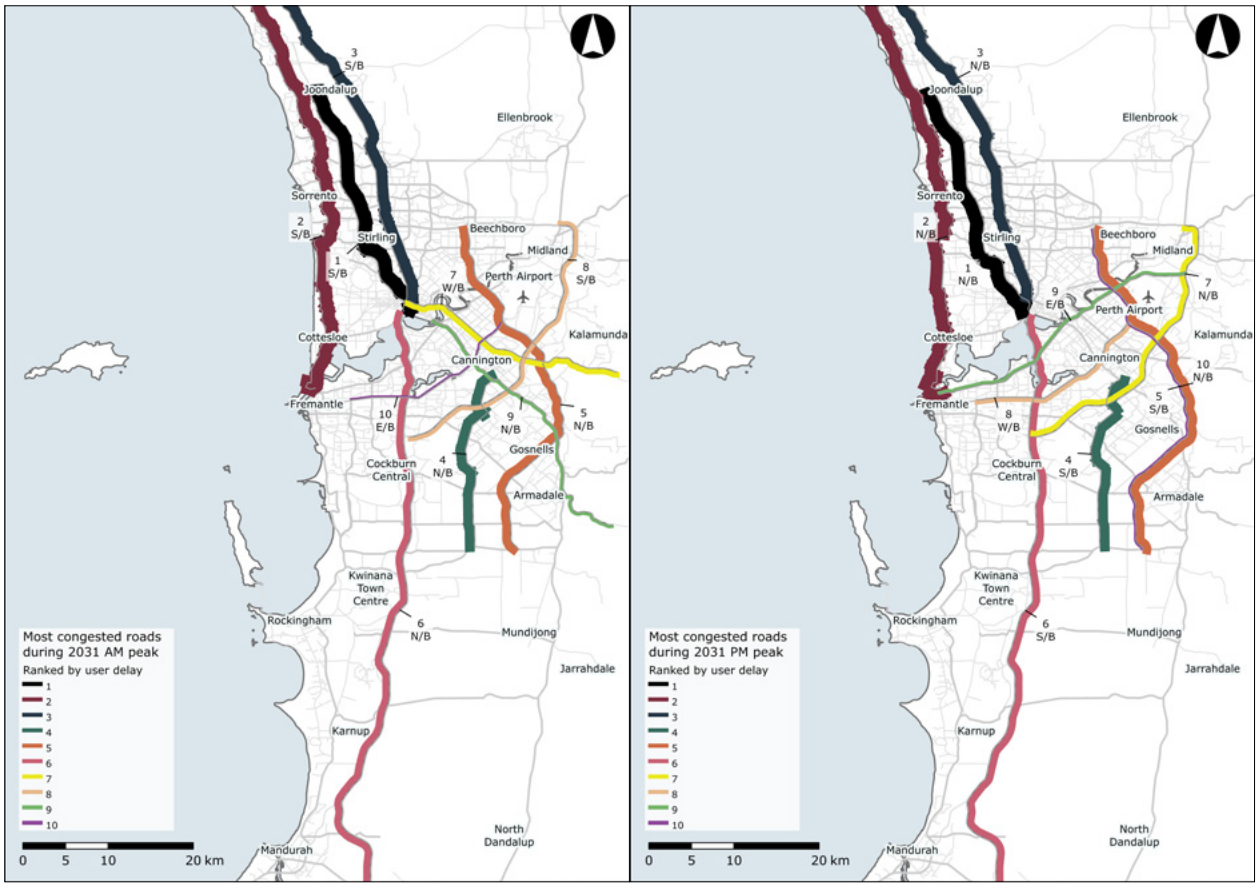
Table 35: Perth's most congested roads (user experience), 2031

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.	Mitchell Freeway corridor (S/B)	29	62%	31	$8.56	$36.88
2.	Marmion Avenue / West Coast Highway corridor (S/B)	61	54%	64	$17.67	$76.14
3.	Wanneroo Road corridor (S/B)	47	53%	48	$13.26	$57.10
4.	Nicholson Road corridor (N/B)	22	52%	19	$5.25	$22.60
5.	Tonkin Highway corridor (N/B)	44	51%	30	$8.29	$35.69
6.	Kwinana Freeway corridor (N/B)	80	51%	50	$13.81	$59.48
7.	Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor (W/B)	24	47%	20	$5.52	$23.79
8.	Roe Highway corridor (S/B)	34	44%	18	$4.97	$21.41
9.	Albany Highway corridor (N/B)	33	43%	24	$6.63	$28.55
10.	Leach Highway corridor (E/B)	19	42%	13	$3.59	$15.47
PM peak						
1.	Mitchell Freeway corridor (N/B)	29	56%	25	$6.90	$29.74
2.	West Coast Highway / Marmion Road corridor (N/B)	61	50%	53	$14.64	$63.05
3.	Wanneroo Road corridor (N/B)	47	48%	40	$11.05	$47.59
4.	Nicholson Road corridor (S/B)	22	48%	17	$4.69	$20.22
5.	Tonkin Highway corridor (S/B)	44	47%	27	$7.46	$32.12
6.	Kwinana Freeway corridor (S/B)	80	46%	42	$11.60	$49.97
7.	Roe Highway corridor (N/B)	34	44%	18	$4.97	$21.41
8.	Leach Highway corridor (W/B)	19	41%	13	$3.59	$15.47
9.	Canning Highway / Great Eastern Highway (west) corridor (E/B)	30	41%	21	$5.80	$24.98
10.	Tonkin Highway corridor (N/B)	44	40%	20	$5.52	$23.79

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

Source: Veitch Lister Consulting (2019)[164]

Figure 87: Perth's most congested roads (user experience), 2031 AM (left) and PM (right) peak periods



Source: Veitch Lister Consulting (2019)[165]

Between 2016 and 2031, vehicle congestion in Perth is expected to have worsened and spread. By 2031, users of the above corridors can expect to spend 40–60% of their time in dense traffic. Inevitably, increased congestion will result in deteriorating road performance, affecting travel times predominantly for commuters travelling to and from central Perth in peak periods. Motorists can expect lengthier periods of congestion stretching greater distances from the city centre in both the morning and evening by 2031.

Perth's forecast population growth will be the principal factor increasing pressure on the city's key access routes by 2031. Despite widening of the Mitchell and Kwinana Freeways, these roads will experience severe congestion in the citybound direction in the AM peak period, with the opposite expected in the PM peak period. Motorists on the Kwinana Freeway are also forecast to experience high levels of congestion in the counter-peak direction. These routes provide access to Perth's city centre for commuters and freight operators travelling from both the north and south. Severe congestion on these corridors will be extremely disruptive to daily travel by cars, buses and trucks. Modelling suggests that by 2031 the Mitchell Freeway will be struggling to accommodate an expected traffic volume well in excess of its design capacity.

Additional demand on Perth's central north-south freeway corridor will also increase traffic volumes on other major roads such as the Roe and Tonkin highways. This is forecast to eventuate despite significant road upgrades, such as interchange grade separation for the Tonkin Highway. While this is expected to improve traffic conditions on some sections of the corridor, the Swan River Crossing will remain a highly congested corridor.

In addition to congestion on major freeways, surface arterial road corridors providing access to these freeways are forecast to experience significant levels of congestion by 2031. Roads providing on-ramp access to freeways, especially in growth areas, will be subject to increased delays due to rising demand for access to jobs and other opportunities in central Perth. Increased traffic and congestion will also be felt at river crossings at Fremantle and to the north-east of the CBD.

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

Modelling has forecast the most congested road corridors in Greater Perth 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 36 and Figure 88. The greatest delays are forecast to be experienced on major freeways and key arterial roads.

Perth's public transport system in 2031

By 2031, Perth's public transport network will need to cater for a much larger population. Overall public transport boardings are forecast to increase strongly, by 95% for rail and 80% for buses.[166] Trains will be expected to cater for long-distance travel, while buses will be more relied on for shorter trips.

Patronage on Perth's rail system is expected to be supported by investments that expand service catchments. Patronage on the Joondalup Line is forecast to grow most significantly, as a result of the rail extension to Yanchep, catering for Perth's most northerly residents.

As in 2016, in 2031 crowding on Perth's rail will be concentrated on the Mandurah and Joondalup lines that facilitate travel from the outer north and south (Figure 89). For both lines, crowding is forecast to increase beyond their maximum or crush capacity in the AM peak on certain sections. The Mandurah Line will experience its most significant crowding between Parmelia and Jandakot as a result of increasing demand not being matched by increased service frequencies. Similarly, the Joondalup Line is forecast to be most crowded between Woodvale and the city.

Perth's bus network is also forecast to experience significant patronage uplift by 2031, particularly on corridors radial to the CBD. This is predicted to be driven by population growth in both emerging and established areas. Bus crowding is predicted to worsen on major routes by 2031 (Figure 90). Radial routes converging on the CBD will experience the greatest levels of crowding. These include routes along the Kwinana and Mitchell Freeways, close to the CBD. In addition, routes running parallel to rail lines are predicted to be increasingly crowded as commuters opt for buses over busy trains. Routes serving areas beyond rail catchments will also experience moderate crowding in 2031.

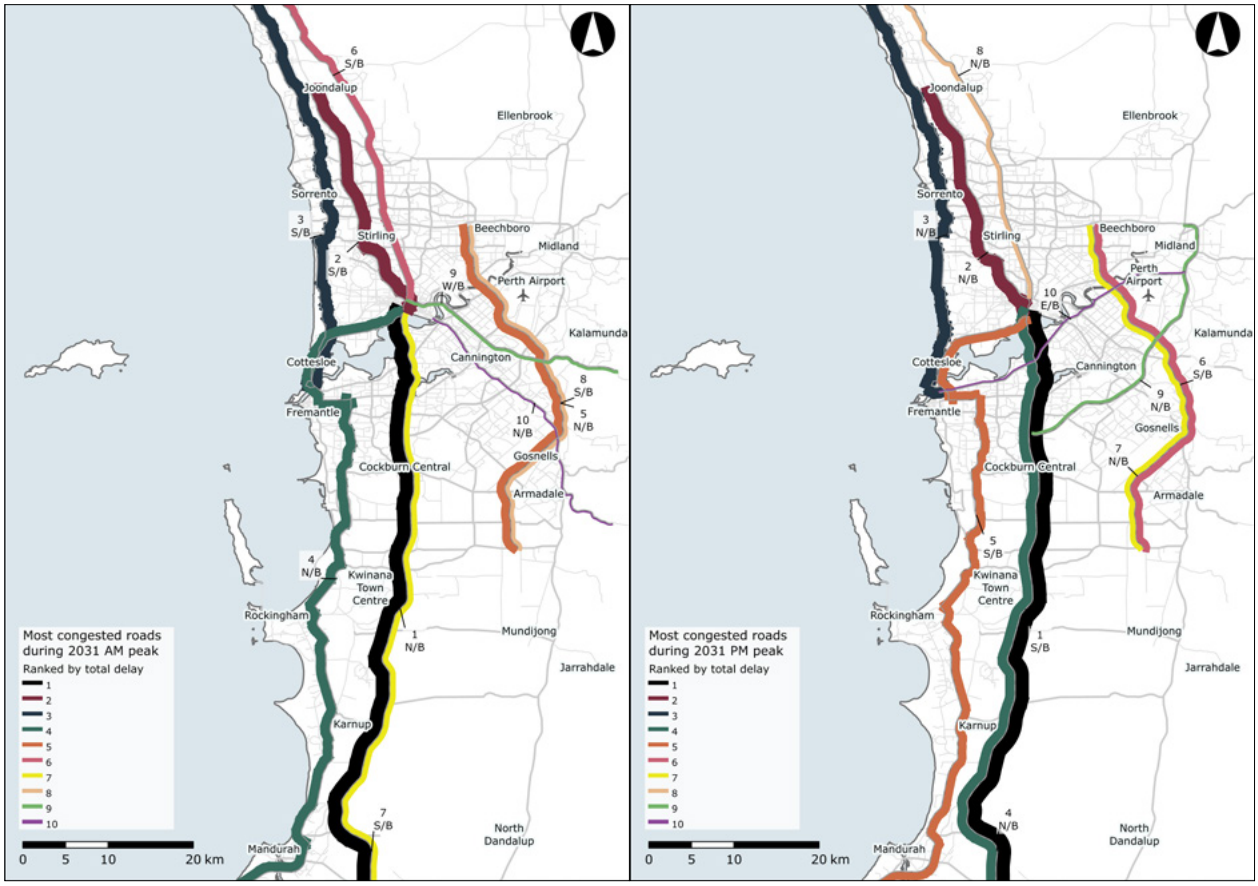
Table 36: Perth's most congested roads (total vehicle delays), 2031

City rank	Corridor	Direction	Total delay hours	Cost of congestion (daily)
AM peak				
1.	Kwinana Freeway corridor	N/B	8,600	$169,000
2.	Mitchell Freeway corridor	S/B	5,200	$101,000
3.	Marmion Avenue / West Coast Highway corridor	S/B	4,100	$81,000
4.	Old Coast Road / Mandurah Road / Stock Road / Stirling Highway corridor	N/B	3,200	$66,000
5.	Tonkin Highway corridor	N/B	3,100	$65,000
6.	Wanneroo Road corridor	S/B	2,500	$49,000
7.	Kwinana Freeway corridor	S/B	2,300	$49,000
8.	Tonkin Highway corridor	S/B	2,200	$45,000
9.	Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor	W/B	2,100	$42,000
10.	Albany Highway corridor	N/B	1,900	$37,000
PM peak				
1.	Kwinana Freeway corridor	S/B	7,500	$148,000
2.	Mitchell Freeway corridor	N/B	4,700	$90,000
3.	West Coast Highway / Marmion Avenue corridor	N/B	3,500	$68,000
4.	Kwinana Freeway corridor	N/B	3,300	$71,000
5.	Stirling Highway / Stock Road / Mandurah Road / Old Coast Road corridor	S/B	2,900	$61,000
6.	Tonkin Highway corridor	S/B	2,900	$61,000
7.	Tonkin Highway corridor	N/B	2,400	$50,000
8.	Wanneroo Road corridor	N/B	2,200	$42,000
9.	Roe Highway corridor	N/B	1,800	$39,000
10.	Canning Highway / Great Eastern Highway (west) corridor	E/B	1,600	$32,000

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

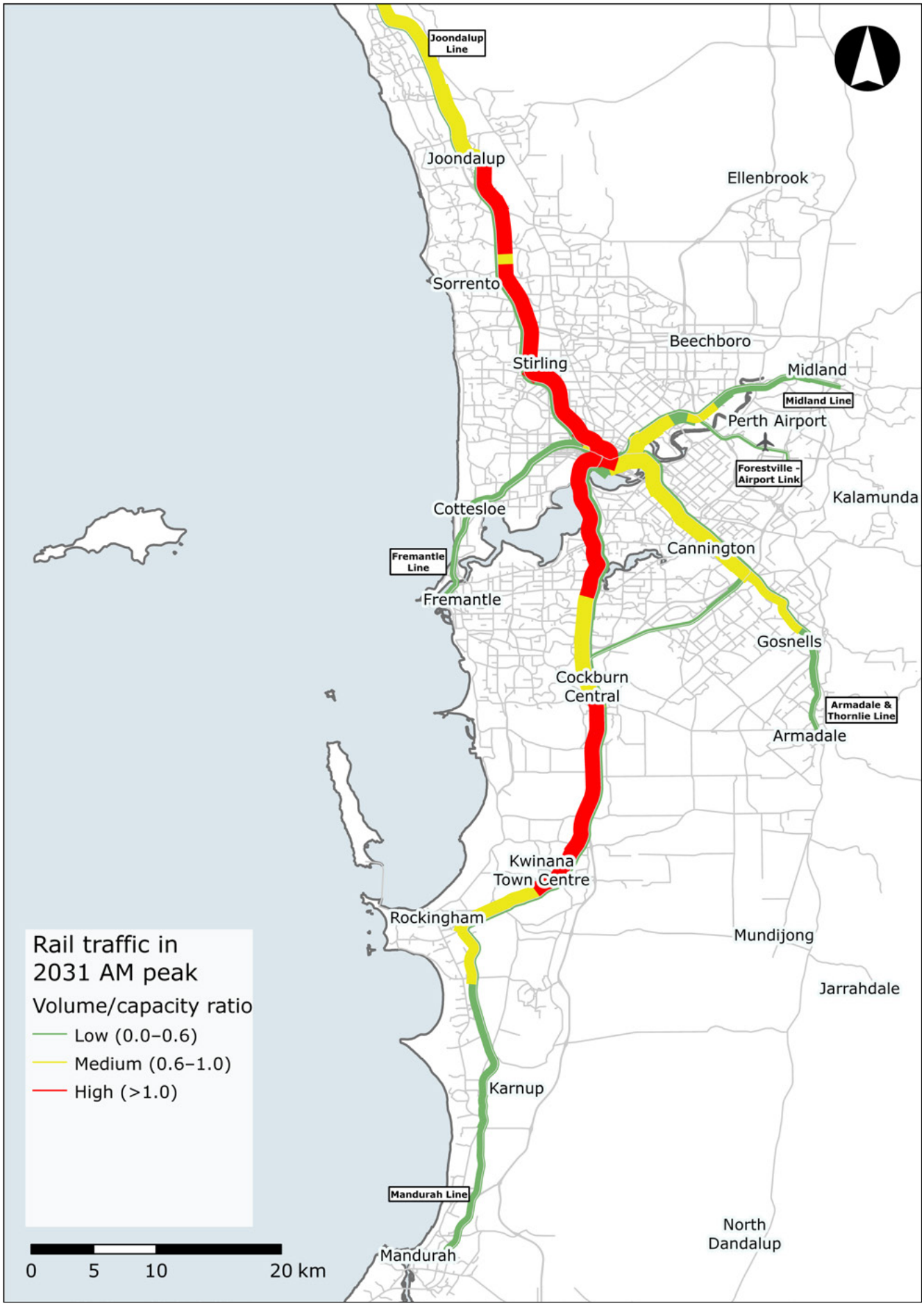
Source: Veitch Lister Consulting (2019)[167]

Figure 88: Perth's most congested roads (total vehicle delays), 2031 AM (left) and PM (right) peak periods



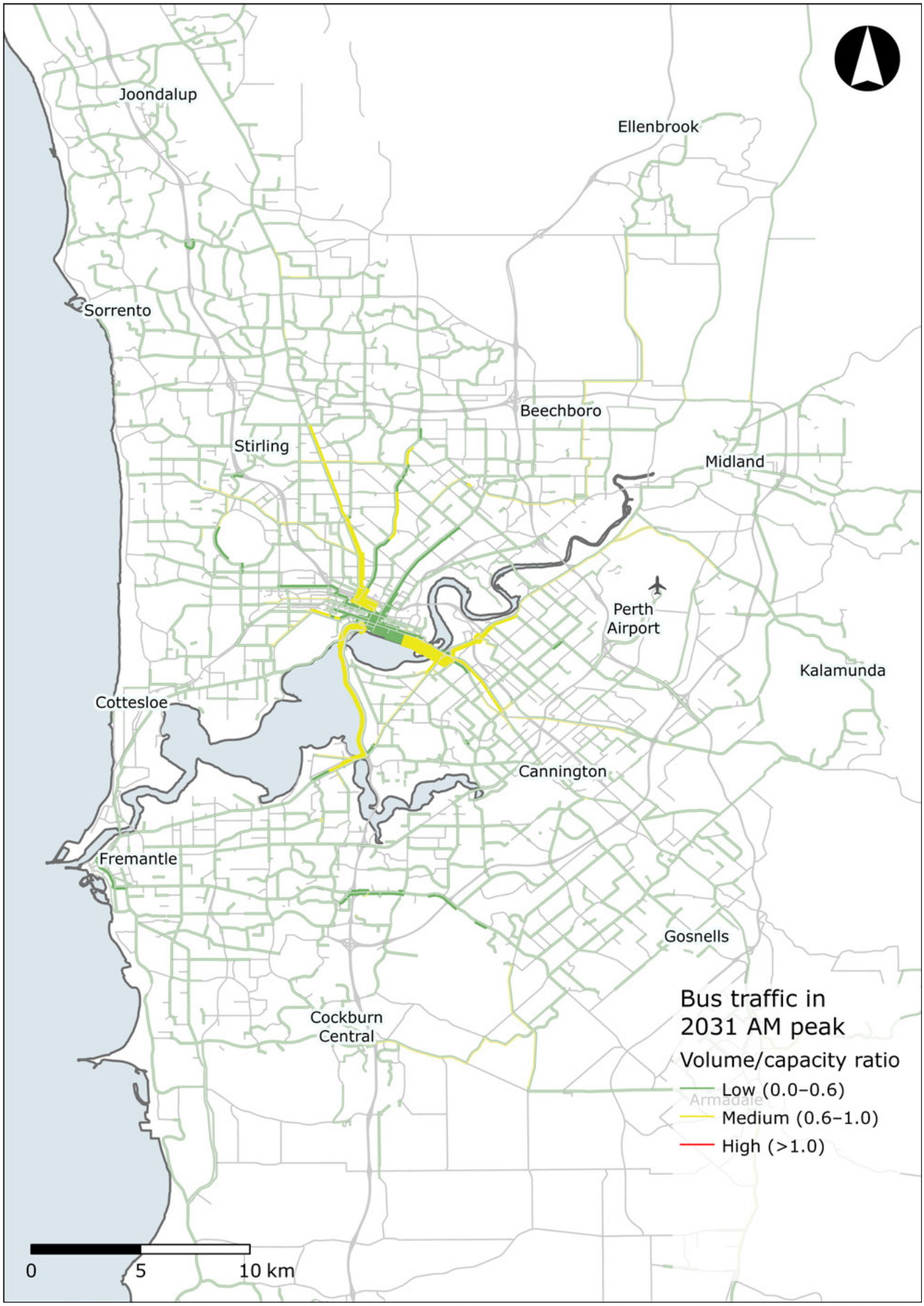
Source: Veitch Lister Consulting (2019)[168]

Figure 89: Perth weekday train passenger volume / capacity ratio, 2031 AM peak



Source: Veitch Lister Consulting (2019)[169]

Figure 90: Perth weekday bus passenger volume / capacity ratio, 2031 AM peak



Source: Veitch Lister Consulting (2019)[170]

Findings

- The 2019 Audit forecasts that the annualised cost of road congestion for Greater Perth will grow from approximately $1.5 billion in 2016 to $3.6 billion in 2031. This is 77% lower than the 2031 forecast cost of road congestion in the 2015 Audit.
- Peak period road users can expect to spend a significant proportion of their journeys on the cities' worst roads in congested conditions.
- Perth's most congested corridors in 2016 are expected to worsen by 2031, including the Mitchell and Kwinana freeways. By 2031 peak users of these corridors can expect to spend up to 60% of their travel time stuck in traffic, up from 40% in 2016 for the worst-performing corridors.
- Long delays are also forecast on key arterial corridors. Users travelling the length of the Welshpool Road East / Orrong Road / Graham Farmer Freeway corridor can expect a travel time of nearly 45 minutes in 2031.
- In outer areas, significant population growth to 2031 will drive congestion on arterial roads. In the far north the Marmion Avenue / West Coast Highway and Wanneroo Road corridors will perform poorly. In the south a similar outcome is expected on the Nicholson Road corridor.
- The cost of public transport crowding in Perth will increase almost fivefold by 2031. The Joondalup and Mandurah lines will continue to see the most crowded services. Generally, population growth in emerging and established areas appears not to be adequately serviced by additional rail infrastructure and services by 2031.
- Buses will experience more significant crowding in 2031, due to increased population and travel demand, and as a result of more commuters choosing buses over crowded trains. Key bus routes will reach crush capacity close to the CBD, with Kwinana Freeway services particularly affected.

8.5 Transport decisions impact access to jobs and services

Hospital access in Perth – by car and public transport, in 2031

Greater Perth's access to critical healthcare is measured by the time it takes to travel to the nearest public hospital, or hospital with an emergency department, by car versus public transport (Figure 91).

Despite all but one of Greater Perth's public hospitals having close access to rail services, car accessibility to hospitals is superior to public transport. While in 2031 the average time to the nearest public hospital in Greater Perth is forecast to be 16 minutes by car (a four-minute increase from 2016), residents without access to a car will continue to be subject to longer travel times.

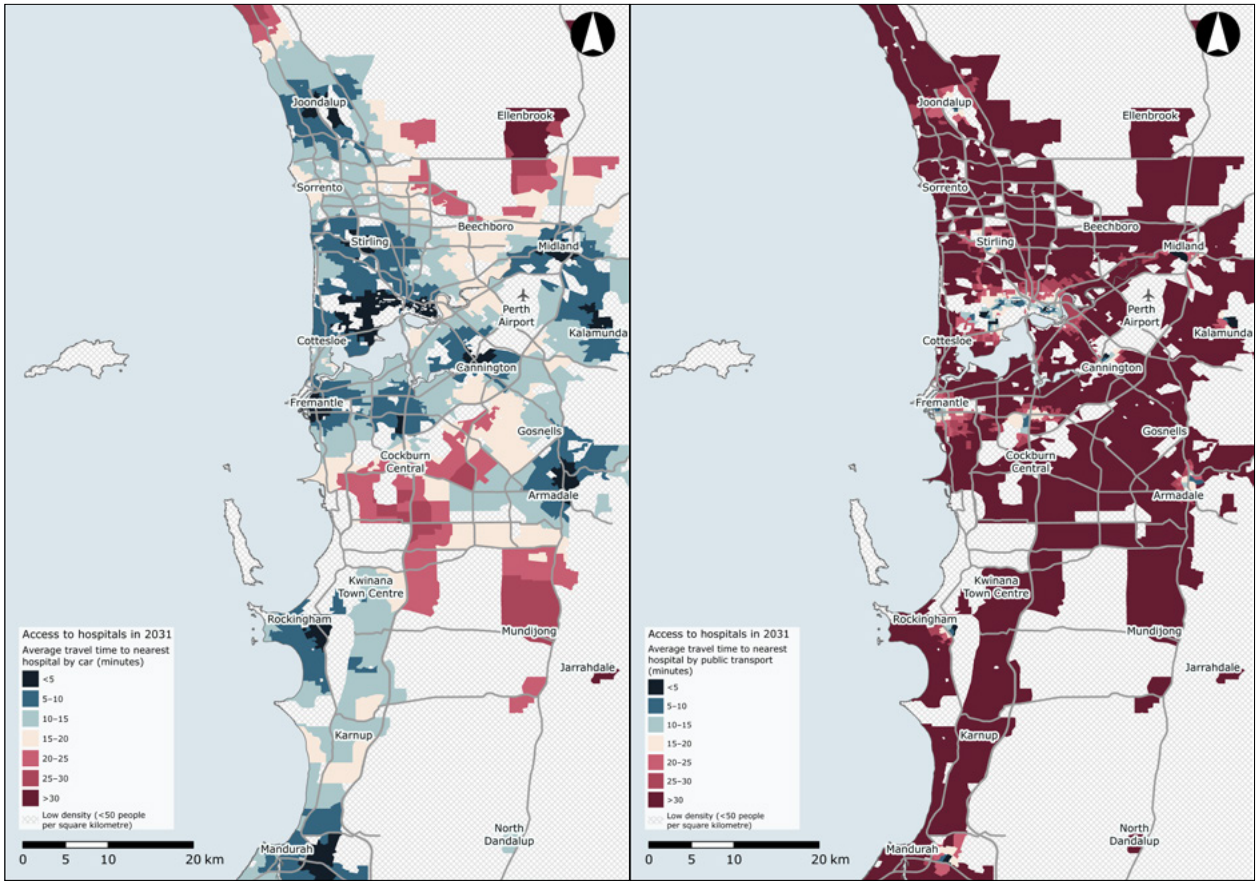
Perth's average travel time by public transport to the nearest public hospital in 2031 will be over 50 minutes. This number reflects the very long travel times modelled for residents of outer or other growth areas where there is limited certainty regarding future public transport connections, including Serpentine–Jarrahdale, Swan and Wanneroo. For residents of middle ring areas, 30–40 minutes will be feasible. This time is reduced further for residents of Perth City, whose nearest public hospital will be accessible in a little over 20 minutes by public transport.

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

The average resident of the Greater Perth region, if they have the use of a car, can access childcare services (Figure 92), public primary schools (Figure 93) and public secondary schools (Figure 94) within a five-minute trip in 2016. This is expected to extend to a seven-minute trip by 2031.

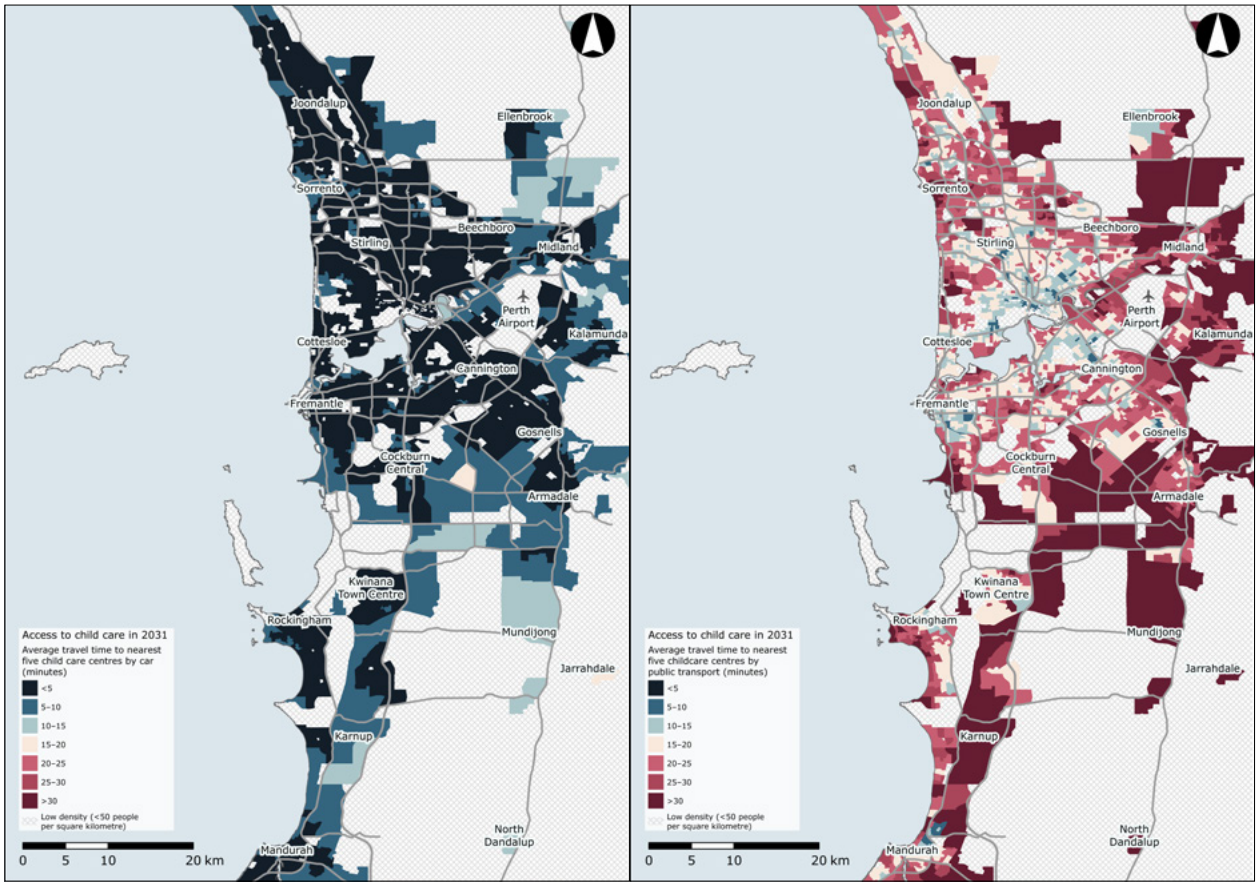
For residents without access to a car, travel times are significantly longer on public transport. Travel times generally average more than 30 minutes for all such destinations, worsening between 2016 and 2031. In some established parts of Perth, public transport offers a realistic alternative to car use, however the urban fringe and areas without direct access to rail services experience much longer travel times. This highlights that while Perth's public transport network effectively facilitates commuting it is less effective at catering for local travel needs.

Figure 91: Greater Perth average time to nearest hospital by car (left) and public transport (right), 2031 AM peak



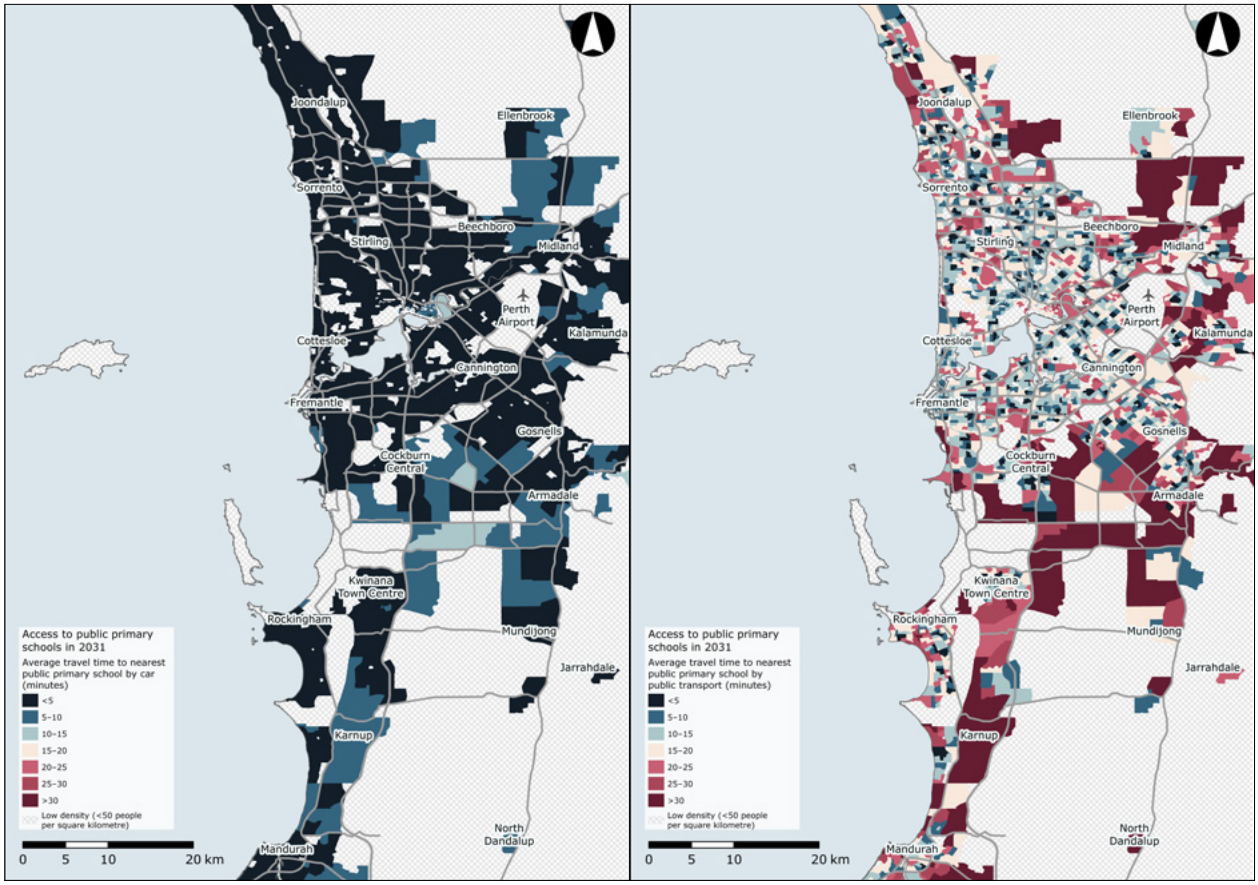
Source: Veitch Lister Consulting (2019)[171]

Figure 92: Greater Perth average time to nearest five childcare centres by car (left) and public transport (right), 2031 AM peak



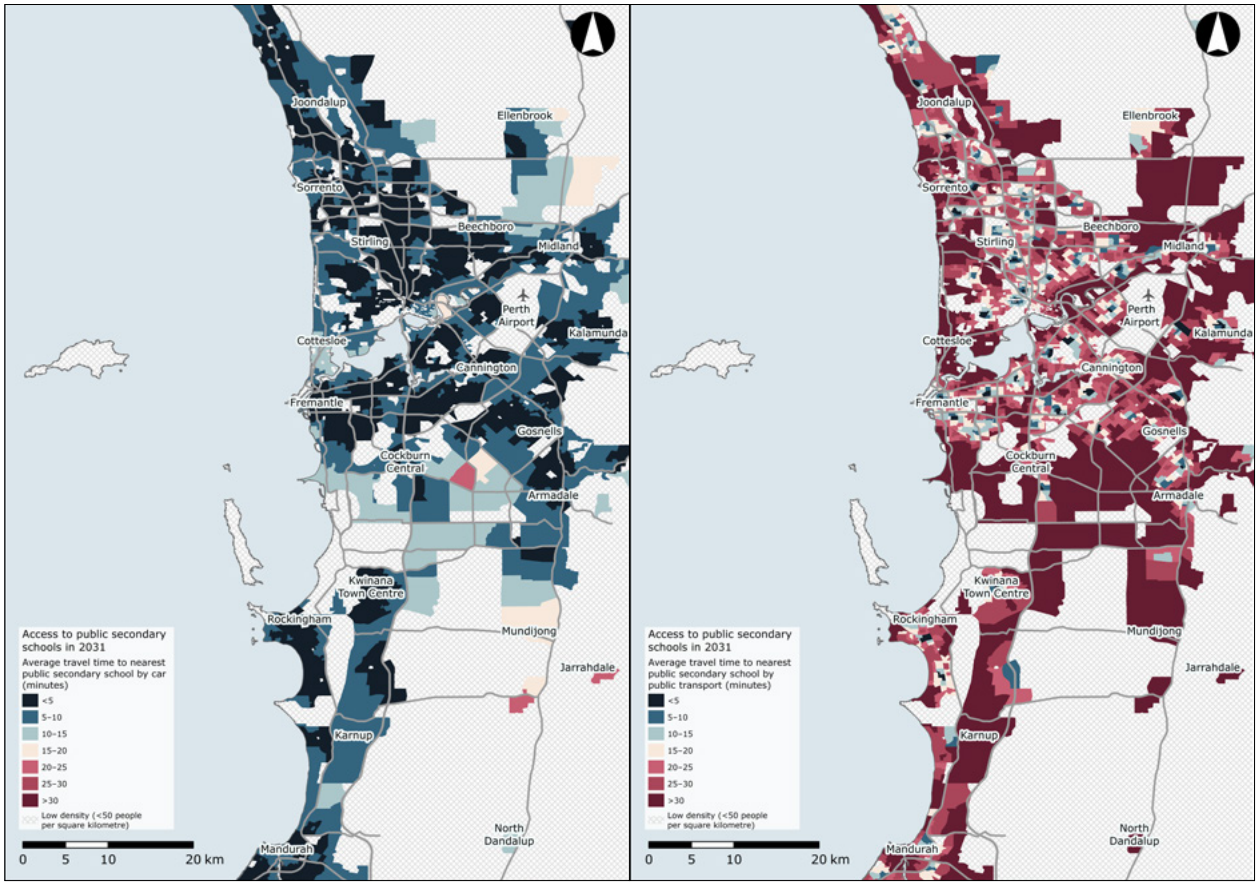
Source: Veitch Lister Consulting (2019)[172]

Figure 93: Greater Perth average time to nearest public primary school by car (left) and public transport (right), 2031 AM peak



Source: Veitch Lister Consulting (2019)[173]

Figure 94: Greater Perth average time to nearest public secondary school by car (left) and public transport (right), 2031 AM peak



Source: Veitch Lister Consulting (2019)[174]

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

Employment accessibility has been measured as the percentage of jobs that can be reached in Greater Perth within 30 minutes of home by car (Figure 95) and by public transport (Figure 96) in the two modelled years.

Access to employment across Greater Perth differs based on where a person lives and which mode of transport they opt for. Due to the high current and future concentration of jobs in Perth's city centre, accessibility to this area is the main driver of job accessibility.

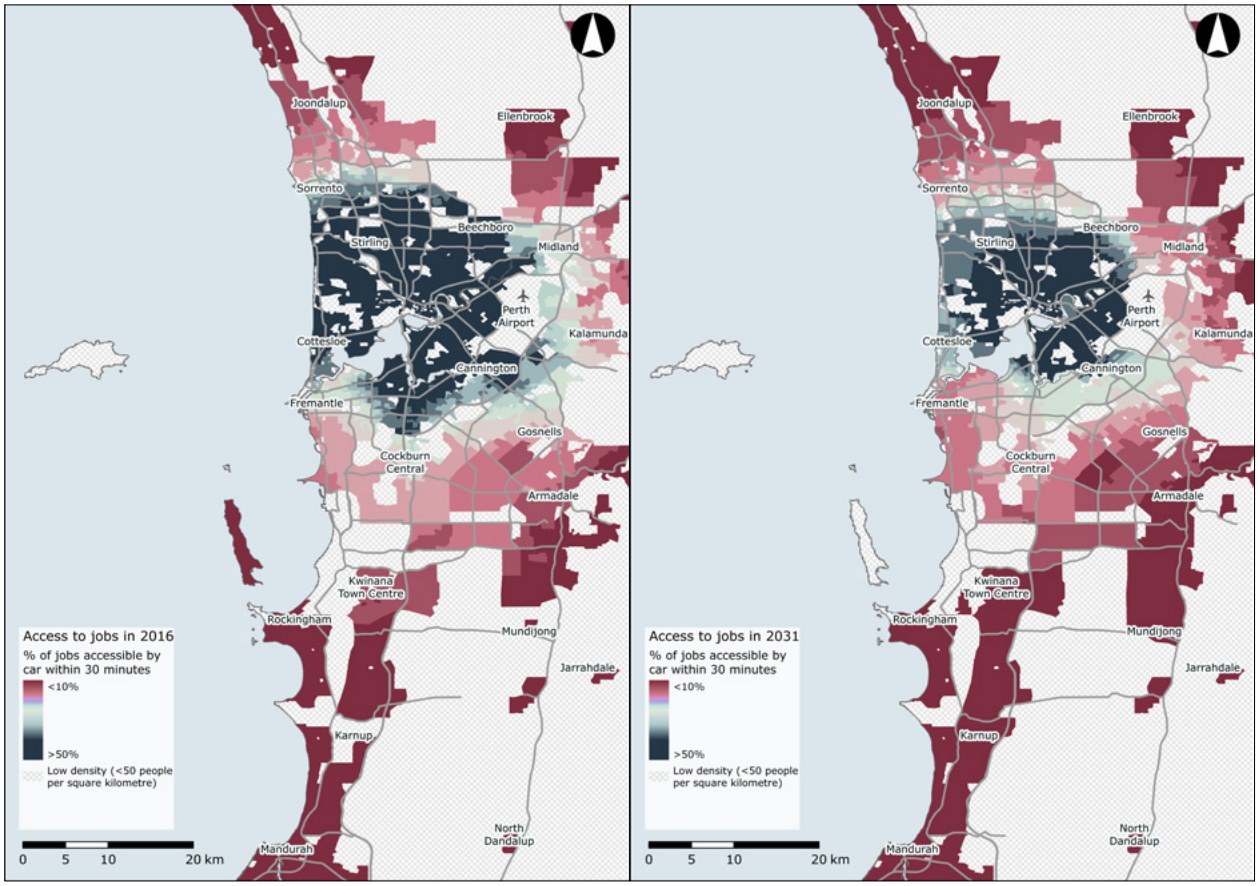
Job accessibility by car is expected to reduce by 2031 due to road congestion. As a result motorists are expected to be able to reach a smaller proportion of jobs by car in 2031 than in 2016. This is particularly the case in areas south of the Swan River, due to the constraints river crossings present to the movement of traffic.

Job accessibility by public transport is forecast as relatively stable between 2016 and 2031. Notwithstanding issues with crowding of bus and rail due to service provision not keeping pace with population growth, in terms of coverage areas that have good accessibility to jobs by public transport in 2016 are forecast to continue to benefit from this in the future. Outer urban areas will still be, as today, relatively disadvantaged in this respect.

Findings

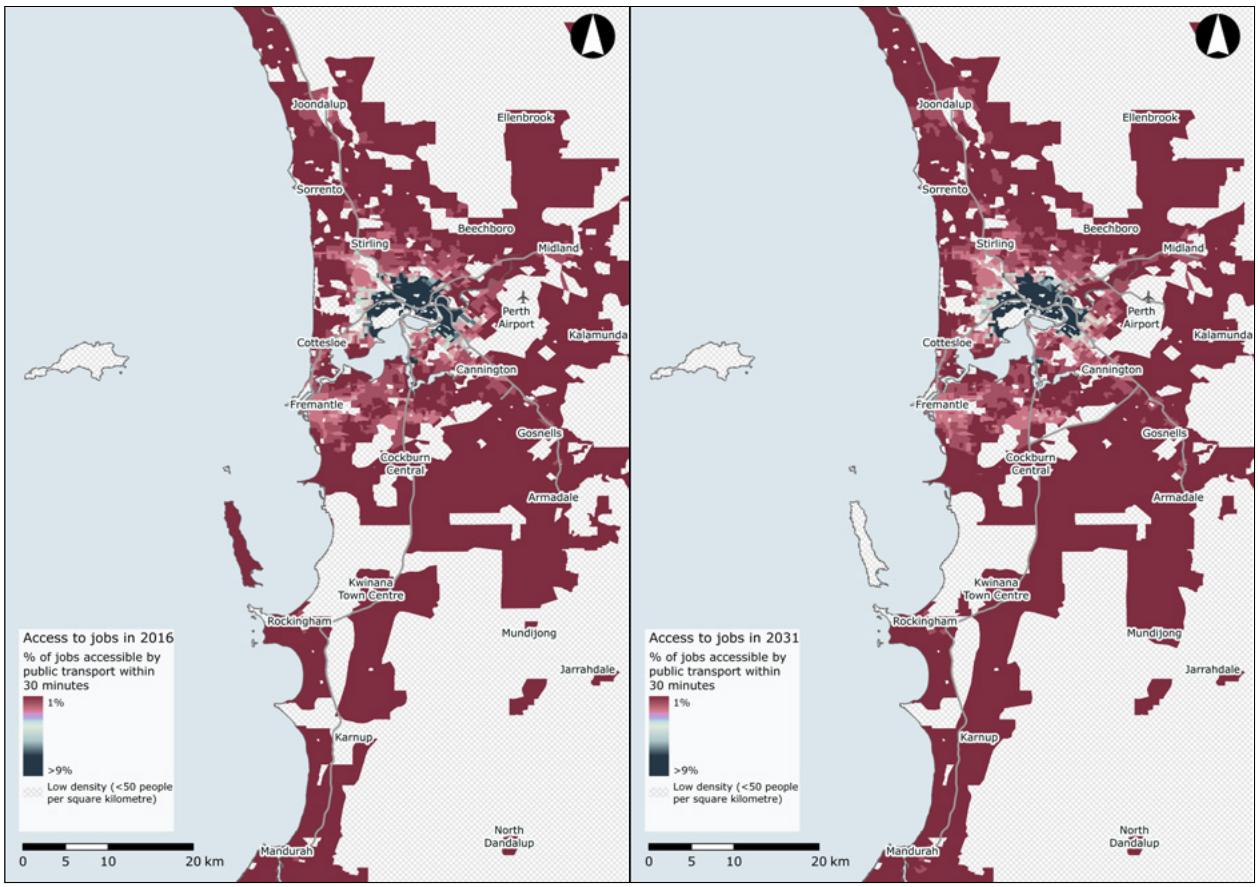
- Perth residents without use of a car have significantly reduced access to social infrastructure today and in the future.
- In central Perth public transport offers a realistic alternative to car ownership and use. However, on the urban fringe and in other outer areas this is not the case.
- Road congestion will generally reduce the proportion of jobs able to be reached by car in 2031.
- The concentration of jobs in Perth's city centre means residents of central areas have significantly more employment options within a 30-minute commute, especially by public transport, than residents of outer areas.

Figure 95: Greater Perth access to jobs by car, 2016 and 2031 AM peak



Source: Veitch Lister Consulting (2019)[175]

Figure 96: Greater Perth access to jobs by public transport, 2016 and 2031 AM peak



Source: Veitch Lister Consulting (2019)[176]

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