vicroads

Traffic Monitor 2012-13

MARCH 2015

keeping victorians connected

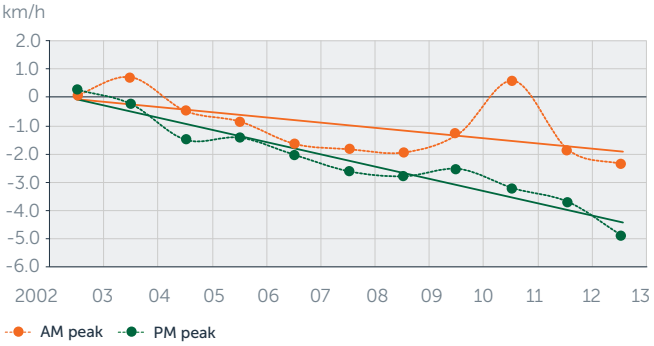
Contents

Victoria's traffic performance — key points

- The trend in average travel speed on the monitored network shows a decrease of 1.9km/h in the morning peak, 4.4km/h in the afternoon peak and 3.4km/h in the off peak over the last 10 years from 2002-03 to 2012-13.
- Over the last 10 years (2002 to 2012), the trend in the number of vehicle kilometres travelled in Melbourne shows an increase of 16%. The majority of this has occurred in the outer zone which accounts for 47% of the total vehicle kilometres travelled.
- In 2012, vehicles travelled 28.0 billion kilometres on Melbourne's arterial roads and freeways, an increase from the 24.3 billion kilometres travelled in 2002.
- The growth of vehicle kilometres travelled on freeways in Melbourne has increased by 61% over the last 10 years.
- Over the last 10 years, the trend in truck vehicle kilometres travelled in Melbourne shows an increase of around 428 million kilometres.
- Over the last 10 years, the trend in average delay on the monitored network shows an increase during both peak and off-peak periods. The trend in delay during the morning peak suggests that an average 10km trip in 2012-13 would take about 57 seconds longer than the same trip in 2002-03.
- The trend in travel time variability indicates that off-peak periods have the most consistent travel times. The morning and afternoon peaks experience similar variability in travel time.
- The durations of peak periods on Melbourne's roads have been increasing over time with the peak being longer in the afternoon.
- Over the last 10 years, car occupancy rates have decreased by 3.5% in the morning peak and 5.1% in the afternoon peak. Despite having the larger reduction, the occupancy rate is still higher in the afternoon peak.
- In 2012-13, arterials with trams carried around 8.3% more people per lane per hour compared to a similar arterial road without trams during all recorded time periods.
- The trend in weekday bicycle counts indicates an increase of around 51% since 2006-07.
- The trend in public transport boardings shows an increase of patronage on metropolitan trains, trams and buses with increases of around 83%, 44% and 37% respectively over the last 10 years.

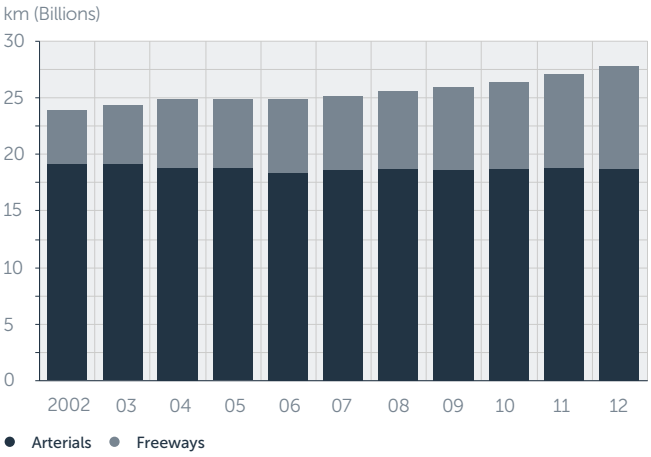
Note: Vehicle kilometres travelled is reported by calendar year as opposed to travel speed, delay and variability, which are reported by financial year.

Change in average travel speed



Change in average travel speed on the monitored network by time period

Vehicle kilometres travelled in Melbourne



Vehicle kilometres travelled in metropolitan Melbourne by road type

Introduction

VicRoads has systematically collected, analysed and published traffic performance information on freeways and arterial roads in Melbourne since 1994. This report provides information on the performance of the State's arterial road and freeway network for the 2012-13 financial year.

The road network is critical to the economic prosperity and wellbeing of the Victorian community. In keeping Victorians connected, VicRoads builds, operates and maintains the arterial road network to help people to access social and economic opportunities. The network connects people with activities and workplaces as well as enhancing opportunities for growth in both metropolitan and regional Victoria.

Approximately 85% of public transport service kilometres are provided by buses and trams. As a result, the performance of the road and public transport systems are therefore closely related.

Impacts on network performance

Road network performance is affected by a wide range of factors. The volume of traffic using the road network is the single largest factor influencing performance. As the population and economy of Victoria grow, the demand for travel also grows leading to more freight, public transport and private vehicles on the roads.

The road network has a limited vehicle carrying capacity. As the number of vehicles using the network nears this capacity for larger parts of the day, the performance of the network deteriorates, leading to reduced travel speeds, increased delays and greater travel time variability.

The volume of traffic on our roads is also influenced by the mode of travel people choose. Buses, trams, bicycles, pedestrians and motorcycles all use less road space per person than a single car with a driver alone. In the same way, larger trucks also use less road capacity per tonne of freight than small trucks and vans.

How is VicRoads helping improve network performance?

VicRoads seeks to operate and maintain the road system to help our customers travel easily and reliably. VicRoads also develops the road system to improve connections between places that are important to people and businesses.

VicRoads network operating strategy, SmartRoads, provides guiding principles for the priority use of arterial roads in Melbourne by mode of transport, place of activity and time of day. These principles guide decisions to ensure that network efficiency is maximised and the right balance is struck between the needs of diverse transport users (private vehicles, heavy vehicles, public transport, motorcyclists, cyclists, and pedestrians), particularly in peak periods and in congested locations.

VicRoads implements a number of improvement works each year which help reduce delays at some highly congested locations. The growing population and demand for travel reinforces the importance of these works but also highlights the need for ongoing investment in public transport and integrated land use and transport planning to help reduce the demand for travel.

Some of the key freeway and highway projects completed in 2012-13 aimed at increasing the capacity of the network included:

- Plenty Road carriageway duplication between Gordons Road and Hawkestowe Parade.
- Ongoing works to increase capacity on the M80 Ring Road.
- New link to connect Dingley Arterial to Springvale Road.

Some of the key projects that VicRoads undertook to maintain and improve the arterial road network in regional Victoria included:

- Completion of Geelong Ring Road Section 4B (Anglesea Road to Princes Highway West).
- New bypass construction and opening of Goulburn Valley Highway – Nagambie bypass.

Key network management initiatives undertaken in 2012-13 included:

- Providing incident response services on Melbourne's inner freeways.
- Managing and enforcing clearways.
- Coordinating and optimising traffic lights.
- Scheduling roadworks to minimise disruption.
- Prioritising specific modes in accordance with SmartRoads.

VicRoads also works to encourage the use of lower impact transport modes through a range of initiatives that contribute to improving road network performance. These include:

- Tram priority projects to improve tram travel times and reliability using traffic management measures and new technology to improve traffic flow.
- Easy access tram stops to assist equitable access to trams.
- Bus priority projects which improve the reliability and travel times of buses on key routes across Melbourne using bus lanes, traffic light priority and changes to parking.
- Bus stop improvements along SmartBus routes.
- Funding to complete the Darebin Creek trail connection-a key missing link on Melbourne's Principal Bicycle Network which aims to increase the use of bicycles as a transport mode.
- Planning growth areas to support a greater role for lower impact modes.
- Ensuring the needs of buses, trams, bicycles and pedestrians are accounted for in all project design and implemention.

Other external factors have a major influence on road users' choice of transport mode, such as the price of petrol, the availability and cost of public transport and the complexity of individuals' travel patterns.

VicRoads, the Department of Transport, Planning and Local Infrastructure and Public Transport Victoria continue to encourage the use of sustainable means of travel, tackle congestion, and improve accessibility and road safety through a wide range of programs and initiatives. These initiatives also contribute to state and national economies and the liveability of Melbourne and regional Victoria.

The metropolitan monitored network

VicRoads uses a sample of arterial roads and freeways as the basis for efficiently monitoring the performance of the network. This sample of roads is known as the 'monitored network' and includes:

Metropolitan Melbourne monitored network 2012-13

- 100% of freeways
- 22% of undivided arterials
- 22% of divided arterials
- 22% of undivided arterials with trams

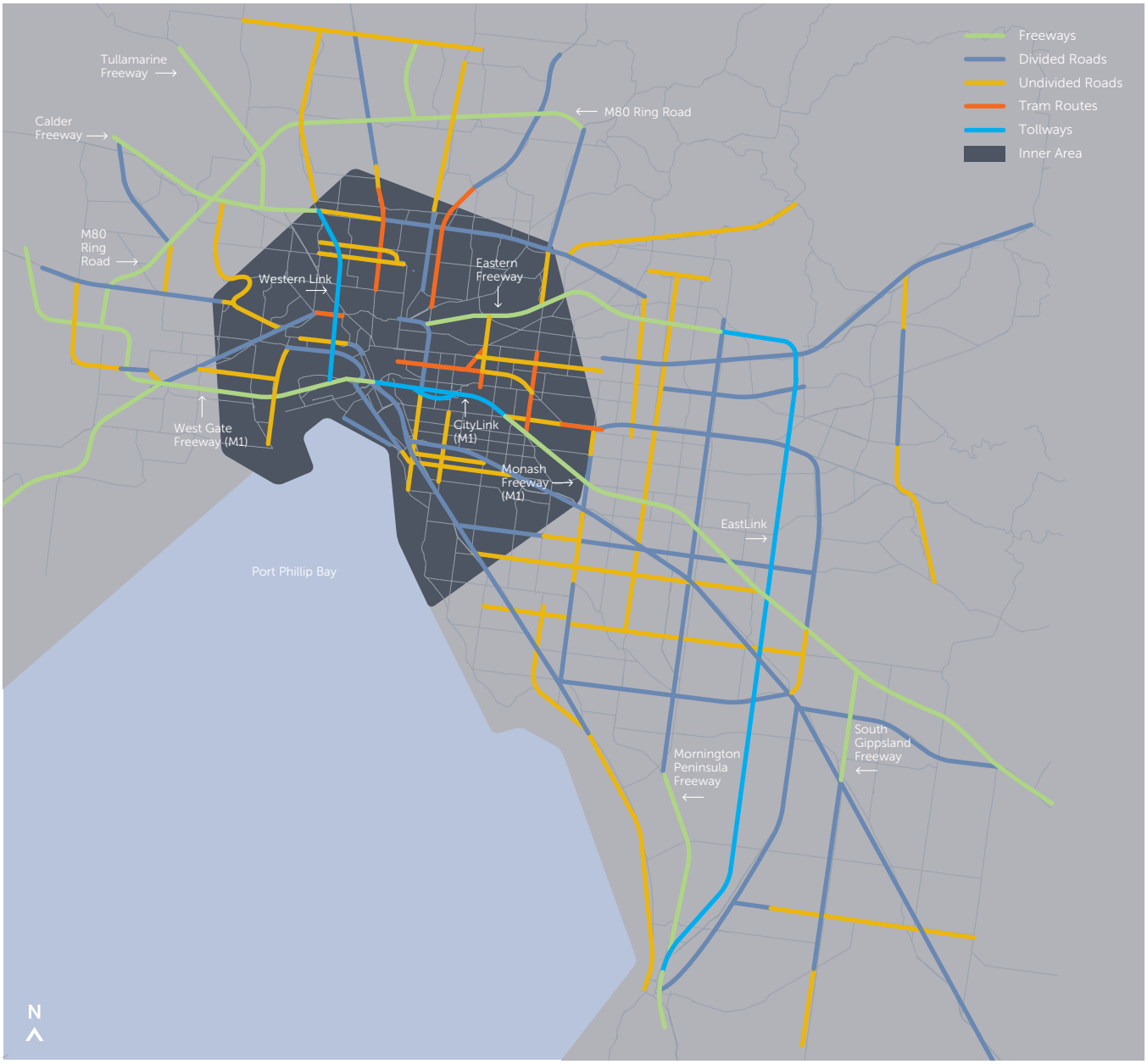
The monitored network was established in 1994 as a representative sample of the network at that time. Not all arterial roads are included in the monitored network due to the expense of collecting detailed performance data.

The monitored network is also divided into inner and outer areas as shown in the 'Metropolitan Melbourne Monitored Network 2012-13' map below.

New freeway links and some arterials have been added to the monitored network over time but there is currently limited representation of Melbourne's growth areas and urban fringe.

Monitored roads carry approximately 47% of the vehicle travel that occurs on Melbourne's freeways and arterial roads. It is therefore important to consider the limitations of the monitored network when analysing performance data from this report.

Metropolitan Melbourne monitored network 2012–13



Arterial roads and freeways monitored by VicRoads for the purpose of determining network performance

Time periods

The data from the monitored network is also collected for the purpose of reporting Austroads' National Performance Indicators (NPIs). Austroads publishes NPIs annually to allow member road authorities to benchmark the performance of their networks over time. NPIs for Melbourne and other state capitals can be found on the Austroads website at **austroads.com.au**.

In order to provide Austroads with data that is consistent with the other states, VicRoads collects data in accordance with the following time periods as defined by Austroads. This report also uses the same time periods in discussing network performance. These are the weekdays of a normal working week defined by:

- Morning peak (AM): 7:30am to 9:00am
- Afternoon peak (PM): 4:30pm to 6:00pm
- Off peak: 10:00am to 3:00pm

Road network performance

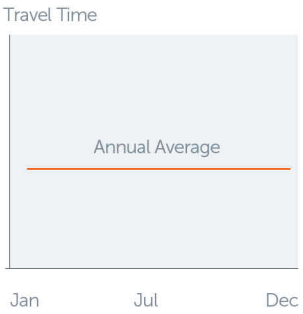
This section describes the different network performance indicators, including how the data is collected, what the indicators mean and how they should be interpreted. The performance indicators in this section are:

- Average travel speed.
- Delay.
- Travel time variability.
- Peak spreading.
- Lane occupancy.

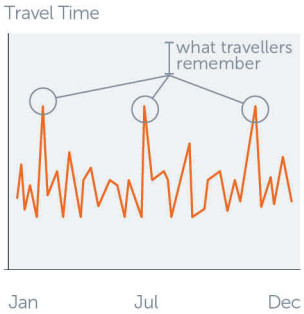
Each indicator has been presented in terms of trend over recent years. Trend information is used because the values recorded can vary significantly from year to year and only the longer-term trend shows a true picture of how performance is changing.

As these trends are averages across the network they do not highlight best or worst performing links. The averages also hide the impacts of unexpected incidents such as breakdowns, illegal parking, crashes or construction zones which may cause significant delays for the motorists on individual days. The results for travel time variability (detailed further on page 14) show that travel times vary by about 14% from the average on a typical journey without incidents. Incidents cause much higher levels of variation from the average, and it is these incidents that motorists most readily remember (see figure).

How traffic conditions are measured for this report



How traffic conditions are perceived

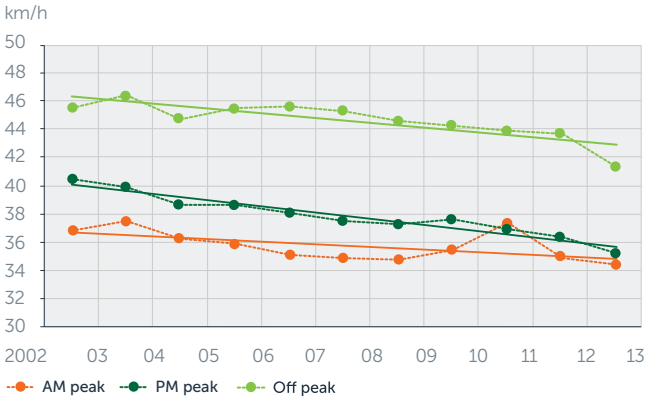


Source: Federal Highway Administration (2006)

Average travel speed

Average travel speed is calculated by measuring the time taken to travel a length of road. Average travel speed will be affected by any time spent stopped at traffic lights and other intersections as well as the slower speeds and stoppages due to congestion. At times when congestion is not affecting travel times, average travel speed will still be below the posted speed limit on arterial roads, due to traffic lights and other intersection controls.

Average travel speed



Average travel speed on the monitored network by time period

Average travel speed has been decreasing over the last 10 years in both peak and off-peak periods. Since 2002-03, the trends show a reduction in average travel speed of approximately 1.9 km/h in the morning peak and 4.4 km/h in the afternoon peak.

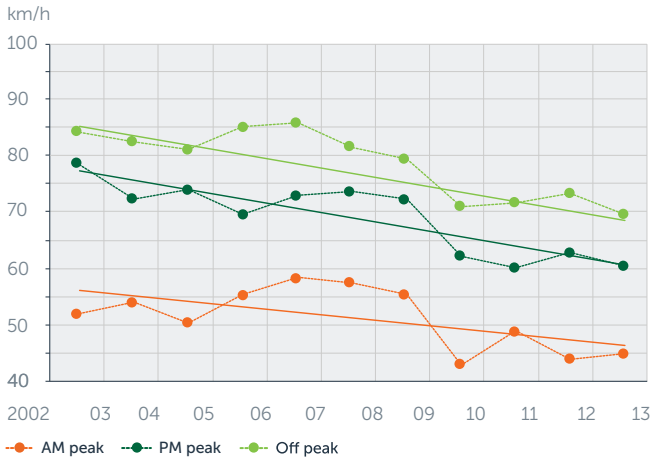
The average travel speed recorded in 2012-13 is close to the long-term trend for the morning and afternoon peak time periods. The average travel speed recorded in the off-peak period dropped below the long-term trend in 2012-13.

Average travel speeds by road category and area

Freeways

Speeds on freeways in the inner area (refer to monitored network map on page 6 for the breakdown of areas) have been decreasing in all time periods since 2002-03. The morning peak has the slowest travel speeds with the trend showing an average speed in 2012-13 of approximately 45 km/h. Freeways in the inner area are also slower than freeways in the outer area in all time periods.

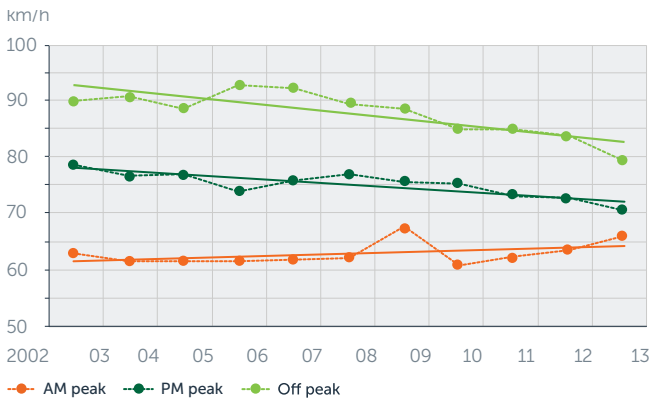
Average travel speed — inner freeways



Average travel speed on Melbourne's freeways in the inner area by time period

Speeds on freeways in the outer area have been decreasing less than those on freeways in the inner area with the trend showing a change of approximately 6 km/h in the afternoon peak and 10 km/h in the off-peak period since 2002-03. Morning peak speeds have remained virtually unchanged over the last 10 years until 2012-13, where the speeds have actually increased by 3km/h, and almost reaching the peak speed recorded in 2008-09 when EastLink opened. Freeways in the outer area have the fastest average travel speed of all roads in all time periods.

Average travel speed — outer freeways



Average travel speed on Melbourne's freeways in the outer area by time period

Divided arterial roads

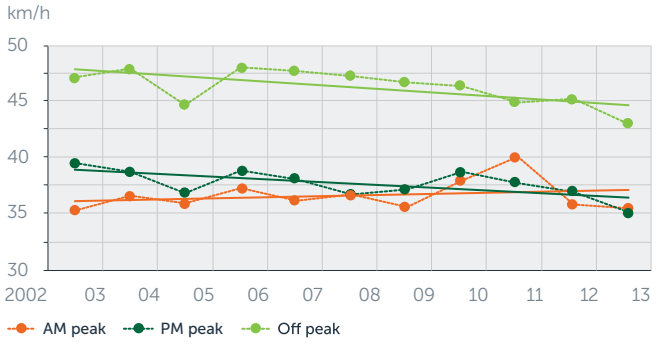
Speeds on divided arterial roads in the inner area are similar in morning and afternoon peaks with both trends showing declines in the average travel speed to around 25 km/h in 2012-13. This is a decrease of approximately 11 km/h since 2002-03. Divided arterial roads are slower in the inner area than the outer area in all recorded time periods.

Average travel speed — inner divided roads

Average travel speed on divided arterial roads in the inner area by time period

The trend in morning peak speeds on divided arterial roads in the outer area shows that the average travel speed has been gradually increasing with a change of approximately 1km/h over the last 10 years. The trend shows that the afternoon peak and off-peak average travel speeds have each decreased by around 3 km/h in the same timeframe.

Average travel speed — outer divided roads



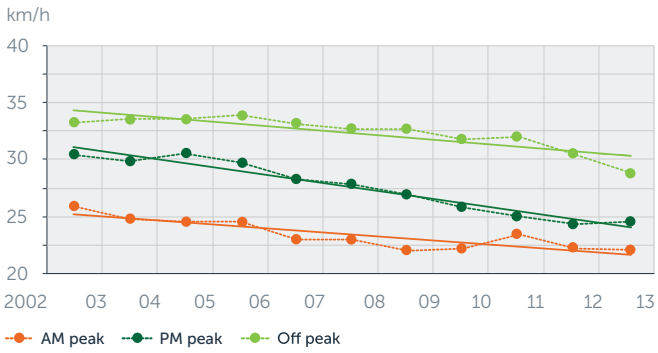
Average travel speed on divided arterial roads in the outer area by time period

Undivided arterial roads

The average travel speed trends on undivided arterial roads in the inner area indicate they are experiencing declines in all time periods. Speeds are now similar on both divided and undivided roads in the afternoon peak in the inner area.

Note: Arterial roads with trams are included in this sample.

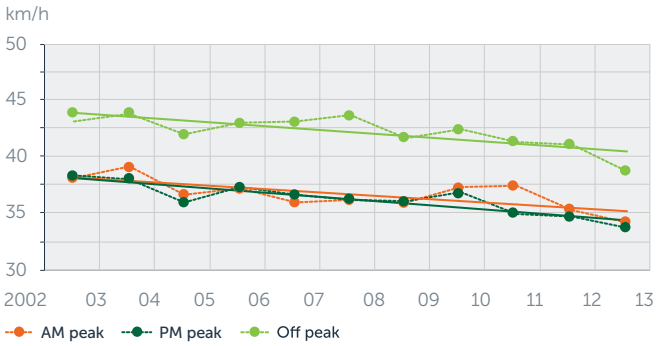
Average travel speed — inner undivided roads



Average travel speed on undivided arterial roads in the inner area by time period

In both morning and afternoon peak periods the trend in average travel speeds on undivided arterial roads in the outer area shows they are both slowly declining (approximately 3 km/h and 4km/h respectively since 2002-03). Morning and afternoon peak average travel speeds in the outer area are approximately the same on both divided and undivided arterial roads.

Average travel speed — outer undivided roads



Average travel speed on undivided arterial roads in the outer area by time period

Freeway average travel speed map

The average freeway travel speed images presented below provide a snapshot of the performance of these freeways in 2012-13. As speeds can vary significantly from year to year, the travel speeds shown on these maps should be read as indicative only.

Morning Peak

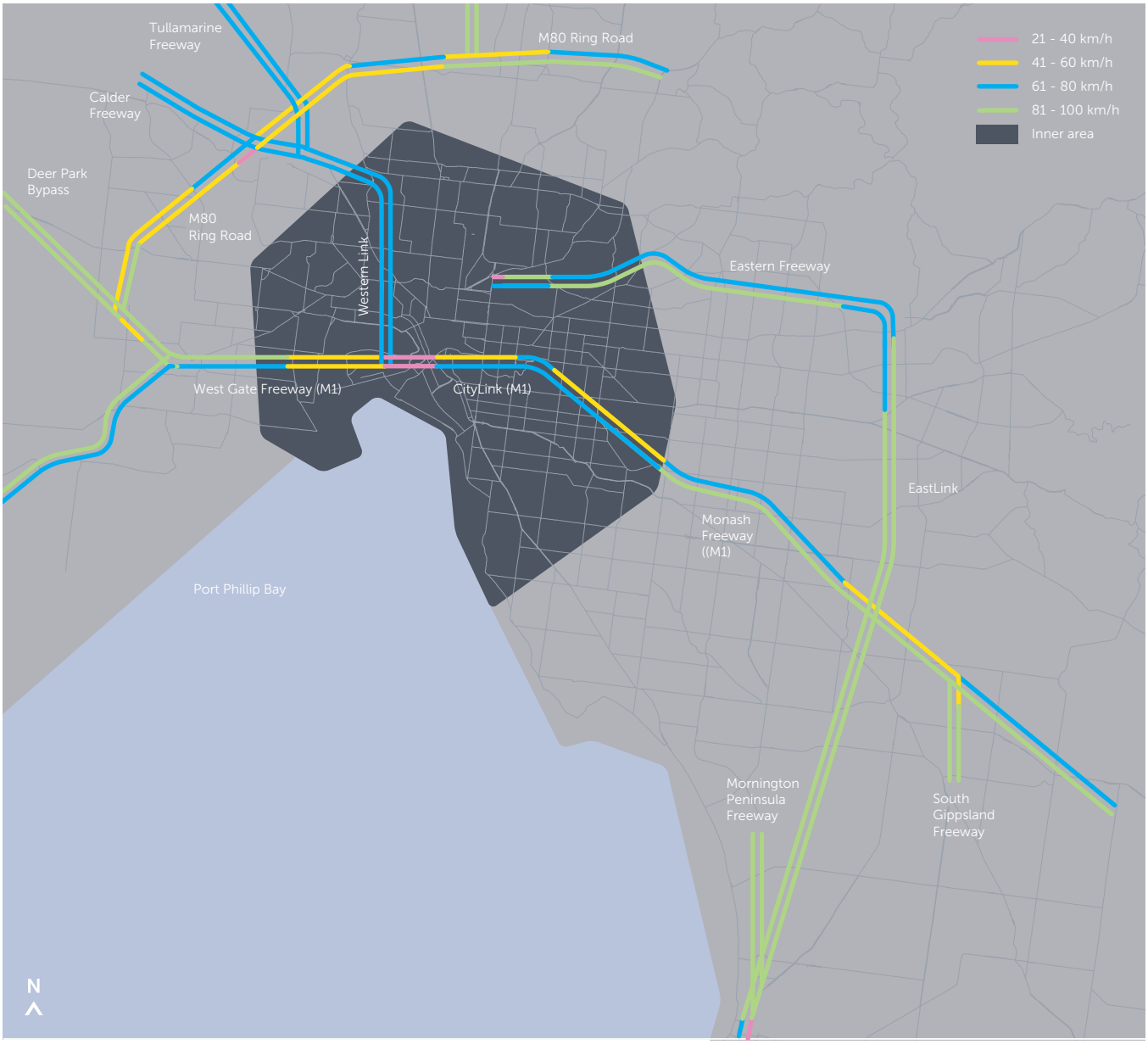
Average travel speed on Melbourne's freeways in the morning peak (7:30am to 9:00am) for 2012-13 (travel speeds are represented by travel direction).

Note: this map is a visual representation of the data only and nominal sections as shown may not be entirely accurate. The blue section (61-80km/h) at the end of the Eastern Freeway is the segment between Hoddle Street and Gold Street. This section is commonly referred to as Alexandra Parade but it is actually the end segment of the Eastern Freeway. The red section adjacent (<20km/h) refers to the segment between Chandler Highway and Hoddle Street.

Morning peak average travel speed changes

Freeway	Direction	Location	Change in speed	2012-13	2011-12
West Gate FWY	Inbound	Princes HWY - Williamstown Rd	Increase	Yellow	Pink
	Inbound	City Link - Western Link - Power St	Increase	Yellow	Pink
Calder FWY	Inbound	Sunshine Av - Green Gully Rd	Increase	Blue	Yellow
Eastern FWY	Outbound	Burke Rd - Doncaster Rd	Increase	Green	Blue
	Inbound	Springvale Rd - Doncaster Rd	Increase	Blue	Yellow
	Inbound	Burke Rd - Chandler HWY	Increase	Green	Blue
EastLink	Southbound	Ringwood Bypass - Burwood HWY	Decrease	Blue	Green
	Southbound	Burwood HWY - Monash FWY	Decrease	Blue	Green
	Northbound	Burwood HWY - Ringwood Bypass	Decrease	Blue	Green
	Northbound	Monash FWY - Burwood HWY	Decrease	Blue	Green
Hume FWY	Outbound	M80 Ring Rd - Cooper St	Increase	Green	Blue
M80 Ring Road	Greensborough Bound	Mahoneys Road Overpass - Dalton Rd	Decrease	Blue	Green
	Greensborough Bound	Dalton Road - Greensborough HWY	Decrease	Yellow	Blue
	Greensborough Bound	Tullamarine FWY - Pascoe Vale Rd	Increase	Blue	Yellow
	Greensborough Bound	Western HWY - Sunshine Av/Mcintyre Rd	Decrease	Yellow	Blue
	Altona Bound	Sunshine Av/Mcintyre Rd - Western HWY	Decrease	Yellow	Blue
	Altona Bound	Keilor Park Dv - Sunshine Av/Mcintyre Rd	Increase	Blue	Yellow
	Greensborough Bound	Boundary Rd - Western HWY	Decrease	Yellow	Blue
	Altona Bound	Calder FWY - Keilor Park Dv	Increase	Blue	Yellow
Monash FWY	Inbound	Princes HWY - Jacksons Rd	Increase	Yellow	Pink
	Outbound	Burke Rd - Warrigal Rd	Increase	Green	Blue
	Inbound	Burke Rd - Toorak Rd	Increase	Blue	Yellow
Southern Link	Inbound	Toorak Rd - Loyola Gv	Increase	Blue	Yellow
Mornington Peninsula FWY	Northbound	Frankston - Dandenong Rd - Springvale Rd	Decrease	Blue	Green
Sth Gippsland FWY	Northbound	South Gippsland HWY - Princes HWY	Increase	Green	Blue
Western Link	Southbound	Brunswick Rd - Flemington Rd	Increase	Yellow	Pink
	Northbound	Flemington Road - Brunswick Rd	Decrease	Blue	Green
	Southbound	Flemington Road - Dynon Rd	Increase	Yellow	Pink
	Northbound	Dynon Road - Flemington Rd	Decrease	Blue	Green
Tullamarine FWY	Inbound	Calder FWY - Bulla Rd	Increase	Green	Blue
	Outbound	Bulla Rd - Calder FWY	Decrease	Blue	Green
	Inbound	Bulla Rd - Bell St	Increase	Blue	Yellow
Western Link	Southbound	Bell St - Brunswick Rd	Increase	Blue	Yellow

Afternoon peak



Average travel speed on Melbourne's freeways in the afternoon peak (4:30pm to 6:00pm) for 2012-13 (travel speeds are represented by travel direction)

Note: this map is a visual representation of the data only and nominal sections as shown may not be entirely accurate.

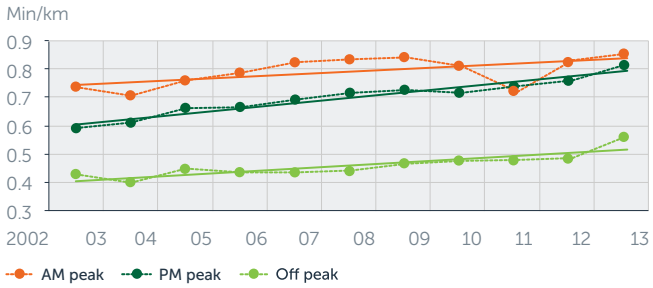
Afternoon peak average travel speed changes

Freeway	Direction	Location	Change in speed	2012-13	2011-12
Calder FWY	Inbound	Sunshine Av - Green Gully Rd	Decrease	Blue	Green
Eastern FWY	Inbound	Chandler HWY - Hoddle St	Decrease	Blue	Green
EastLink	Southbound	Ringwood Bypass - Burwood HWY	Decrease	Blue	Green
	Southbound	Burwood HWY - Monash FWY	Decrease	Blue	Green
	Northbound	Burwood HWY - Ringwood Bypass	Decrease	Blue	Green
	Northbound	Monash FWY - Burwood HWY	Decrease	Blue	Green
Monash FWY	Inbound	Warrigal Rd - Burke Rd	Decrease	Blue	Green
	Outbound	Loyola Gv - Toorak Rd	Increase	Blue	Yellow
Western Link	Southbound	Brunswick Rd - Flemington Rd	Decrease	Blue	Green
	Northbound	Flemington Road - Brunswick Rd	Increase	Blue	Yellow
	Southbound	Flemington Road - Dynon Road	Decrease	Blue	Green
	Northbound	West Gate FWY On Ramp - Dynon Rd	Decrease	Blue	Green
Tullamarine FWY	Inbound	M80 Ring Rd - Calder FWY	Decrease	Blue	Green
	Inbound	Calder FWY - Bulla Rd	Decrease	Blue	Green
	Outbound	Bulla Rd - Calder FWY	Decrease	Blue	Green
	Inbound	Bulla Rd - Bell St	Decrease	Blue	Green
	Inbound	Bell St - Brunswick Rd	Decrease	Blue	Green
M80 Ring Road	Greensborough Bound	Tullamarine FWY - Pascoe Vale Rd	Increase	Yellow	Pink
	Altona Bound	Mahoneys Rd - Pascoe Vale Rd	Increase	Yellow	Pink
	Altona Bound	Sunshine Av/Mcintyre Rd - Western HWY	Decrease	Yellow	Blue
	Greensborough Bound	Sunshine Av/Mcintyre Rd - Keilor Park Dv	Increase	Blue	Pink
	Altona Bound	Keilor Park Dv - Sunshine Av/Mcintyre Rd	Decrease	Yellow	Blue
	Greensborough Bound	Boundary Rd - Western HWY	Decrease	Yellow	Blue
	Altona Bound	Tullamarine FWY - Calder FWY	Decrease	Yellow	Blue
	Greensborough Bound	Calder FWY - Tullamarine FWY	Increase	Yellow	Pink
	Altona Bound	Calder FWY - Keilor Park Dv	Decrease	Pink	Blue
	Greensborough Bound	Keilor Park Dv - Calder FWY	Increase	Blue	Pink
West Gate FWY	Outbound	Williamstown Rd - Princes HWY	Increase	Blue	Yellow
	Inbound	Williamstown Rd - CityLink/Western Link	Decrease	Yellow	Blue
	Outbound	Power St - Graham St	Decrease	Pink	Yellow

Average delay

Average delay indicates the level of stoppage and congestion on the road network. Average delay is calculated by measuring the time taken to travel a length of road and comparing this against the time it would have taken to travel the same length of road at the speed limit without stopping. This means that delay includes all time spent stopped at traffic lights and other intersections as well as the slower speed due to congestion caused by other traffic. At times when congestion is not affecting travel times, delays will still occur on arterial roads due to traffic lights and other intersections.

Average delay



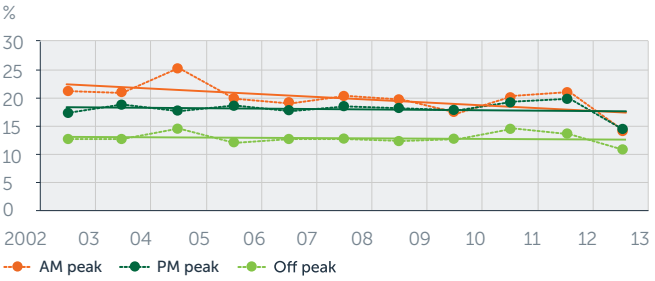
Average delay on the monitored network by time period

Over the last 10 years, the trend shows that average delay on the monitored network has increased during both peak and off-peak periods. Average delay has been increasing at the greatest rate during the afternoon peak period and least during the morning peak period. The trend in delay during the morning peak suggests that an average 10km trip in 2012-13 would take about 57 seconds longer than the same trip in 2002-03.

Travel time variability

Travel time variability is an indication of the difference in travel times on different days on the monitored network. Travel time variability is calculated by recording the travel time along a length of road multiple times and comparing the results. It is expressed as a percentage of the average travel time, such that 85% of all trips are within a range between the average travel time minus the variability and the average travel time plus the variability. A consistent travel time (i.e. low travel time variability) is considered desirable.

Travel time variability



Travel time variability on the monitored network by time period

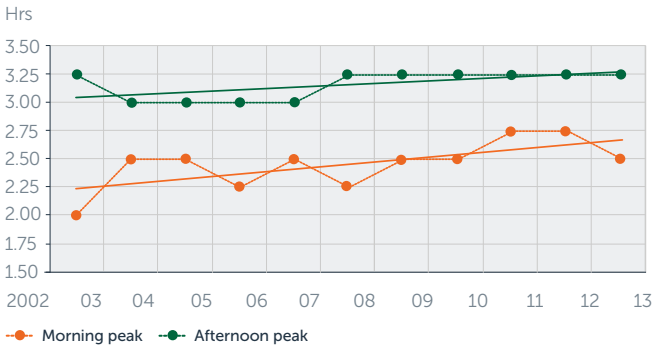
The trend over the last 10 years shows that travel time variability has been decreasing during the morning peak period and has stayed relatively stable during the afternoon peak and off-peak periods. In 2012-13 the travel time variability decreased to its lowest recording for all time periods in the last 10 years.

Peak spreading

The duration of the peak periods is an indicator of the level of traffic congestion. As traffic demand continues to increase, evidenced by continuing growth in vehicle kilometres travelled, the capacity of the road system is fully utilised for longer periods each day, resulting in the extension of peak traffic periods. This is referred to as 'peak spreading'.

For comparative purposes, a consistent definition of peak period is required. The definition used here is the length of time for which the traffic volume is above 85% of the highest volume recorded during the given peak. The duration of the peak period is most clearly observed on freeways where road capacity is relatively constant and is not constrained by traffic signals, parking, pedestrians and stopping vehicles.

Peak period duration (freeways)

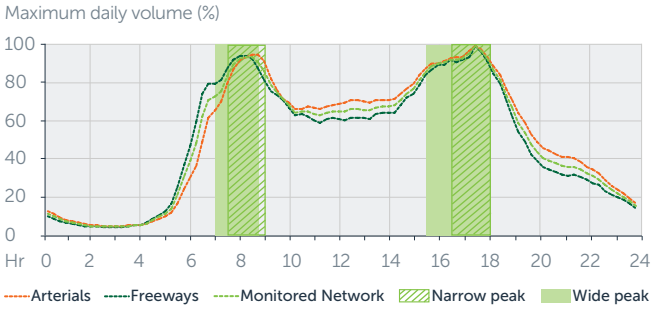


Duration of weekday peak periods on metropolitan freeways by time period

The durations of the peak periods on Melbourne's roads have been changing over time with increasing peak durations observed in both morning and afternoon periods. The peak is longer in the afternoon than in the morning.

The 'Peak Travel Periods' figure shows the typical weekday traffic profile on both freeways and arterial roads. The peak periods of travel are also highlighted. The 'narrow peak' periods shown in the figure below are the representative periods defined by Austroads for measuring peak traffic conditions. The 'wide peak' periods are calculated based on the peak period definition described in this section.

Peak travel periods



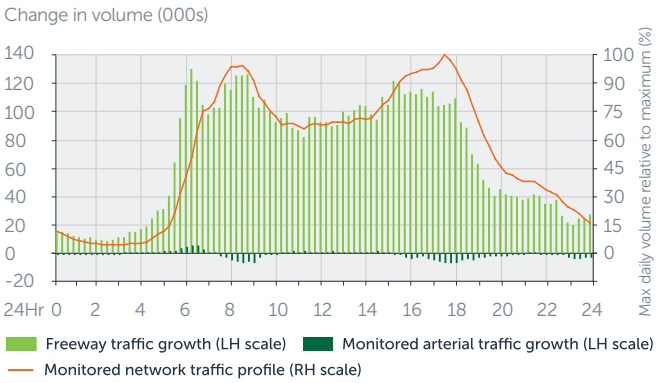
Peak travel periods on the monitored network

Road use growth by time of the day

Peak spreading can also be seen in the timing of traffic growth on both freeways and arterials. These figures allow a comparison to be made between the times when existing traffic volumes are the highest and the times when changes in volume are occurring.

The bars in the following figures show the growth in traffic since 2007-08 at the same time of day (in thousands, shown on the left) while the contour line in each figure shows the relative volume of traffic at the given time of day (the percentages shown on the right). Please note that the monitored network traffic volumes are recorded for 100% of freeways and 22% of arterial roads.

Distribution of traffic growth (freeways and arterial roads)

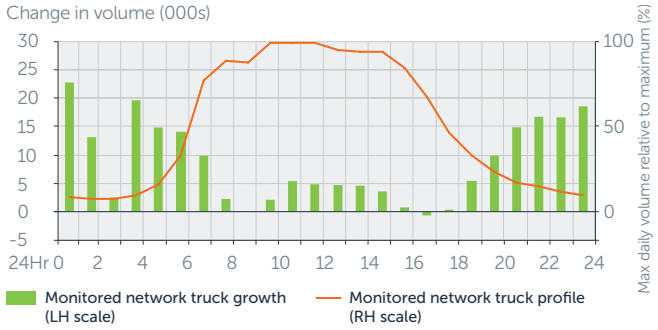


Growth in traffic volumes (since 2007-08) and relative traffic volume profile by time of day for all traffic on the monitored network

VicRoads advises that caution should be exercised when interpreting these figures, given that the monitored freeway network has been significantly expanded, whereas most expansions on the arterial network have been on roads that do not form part of the monitored network.

Freeway volumes have increased most between 6am and 6pm while volume growth on arterial roads is occurring just prior to the morning peak. Freeways have experienced growth during most of the day, due to significant capacity upgrades in the past decade, while monitored arterial roads have not. During the peak periods, monitored arterial roads carried less traffic in 2012-13 than in 2007-08.

Distribution of traffic growth (trucks)



Percentage volume growth (since 2007-08) and volume profile by time of day for truck traffic on the monitored network

Growth in truck volumes has occurred outside the peak periods, with the strongest growth occurring just before the morning commuter peak and in the late evenings.

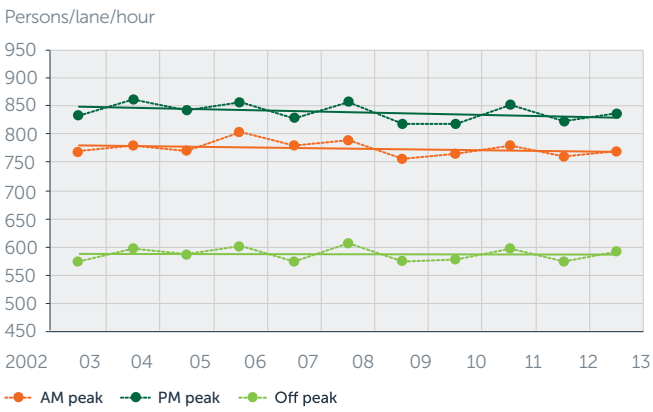
Lane occupancy

Lane occupancy is an indicator of how efficiently the road network is being used. If more freight and people are able to be moved on each traffic lane, then fewer traffic lanes will be required. Lane occupancy rates are calculated for both people and freight during specified time periods and are measured in persons per lane per hour and tonnes per lane per hour respectively.

Person lane occupancy

Person lane occupancy (PLO) is a measure of how efficiently the road network is being used to move people. VicRoads seeks to move as many people as possible in each lane in order to maximise the use of road space. The patronage of on-road public transport, the number of people travelling in each private car and the management of the network all have an impact on this measure. PLO rates are recorded by observers counting, or estimating, the occupancy of each vehicle as it passes a set point on the road.

Person lane occupancy



Person lane occupancy rates on the monitored network by time period

Person lane occupancy rates on the monitored network have been consistently higher in the afternoon peak than the morning peak. The figure above show PLO rates are relatively stable overall with minor decreases in the peak periods (1.5% in AM peak and 2.3% in PM peak).

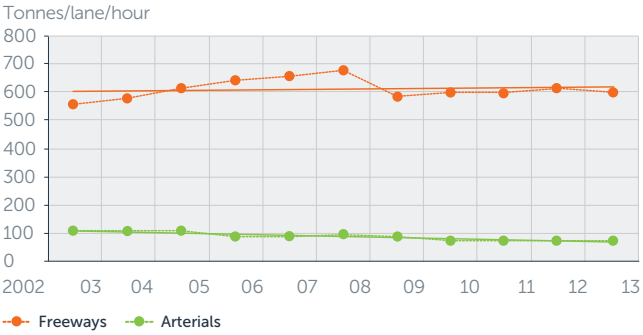
Freight lane occupancy

Freight lane occupancy rates are an estimate of the efficiency of freight movement on the road network. The number of freight vehicles on the road and the capacity of each vehicle are the major factors affecting freight occupancy.

Freight lane occupancy rates are recorded by automated counts and observations of different types of trucks being multiplied by set estimates of weight by truck type.

This method of data analysis is approximate as it uses mass to quantify freight movement. The capacity of a vehicle is constrained by its volume and mass; thus a vehicle can be loaded to its maximum volume but not necessarily at its maximum mass. Therefore weight is not a perfect indicator of the efficiency and values should be interpreted accordingly.

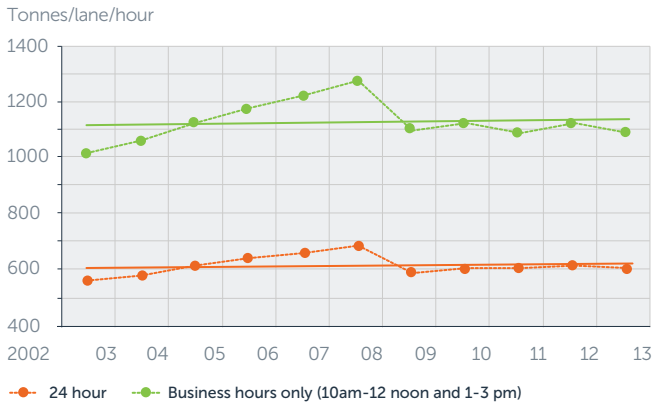
Freight lane occupancy



All day freight lane occupancy rates on the monitored network by road type

The lane occupancy rates for freight on freeways have generally increased over time due to increases in truck volumes. In 2008-09 there was a large reduction when EastLink was added to the monitored network. EastLink has a lower freight lane occupancy rate than other freeways in Melbourne. This means that its addition to the network temporarily lowered the average occupancy rate. The lane occupancy rates for freight on arterials have been decreasing over time. This is likely due to freight vehicles increasingly choosing to travel on new or upgraded freeway links.

Freeway freight lane occupancy



Freight lane occupancy on the monitored network by time of day

Freight volumes on freeways are highest during business hours, shown in the higher than average freight lane occupancy observed during this time. While not shown here, this higher occupancy rate is also generally observed on arterial roads during business hours.

Trams on the road network

Melbourne has the world's largest on-road tram network. This makes managing the interaction between trams and other vehicles that share limited road space important. This section looks at the operational performance of trams on the arterial road network.

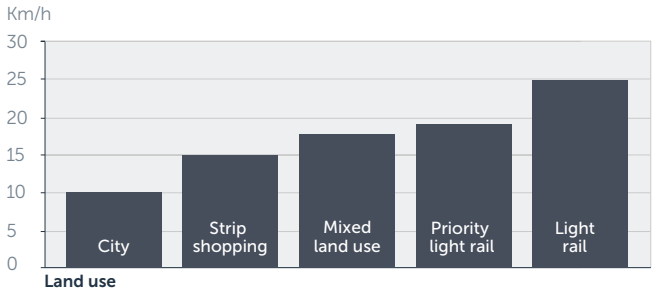
Over the last 10 years, tram speeds have been declining slowly in both peak periods, with tram speeds in the afternoon peak being slower than in the morning peak. This is in contrast with general traffic where afternoon peak speeds are typically faster than in the morning peak. Tram travel speeds are heavily influenced by operational factors such as scheduling and stopping for passengers.

Average tram travel speeds

Average tram travel speeds in metropolitan Melbourne by time period
Source: Public Transport Victoria

Sharing road space with traffic has an impact on the performance of trams. Trams which operate in a mixed land use traffic environment have a slower average travel speed than those that operate in separated tramways. The 'Average tram travel speeds by operating environment' figure shows that trams operate at the lowest average travel speeds in the Melbourne CBD followed by strip shopping environments. Trams achieve the highest travel speeds when in a 'light rail' environment, where they have full priority over traffic such as on route 109 in Port Melbourne. 'Priority light rail' refers to situations where trams do not share road space but do have to stop at traffic signals when they cross some other roads (such as along Victoria Parade).

Average tram travel speeds by operating environment

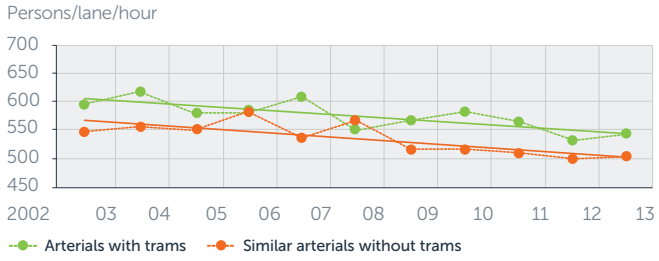


Average tram travel speeds in metropolitan Melbourne by operating environment

Source: Public Transport Victoria (2012-13)

The 'Tram impacts on person lane occupancy' figure below shows the person lane occupancy rate on monitored arterials with trams and on comparable arterials without trams. The trends presented show that roads with trams carry people more efficiently (i.e. move a greater number of people per lane per hour). Roads with trams carry more people per lane per hour during all recorded time periods. Lane occupancy rates include tram passengers.

Tram impacts on person lane occupancy



Person lane occupancy rates for inner undivided arterials with and without trams (averaged across AM, PM and off-peak periods) on the monitored network

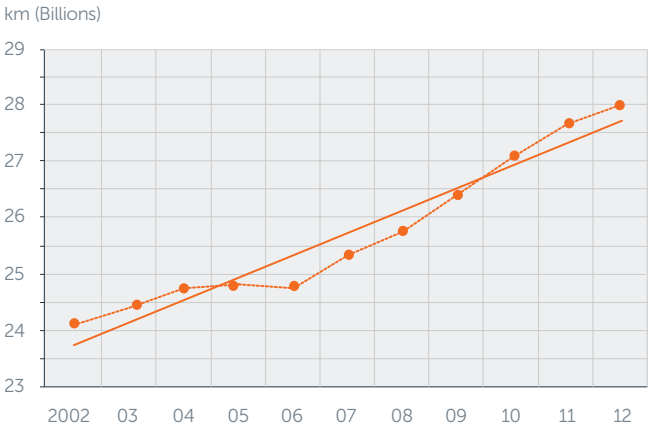
Factors affecting network performance

Road use

The biggest factor affecting road network performance is the amount of traffic using the network at any time. The term traffic refers to all vehicles using the road, including cars, buses, trams, trucks, motorcycles and bicycles. All of these vehicles have an impact on road network performance. The indicator used to represent road use is the number of vehicle kilometres travelled (VKT) on the road network. VKT is calculated by counting the number of vehicles passing a given location, then multiplying that volume by the length of road represented by that count. Counting methods and/or technologies at some locations are not able to record bicycles, motorcycles and trams. Note that unlike travel speed, delay and variability, VKT is reported by calendar year as opposed to financial year.

Melbourne road use — all traffic

Total vehicle kilometres travelled in Melbourne



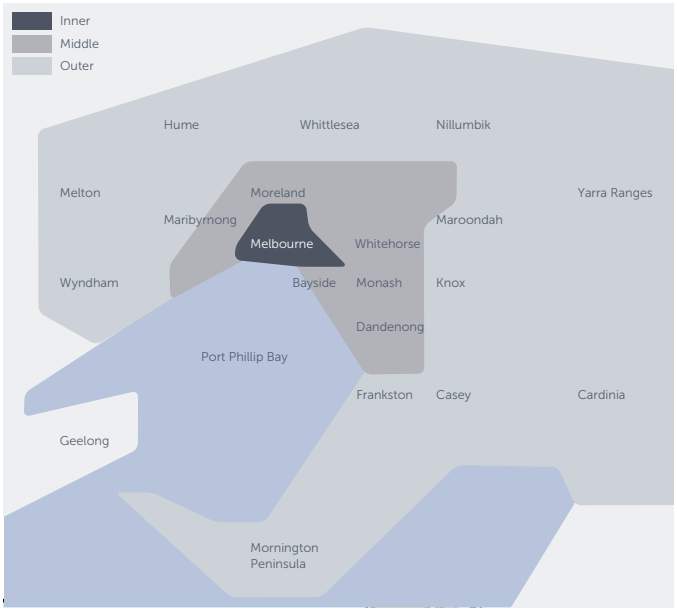
Vehicle kilometres travelled on arterial roads and freeways in Melbourne

Road use in Melbourne has experienced fairly consistent growth over the last 10 years with the trend showing growth of approximately 16% since 2002. Growth has been particularly strong since 2006.

For the purpose of reporting VKT estimates, Melbourne has been broken up into three 'zones'. These three zones are different from the two 'areas' used to report on the performance of the monitored network.

The three zones used for VKT data divide Melbourne into inner, middle and outer and are shown in the 'Zones used for reporting vehicle kilometres travelled' figure below. These zones are based on local council boundaries.

Zones used for reporting vehicle kilometres travelled

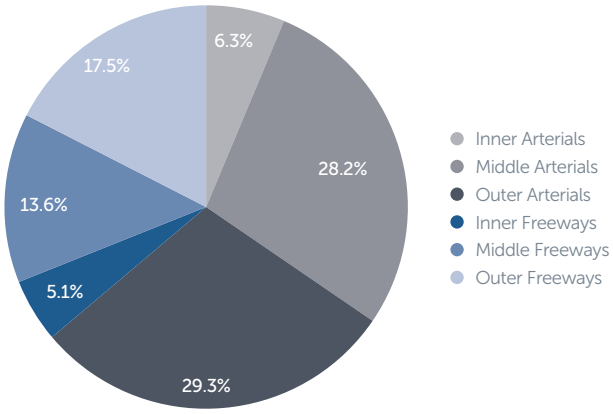


The three zones used for reporting on vehicle kilometres travelled in metropolitan Melbourne (based on local council boundaries)

Inner	Middle	Outer
Melbourne City	Banyule City	Brimbank City
Port Phillip City	Bayside City	Cardinia Shire
Stonnington City	Boroondara City	Casey City
Yarra City	Darebin City	Frankston City
	Glen Eira City	Hume City
	Greater Dandenong City	Knox City
	Hobsons Bay City	Maroondah City
	Kingston City	Melton Shire
	Manningham City	Mornington Peninsula Shire
	Maribyrnong City	Nillumbik Shire
	Monash City	Whittlesea City
	Moonee Valley City	Wyndham City
	Moreland City	Yarra Ranges Shire
	Whitehorse City	

In 2012, 64% of VKT was recorded on arterial roads and 36% on freeways, the same as recorded in 2011. Of all VKT recorded 11% was within the inner zone, 42% in the middle zone and 47% in the outer zone.

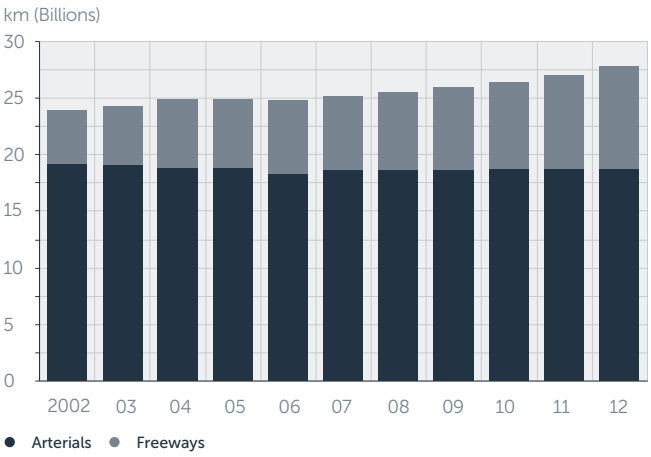
Distribution of vehicle kilometres travelled in Melbourne



Share of vehicle kilometres travelled by road type and zone in Melbourne

The 'Vehicle kilometres travelled in Melbourne' figure below demonstrates the share of vehicle kilometres travelled (VKT) over a 10-year period for both freeways and arterial roads.

Vehicle kilometres travelled in Melbourne

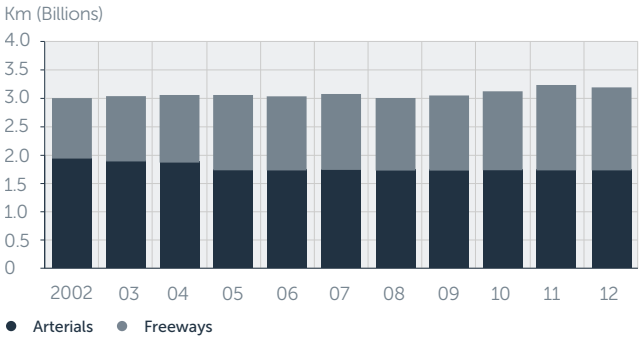


Vehicle kilometres travelled in metropolitan Melbourne by road type

The growth in VKT has occurred almost entirely on freeways with VKT on arterial roads remaining approximately the same between 2002 and 2012. Over the last 10 years, the trend shows that the total growth in VKT on Melbourne's freeways has been 61.1% or around 3.8 billion vehicle kilometres. The percentage of VKT taking place on freeways increased from 27% in 2002 to 36% in 2012.

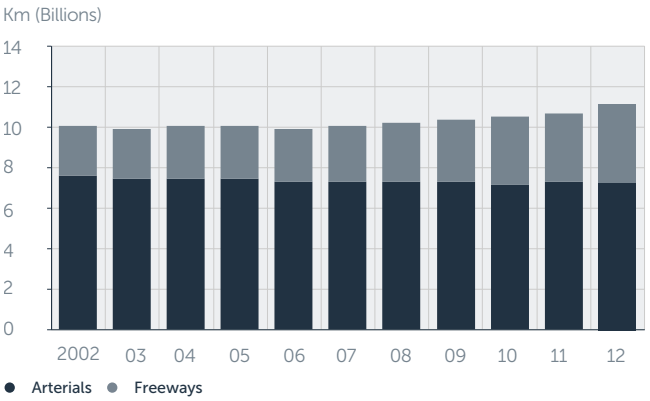
The trends for all zones indicates growth in VKT over the last 10 years. Both the inner and middle zones have experienced a slight decline in arterial VKT, representing a shift of travel from arterial roads onto improved freeway links. The outer zone trend shows this area has experienced increasing VKT on both arterial roads and freeways and has experienced the largest growth of the three zones.

VKT in inner zone of Melbourne



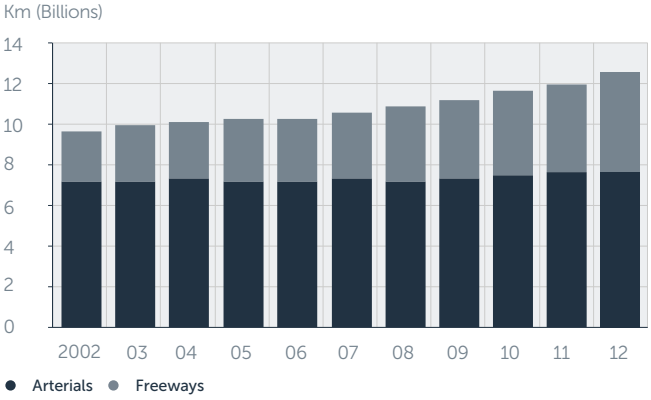
Vehicle kilometres travelled in inner zone of metropolitan Melboune by road type

VKT in middle zone of Melbourne



Vehicle kilometres travelled in middle zone of metropolitan Melbourne by road type

VKT in outer zone of Melbourne



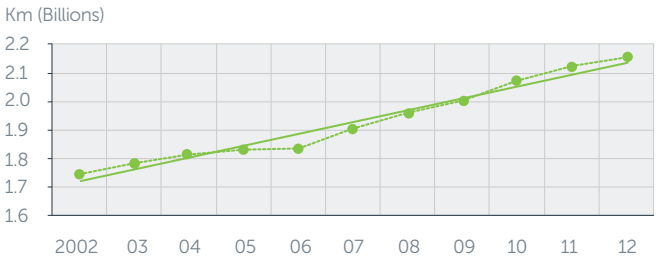
Vehicle kilometres travelled in outer zone of metropolitan Melbourne by road type

Freight road use

Freight movement is extremely important for Victoria's economic prosperity and must be effectively managed. Freight estimates on Melbourne freeways are made by counting the number and type of freight vehicles and using set estimates for the load of each vehicle.

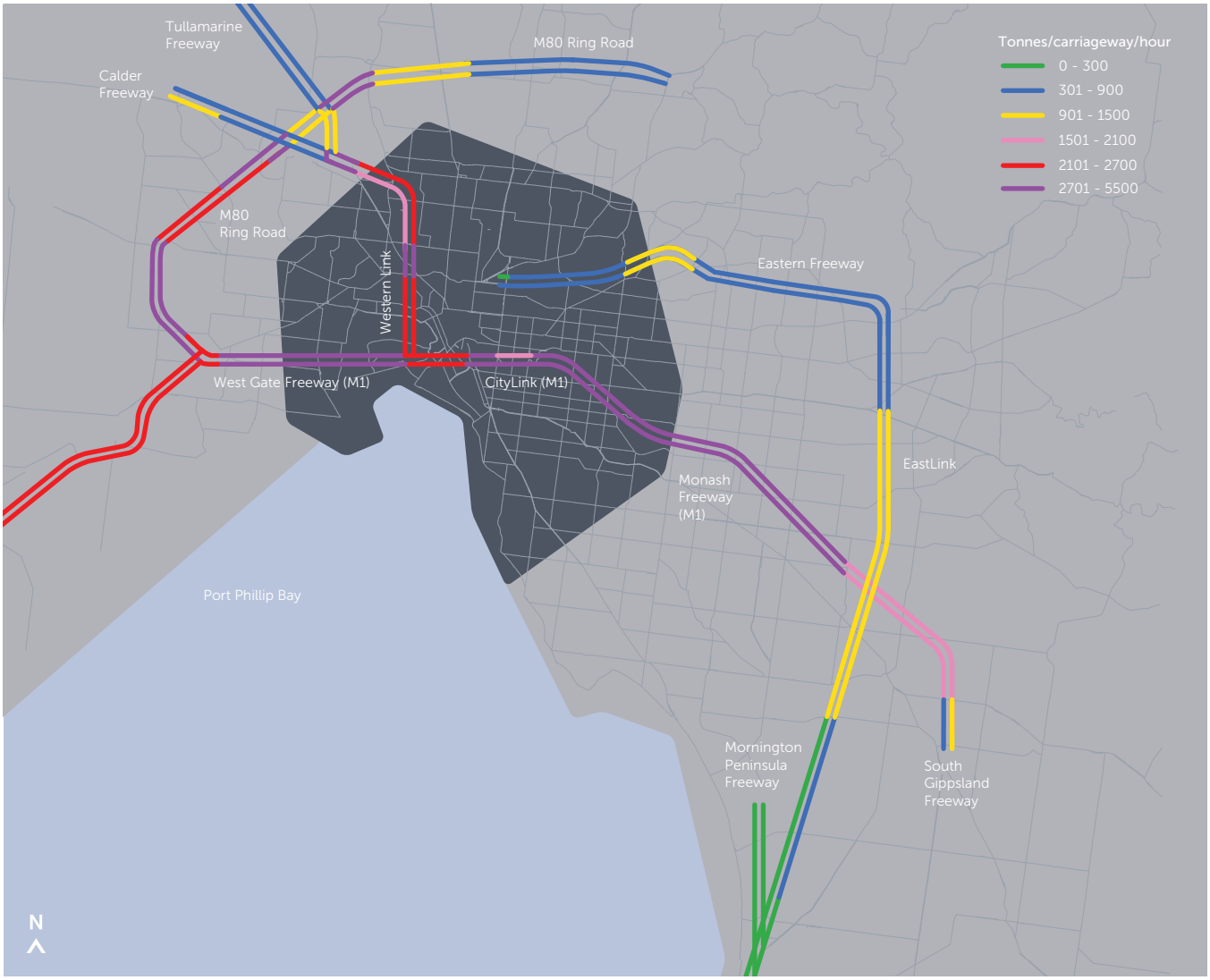
Truck volumes in Melbourne have been increasing in recent years. The growing Victorian economy is increasing demand for freight transport, leading to more trucks using the road network. Since 2002, the trend shows that truck VKT in Melbourne has increased around 22% in total.

Truck vehicle kilometres travelled in Melbourne



Vehicle kilometres travelled on arterial roads and freeways by freight vehicles in metropolitan Melbourne

Freeway freight volumes for 2012-13



Freight volumes on Melbourne's freeways in 2012-13 (freight volumes are represented by travel direction)

Note: this map is a visual representation of the data only and nominal sections as shown may not be entirely accurate.

Freeway freight volume changes

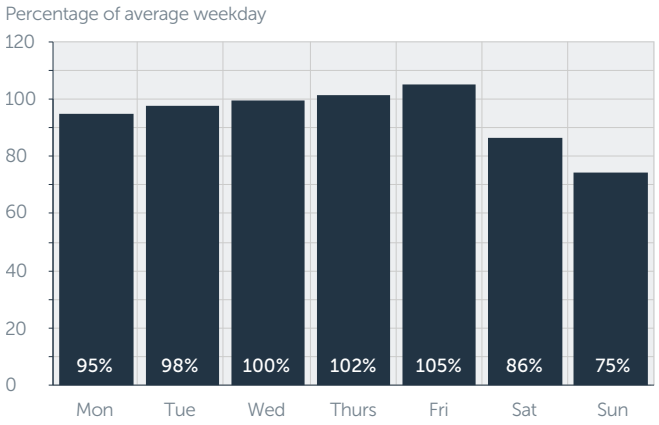
Freeway	Direction	Location	Change in volume	2012-13	2011-12
Eastern Fwy	W	Gold St - Hoddle St	Decrease	Green	Blue
	E	Hoddle St - Gold St	Increase	Blue	Green
EastLink	S	Dandenong Bypass - Frankston Fwy	Increase	Blue	Green
M80 Ring Road	W	Dalton Road - Mahoneys Rd	Decrease	Blue	Yellow
	E	Mahoneys Road - Dalton Rd	Decrease	Blue	Yellow
Princes Fwy	NE	Forsyth Rd - West Gate Fwy	Increase	Red	Pink
Southern Link	SE	Anderson St - Loyola Gv	Decrease	Pink	Red
South Gippsland Fwy	N	South Gippsland Hwy - Princes Hwy	Decrease	Blue	Yellow
Tullamarine Fwy	S	Western Ring Rd - Calder Fwy	Decrease	Yellow	Pink
Western Link	N	West Gate Fwy - Dynon Rd	Increase	Red	Pink
Tullamarine Fwy	E	Bulla Rd - Bell St	Increase	Red	Pink
	SE	Centre Rd - Western Ring Rd	Increase	Blue	Green
Western Link	N	Boundary Rd/Flemington Rd - Brunswick Rd	Increase	Purple	Red
	N	Dynon Road - Flemington Rd	Increase	Red	Pink
	S	Bell St - Brunswick Rd	Increase	Red	Pink
M80 Ring Road	W	Mahoneys Rd - Pascoe Vale Rd	Decrease	Yellow	Red
	E	Pascoe Vale Rd - Mahoneys Rd	Decrease	Yellow	Red
	NW	West Gate Fwy/Western Ring Rd - Boundary Rd	Decrease	Purple	Red
	NE	Sunshine Ave - Keilor Park Dr	Decrease	Purple	Red
	NE	Calder Fwy - Tullamarine Fwy	Decrease	Yellow	Red
	NE	Keilor Park Dv - Calder Fwy	Increase	Purple	Red
	SW	Tullamarine Fwy - Calder Fwy	Decrease	Yellow	Pink

Melbourne traffic profiles (road use by day, week and year)

Traffic volumes vary based on the day of the week and time of the year.

There is as much as a 10% variation in weekday traffic volumes depending on the day of the week. Weekends have average daily traffic volumes below those of all weekdays.

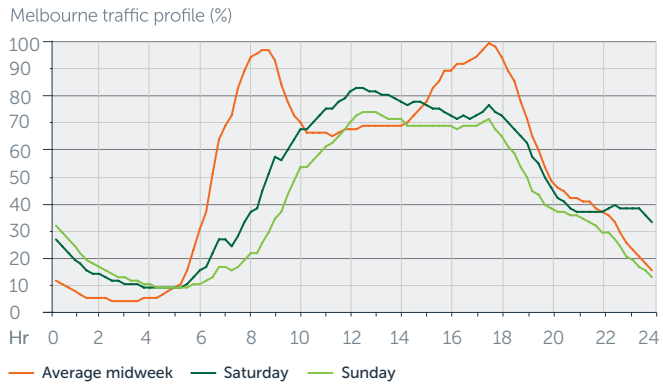
Traffic volumes by day of the week



Proportion of the average 24 hour weekday traffic volume experienced on each day of the week in 2012-13

Daily traffic profiles also vary depending on the day of the week. This is most noticeable for weekends where volumes peak in the middle of the day rather than in the morning and afternoon as they do during the week. Traffic volumes at midday on the average weekend are higher than volumes at the same time of day on weekdays. Peak volumes on weekends are significantly below peak volumes on weekdays.

Traffic volumes by time of day

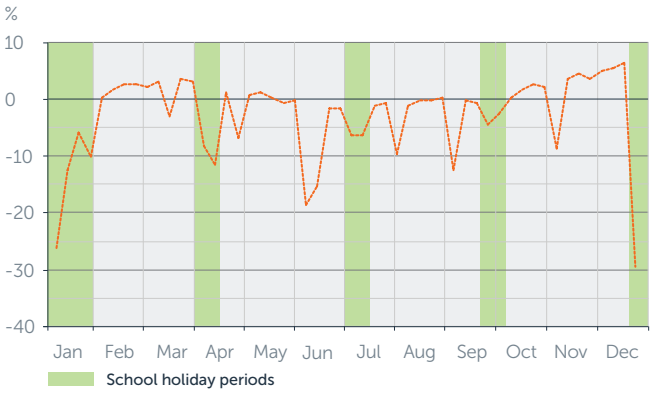


Proportion of the maximum weekday traffic volume experienced at different times of the day on weekdays and weekends in 2012-13

Traffic volumes change at different times of the year. The figure below shows the weekly volumes as the percentage variation from the yearly average.

The figure demonstrates below average volumes recorded during school holidays, especially during January. The highest weekly volumes are recorded in November and December.

Traffic volumes by week of the year



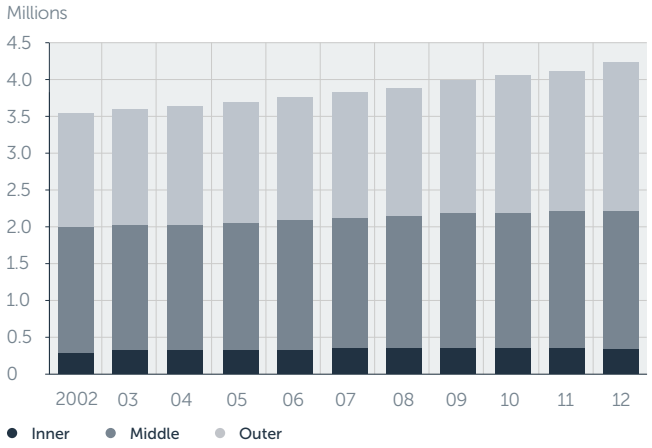
Traffic volume variations (from average non-holiday week) by week of the year in 2012

Note: the average week is taken across the whole year excluding public holidays.

Population growth

The largest contributor to the increase in road use in Melbourne is the growth in population. Between 2002 and 2012 the population of Melbourne grew by approximately 20%.

Population of Melbourne



Population growth in Melbourne by zone
(Source: Australian Bureau of Statistics)

Population growth has occurred in all three zones although the majority occurred in the outer zone. The inner and outer zones recorded similar average annual growth rates of 2.5% and 2.6% per year respectively, while the middle zone grew at a much slower rate of 1.1% per year.

The different population growth rate of each zone has lead to a shift in the relative share of population in each zone. In 2002 the outer zone accounted for 43% of Melbourne's population, whereas in 2012 this had increased to 46%. This 3% increase in population share has occurred at the same time as almost 4% increase in the share of VKT in the outer zone. Over the same period, the share of population in the middle zone has decreased by 4%, matched by a VKT share decrease of 3% (refer to VKT discussed on pages 18 to 20). This pattern highlights the influence of population on VKT growth.

Land use change

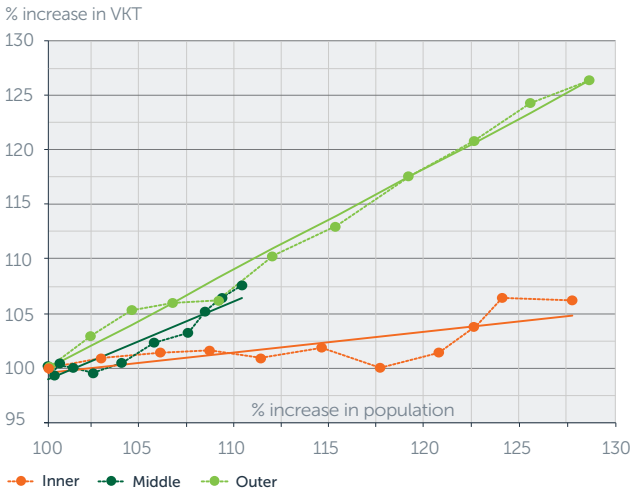
Land use change is a key factor affecting transport demand. The location and density of residential, employment, business, health and educational areas /services play a major role in determining how far people travel and which modes they use.

The 'Growth in VKT against growth in population' figure demonstrates the impact that population growth in different areas of Melbourne has on road use. The trend, between 2002 and 2012, shows that in the outer and middle zones the percentage growth in VKT has followed the percentage growth in population very closely.

The inner zone has experienced a significantly different trend, where a 28% increase in population has resulted in only a 6% increase in VKT. This suggests that population growth in the inner suburbs of Melbourne has a far smaller impact on the road network than growth in the middle and outer suburbs. This may be a result of a number of factors including:

- Better public transport.
- Better access to employment, education and other services.
- Shorter trip lengths in the inner zone.
- The road network being at or near capacity.
- High parking costs and/or lack of parking availability.

Growth in VKT against growth in population



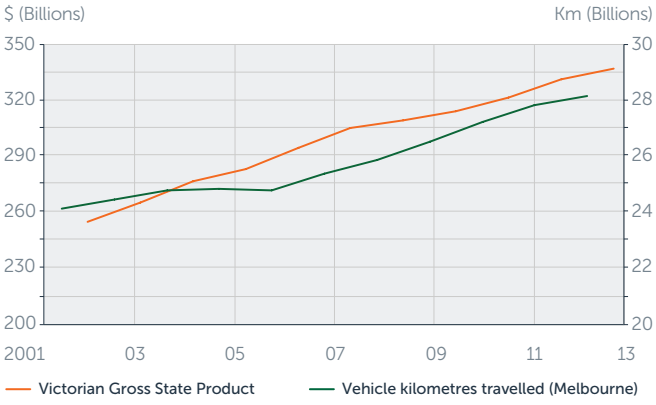
Change in vehicle kilometres travelled and change in population for each zone in metropolitan Melbourne (2002 to 2012)

This analysis compares the population growth within a given geographical area with the traffic growth in the same area. There is an underlying assumption implied in this analysis that only people living within each zone are using the roads in that zone. This is clearly not the case, as although it is likely that the majority of road travel in the outer zone is undertaken by people living within that zone, the inner zone is likely to have a high percentage of use by those living in other zones. This means that the difference in the traffic impacts of population growth between the inner and outer zones is in fact greater than that shown in the 'Growth in VKT against growth in population' figure above.

Economic growth

The amount of economic activity taking place in Victoria is a major driver of demand for travel. The need to travel for business and employment purposes makes up a significant portion of the demand for travel in Melbourne. The income earned by individuals in a strong economy also gives them greater ability to travel for social and recreational activities, thus further increasing demand.

Economy and road use



Gross State Product of Victoria and vehicle kilometres travelled in Melbourne
Source: Australian Bureau of Statistics

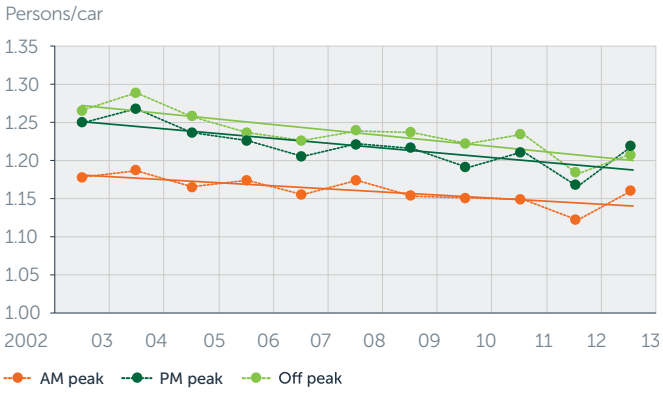
Victoria's gross state product (a key indicator of the size of the Victorian economy) increased by 30%, between 2002-03 and 2012-13, in the same timeframe that VKT in Melbourne increased by 15%. The strength of the Victorian economy increased the demand for transport in Melbourne leading to an increased use of the road network.

Travel behaviour

Car occupancy

The car occupancy rate is the average number of people per car as measured by visual observations of vehicles travelling on the monitored network. As an example, car occupancy of 1.2 persons per car would mean that there is an average of six people for every five cars or one car in every five was carrying two people. A higher car occupancy rate is seen as preferable, as a full car takes up the same amount of road space as a car with a driver alone.

Car occupancy



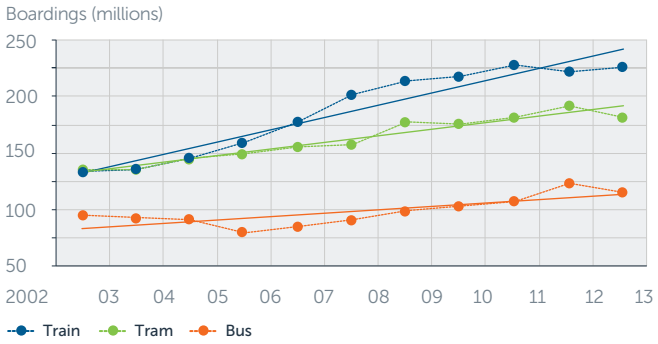
Weekday car occupancy rate for monitored network across all time periods

The trend in car occupancy indicates that occupancy rates have been decreasing at approximately the same rate in each time period over the last 10 years. The change in car occupancy since 2002-03 is equivalent to one fewer passenger for every 58 cars in the morning peak and for every 33 cars in the afternoon peak. Given that a freeway lane can carry around 2,000 cars per hour, this change in occupancy would mean a four-lane freeway would carry 139 fewer people per hour in the morning peak and 240 fewer people per hour in the afternoon peak.

Public transport patronage

Public transport boardings are a record of the number of times a passenger gets on a train, tram or bus. A passenger using multiple public transport modes (e.g. train and tram) will record multiple boardings for the one trip. Boardings figures are used as an indicator of public transport patronage.

Public transport boardings in Melbourne



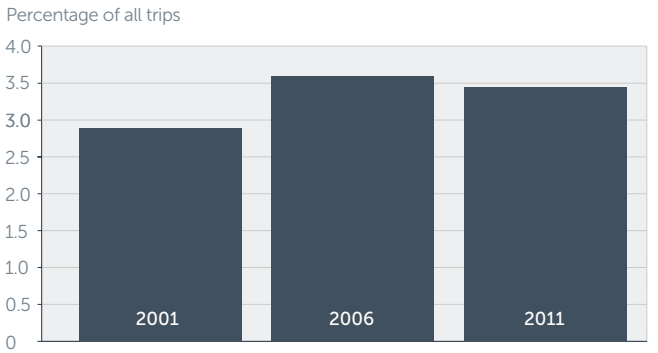
Annual public transport boardings by mode for Melbourne
Source: Public Transport Victoria

The trend in public transport patronage indicates an increase on all modes since 2002-03. This increase has been greatest on Melbourne trains with total growth of around 83% since 2002-03. Tram and bus boardings have increased by 44% and 37% respectively in the same timeframe.

Walking

Data on walking* as a mode of transport is taken from the national census and shows the percentage of people who get to work by walking only. This does not include people who walk as part of their journey, such as to a train station.

Journey to work trips — walking only



Share of journey to work trips which were walking only
Source: ABS Census

The trend for walking, between 2001 and 2011, indicates that the number of people walking to work in Melbourne increased by 50%. The number of people walking to work in 2011 accounts for 3.4% of all trips made to work.

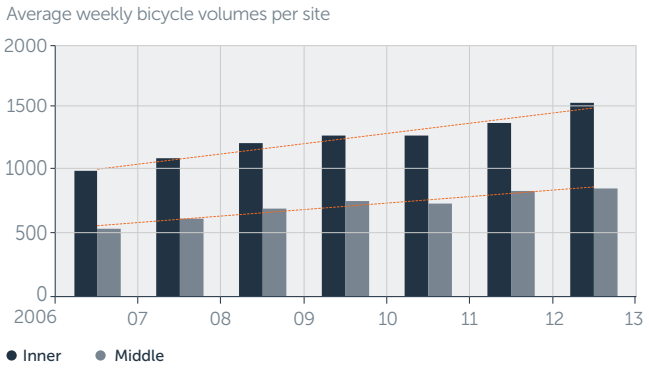
***The information reported on walking is the same as reported in the 2011-12 Traffic Monitor due to census data only being available every 5 years.**

Bicycles

Bicycle counts are used as an indicator of the use of bicycles in Melbourne. VicRoads has installed permanent counters in various strategic locations across Melbourne that record bicycle volumes continuously. This information is useful for monitoring changes in bicycle use over the seasons as well as from year to year.

Detailed statistics from permanent count sites are available on VicRoads' website at vicroads.vic.gov.au. VicRoads does not currently have any permanent bicycle counters in the outer zone (other than one located in Phillip Island).

Bicycle volumes at selected sites in Melbourne



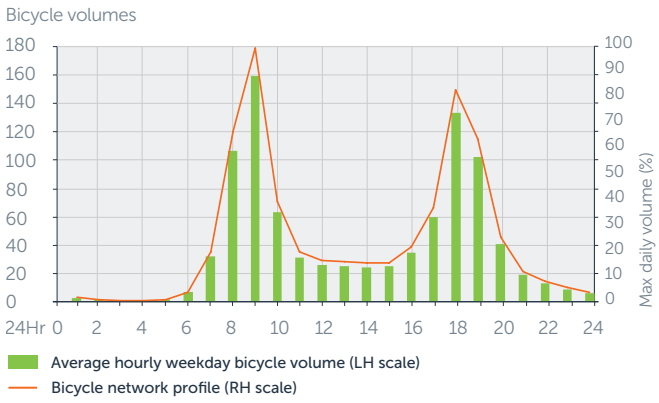
Weekday bicycle use recorded at selected permanent count sites in metropolitan Melbourne

The bicycle volume trends show an increase in bicycle use since 2006-07 in both the inner and middle zones. Since 2006-07, the trend shows that recorded bicycle volumes increased by 48% in the inner zone and 55% in the middle zone. These increases in volume at permanent count sites suggest bicycle volumes have been increasing across the network in recent years. While count locations are on popular commuter routes, the volumes recorded do include recreational bicycle use.

Bicycle volumes in the inner zone are consistently higher than in the middle zone. This is likely due to slower vehicle travel speeds and shorter trip distances in the inner zone.

The 'Peak bicycle travel periods' figure below shows the typical weekday bicycle profile and the average hourly volume. The bars show the average hourly weekday volume for all bicycle loop counter sites (shown on the left) while the contour line in the figure shows the relative volume of traffic at the given time of day (percentages shown on the right).

Peak bicycle travel periods

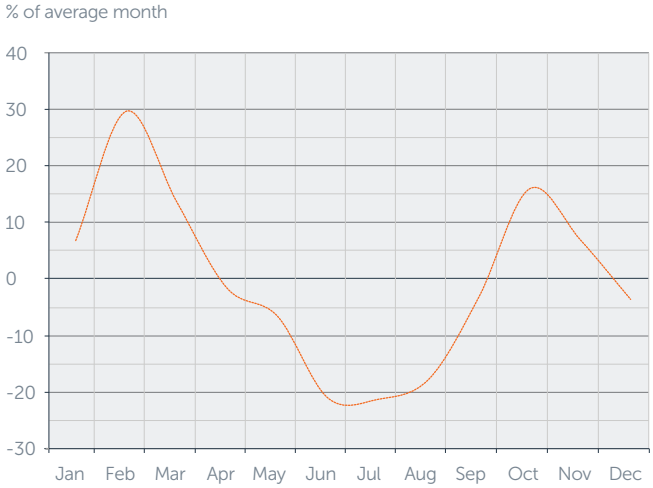


Bicycle volumes and relative bicycle daily profile by time of day (2012-13) for including both commuter and recreational routes.

Bicycle volumes peak around 9:00am in the morning and 6:00pm in the afternoon. The average hourly weekday volume for these times is around 160 and 130 respectively.

When analysing the volumes for bicycle routes that are considered to be predominantly commuter routes, the daily profile is very similar, whereas the average hourly weekday volume is much higher (approximately 240 in the morning and 200 in the afternoon).

Seasonality of bicycle use in Melbourne



Monthly bicycle volume variation from average month — 24 hour/7 day volumes (2006-07 to 2012-13)

Bicycle use in Melbourne varies (up to around 53%) at different times of the year. This variation loosely follows the seasons with higher volumes recorded in the warmer months.

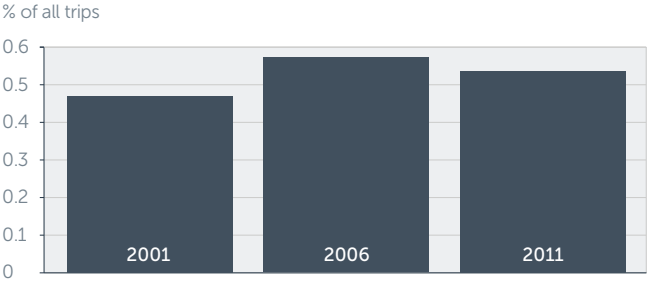
Motorcycles and other powered two-wheelers

Data on the use of motorcycles and other powered two-wheelers* (PTW) is taken from the national census and shows the percentage of people who used a PTW to get to work on census day.

There has been a small increase in travel to work using PTWs over the last 10 years. Between 2001 and 2011 the percentage of people who used a PTW as part of their journey to work, on census day, increased from 0.47% to 0.53%.

The percentage of people who travelled to work in 2011 using PTWs (0.53%) is well below the percentage of PTWs registered in the vehicle fleet (3.36%) in the same year.

Journey to work trips — PTW



Share of journey to work trips which used a powered two wheeler
Source: ABS Census

*The definition of 'Powered two-wheeler' includes motorcycles, scooters, mopeds, motor tricycles and motorcycles with sidecars. The information reported on motorcycles and other powered two-wheelers is the same as reported in the 2011-12 Traffic Monitor. This is due to census data being available every 5 years.

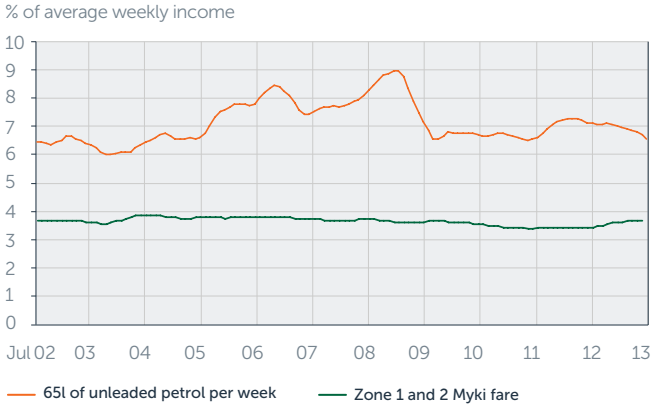
Transport costs

The costs of transport affect the choices people make about how they travel. As transport costs change, individuals reassess the transport decisions they have made. Increasing costs for one mode of transport can lead to an increase in the use of other modes.

While the cost of petrol is only a small part of the cost of owning and operating a car, it is a very visible component of the cost of car use. Increasing petrol prices have been associated with reduced car use and have the potential to influence the way the road network is used. Public transport fares are also very visible and are often the only cost involved in the use of public transport.

The relative cost of fuel is measured as the percentage of the average wage that is required to purchase a 65 litre tank of unleaded petrol each week. Public transport costs are approximated by the price of a zone 1 and 2 monthly Metcard ticket up until 2008, since then the Myki equivalent approximated price has been used. This indicator takes into account the costs of fuel and public transport fares as well as the average income in order to provide an insight into the affordability of transport.

Relative costs of transport



Cost of fuel relative to the average income - based on 65 litre tank of unleaded petrol as per data from ABS

The relative costs of transport figure above indicates that the relative cost of a 65 litre tank of unleaded petrol has been comparatively stable since prices dropped in 2008 after the global financial crisis. The average relative price of fuel in 2012-13 was 6.7%, well below the peak of 8.9% in mid 2008.

The relative cost of public transport fares has been between 3% and 4% consistently over the last 10 years.

Further information

The information in this brochure represents an overview summary of the extent of information available from the surveys undertaken. Further information is available and can be provided at nominal cost by contacting one of the following **VicRoads** officers:

Manager — Road Use Strategy
Strategy and Planning
Telephone: (03) 9093 1455

Manager — Data Services
Information Management and Technology
Telephone: (03) 9090 4631

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10550 06.14 Authorised and published by VicRoads, 60 Denmark Street, Kew, Victoria, 3101.

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