TRANSPORT (T)

SCIENTIFIC ASSESSMENTS Part III

Commissioner *for* Environmental Sustainability Victoria

Traditional Owners

The Commissioner for Environmental Sustainability proudly acknowledges Victoria's Aboriginal community and their rich culture and pays respect to their Elders past and present.

We acknowledge Aboriginal people as Australia's first peoples and as the Traditional Owners and custodians of the land and water on which we rely. We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life, and how this enriches us.

We embrace the spirit of reconciliation, working towards the equality of outcomes and ensuring an equal voice.

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Transport

This chapter includes assessments of Victoria's travel demand, greenhouse gas emissions (and emissions intensities) from transport, and air pollution from transport.

Themes relevant to this chapter are covered in other chapters, specifically the Air chapter, which incorporates air pollution from transport as part of an overall assessment of ambient air quality, and the Energy and Climate Change Impacts chapters, which also report on greenhouse gas (GHG) emissions from transport.

Background

An integrated transport network across all modes of travel is essential for a sustainable, liveable and prosperous Victoria, with the mode and efficiency of travel having a significant effect on the local economy and environment. Pollution from motor vehicles, aircraft, trains and boats increases Victoria's GHG emissions and impacts on Victoria's ambient air quality. Associated noise impacts can also affect human health and wellbeing.

The transport sector is the second-biggest contributor to GHG emissions in Victoria, accounting for 20% of the state's total in 2016. Within the transport sector, passenger cars account for the most GHG emissions, followed by trucks and light commercial vehicles.[1]

Victoria's population has increased from 4.8 million in 2001 to 5.9 million in 2016.[2,3] This population expansion has been reflected in increased motor-vehicle use, with the total kilometres travelled by motor vehicles registered in Victoria increasing by 15% from 2007 to 2016.[4] The population is projected to nearly double in the next three decades, to reach 10.1 million in 2051. Without major changes, this would significantly strain Melbourne's motor vehicle and public transport networks, which are already experiencing congestion and overcrowding.[5,6,7]

A greater amount of road travel increases vehicle emissions and is likely to increase population exposure to degraded ambient air quality. A Tasmanian study published in 2018 found that living within 200 m of a major road influences both the development and persistence of asthma in middle-aged adults.[8]

A denser population, more large-scale transport construction projects, and increased motor-vehicle use mean it is likely that more Victorians will be impacted by noise, and that impacts will be felt more often.

A current example of extended noise impacts associated with motor vehicles is the noise from trucks travelling on major residential streets in Melbourne's inner-western suburbs. Environment Protection Authority Victoria (EPA Victoria) noise-monitoring has shown elevated noise levels associated with truck movements in the region during 2001, and again during 2012. VicRoads has gradually introduced and increased truck curfew timings and locations in Melbourne's inner-west over the past two decades.[9,10,11]

1. Australian Department of the Energy and Environment, 'Australian Greenhouse Emissions Information System', Canberra, Australia http://ageis.climatechange.gov.au/ Accessed 3 December 2018.
2. 'Australian Bureau of Statistics, 'Population by Age and Sex, Victoria June 2002 Canberra, Australia.
3. Australian Bureau of Statistics, '2016 Census QuickStats', Canberra, Australia Accessed 3 December 2018.
4. Australian Bureau of Statistics 2017, 'Survey of Motor Vehicle Use, Australia, 12 months ended 30 June 2016', Canberra, Australia http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/9208.012%20months%20ended%2030%20June%202016?OpenDocument Accessed 3 December 2018.
5. DELWP 2016, 'Victoria in Future 2016', East Melbourne, Victoria https://www.planning.vic.gov.au/__data/assets/pdf_file/0014/14036/Victoria-in-Future-2016-FINAL-web.pdf Accessed 3 December 2018.
6. Infrastructure Victoria 2016, 'The Road Ahead: How an efficient, fair and sustainable pricing regime can help tackle congestion', Melbourne, Victoria http://www.infrastructurevictoria.com.au/sites/default/files/images/The%20road%20ahead%20final%20web.pdf Accessed 3 December 2018.
7. Transport for Victoria 2018, 'Metropolitan Train Load Standards Survey Report May 2018', Melbourne, Victoria https://transport.vic.gov.au/-/media/tfv-documents/data/metropolitan-train-load-standards-report---may-2018-pdf-version.pdf?la=en&hash=49B109D1BA385555ADDD4D32D60EFF1F Accessed 3 December 2018.
8. Bowatte, G. et al 2018, 'Traffic related air pollution and development and persistence of asthma and low lung function', Environment International, 113, pp. 170–176.
9. EPA 2001, 'Traffic Noise Measurement – Francis Street, Yarraville, 2001', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/820.pdf Accessed 3 December 2018.
10. EPA 2013, 'Francis Street monitoring program – Final report', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/1546%201.pdf Accessed 3 December 2018.
11. VicRoads, 'Truck curfews and the Inner West', Melbourne, Victoria https://www.vicroads.vic.gov.au/business-and-industry/heavy-vehicle-industry/registration-permits-curfews-and-compliance/truck-curfews/truck-curfews-in-the-inner-west Accessed 3 December 2018.

The critical environmental and sustainability challenges facing Victoria's transport management now and in the future include:

- reducing GHG emissions and other major pollutants in the transport sector
- reducing travel demand
- limiting noise impacts associated with travel and transport infrastructure construction.

Current Victorian Government Settings: Legislation, Policy, Programs

Transport for Victoria (TfV), part of the Department of Economic Development, Jobs, Transport and Resources, was established in April 2017. Its function is to plan, coordinate and manage the state's transport system. TfV provides leadership to Victoria's transport agencies, including VicRoads, Public Transport Victoria and V/Line, and is the customer of major project construction authorities, such as the Level Crossings Removal Authority, Rail Projects Victoria (formerly Melbourne Metro Rail Authority) and Major Road Projects Authority. TfV also works closely with VicTrack.

The objectives of Victoria's transport system are defined in the *Transport Integration Act 2010*.[12] Section 10 of the Act states that: 'The transport system should actively contribute to environmental sustainability by –

(a) protecting, conserving and improving the natural environment;

(b) avoiding, minimising and offsetting harm to the local and global environment, including through transport-related emissions and pollutants and the loss of biodiversity;

(c) promoting forms of transport and the use of forms of energy and transport technologies which have the least impact on the natural environment;

(d) improving the environmental performance of all forms of transport and the forms of energy used in transport.'

TfV published *Delivering the Goods – Victorian Freight Plan* in July 2018.[13] The plan sets out short, medium and long-term priorities to support Victoria's freight and logistics system through a period of unprecedented growth in freight volumes.

12. Transport for Victoria, 'Transport Integration Act', Melbourne, Victoria https://transport.vic.gov.au/about/legislation/transport-integration-act Accessed 3 December 2018.
13. Transport for Victoria 2018, 'Delivering the Goods', Melbourne, Victoria https://transport.vic.gov.au/-/media/tfv-documents/ports-and-freight/delivering-the-goods.pdf?la=en&hash=3AE9573B325C4886DD60408E190F55E8 Accessed 3 December 2018.

Infrastructure Victoria released a five-year focus report in April 2018 that identified immediate actions to tackle congestion.[14] The Infrastructure Victoria report found that, by 2030, the time spent on congested roads across Melbourne will increase by 20%.[15]

In August 2018, Infrastructure Victoria published a report advising on automated and zero-emissions vehicles infrastructure.[16] The report found zero-emissions vehicles would eliminate all vehicle tailpipe emissions, with a potential reduction in GHG emissions of up to 27 million tonnes by 2046 – the equivalent of about 25% of Victoria's total GHG emissions in 2015. The report also found that eliminating vehicle exhaust emissions could deliver an annual health dividend to Victorians worth between $270 million and $735 million.

14. Infrastructure Victoria 2018, 'Five-year focus – Immediate actions to tackle congestion', Melbourne, Victoria http://infrastructurevictoria.com.au/sites/default/files/images/Five-year%20focus%20-%20Immediate%20actions%20to%20tackle%20congestion%20-%20April%202018.pdf Accessed 3 December 2018.
15. Ibid
16. Infrastructure Victoria 2018, 'Advice On Automated and Zero Emissions Vehicles Infrastructure', Melbourne, Victoria http://www.infrastructurevictoria.com.au/sites/default/files/files/AVZEV/Infrastructure%20Victoria%20-%20Vehicles%20Infrastructure%20Advice%20-%20Evidence%20Base%20Report%20August%202018.pdf Accessed 3 December 2018.

Indicator	Status				Trend	Data Quality
	UNKNOWN	POOR	FAIR	GOOD		
T:01 Travel demand	○	●	○	○	↘	DATA QUALITY: Good
Data Custodian ABS, TfV						

The way Victorians travel to work can have a significant effect on the quality of the surrounding environment. Areas immediately near busy roads often have considerable air pollution. At a broader level, all vehicles with internal combustion engines emit GHGs that contribute to climate change.

The commuting habits of Victorians are slowly changing. Trend data for the period 2001 to 2016 shows that the percentage of Victorians using public transport to commute to work has increased from 11% to 16%. In the same period, there has been a drop in the percentage of people driving to work, from 84% to 79% (Figure T.1).

In Melbourne, commuting to work by bike has increased slightly (1.0% to 1.6%), as has walking to work (2.9% to 3.5%). There have been modest decreases for these transport modes in regional Victoria (1.5% to 0.8% for cycling, and 6.6% to 4.9% for walking).

Despite the decreasing proportion of Victorians driving to work since 2001, the dramatic increase in workforce population means 408,548 more Victorians were driving to work in 2016, compared to 2001. This encapsulates the challenge Victoria is facing to limit the growth in vehicle-use and alleviate congestion on the state's roads as the Victorian and Melbourne populations grow rapidly (Figure T.2).

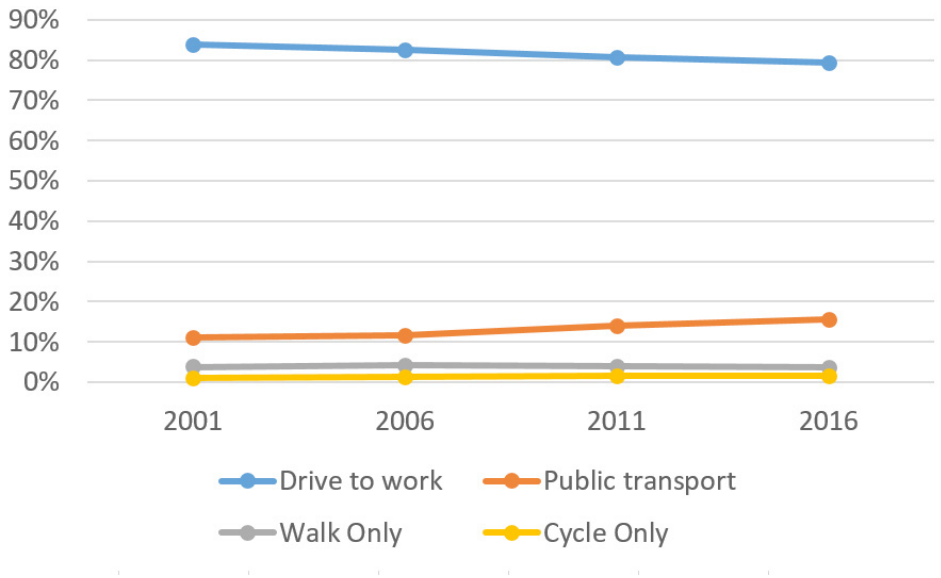

Figure T.1 Percentage of journeys to work by transport mode (Victoria)
(Data source: TfV)

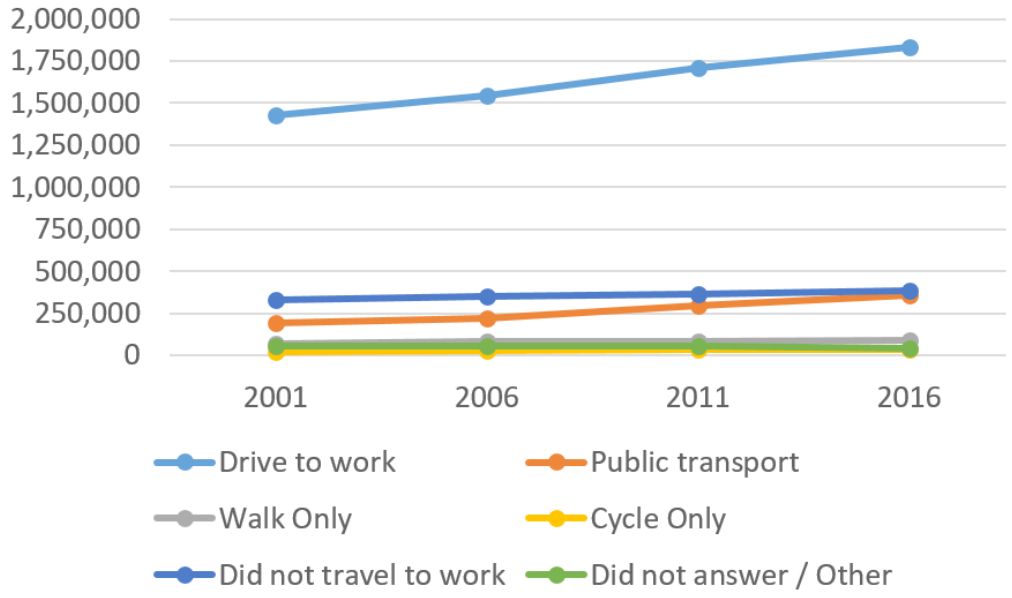

Figure T.2 Number of journeys to work, by transport mode (Victoria)
(Data source: TfV, 2018)

Victoria's population expansion has led to an increase in motor-vehicle use. Total kilometres travelled by motor vehicles registered in Victoria has increased by 15% from 2007 to 2016.[17] This means the growth in vehicle use across Victoria has slightly lagged behind population growth, which increased by 20% throughout the state from 2007 to 2016.[18,19]

That balance is expected to flip, with Melbourne's motor-vehicle use projected to increase by 41% from 2015 to 2030,[20] outpacing population growth, which is expected to be 31% over a similar period (2016 to 2031).[21] However, there is limited scope in the current road network to accommodate the projected growth in motor-vehicle use, so a 41% increase in vehicle use from 2015 to 2030 could be an overestimate and motor vehicle growth might only increase in-line with, or lag slightly behind, population growth.

The overall status for this indicator has been rated as poor, due to the state's reliance on motor vehicles for commuting. The trend is listed as deteriorating, because population growth is outpacing the mode-shift away from motor vehicles to public transport, cycling or walking. More than 400,000 additional Victorians are driving to work than at the start of the century.

17. Australian Bureau of Statistics 2017, 'Survey of Motor Vehicle Use, Australia, 12 months ended 30 June 2016', Canberra, Australia http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/9208.012%20months%20ended%2030%20June%202016?OpenDocument Accessed 3 December 2018.
18. Australian Bureau of Statistics 2008, '3235.0 - Population by Age and Sex, Regions of Australia, 2007', Canberra, Australia http://www.abs.gov.au/ausstats/abs@.nsf/Products/3235.0~2007~Main+Features~Victoria?OpenDocument Accessed 3 December 2018.
19. Australian Bureau of Statistics 2017, '2016 Census: Victoria', Canberra, Australia http://www.abs.gov.au/ausstats/abs@.nsf/MediaRealesesByCatalogue/C508DD213FD43EA7CA258148000C6BBE?OpenDocument Accessed 3 December 2018.
20. Australian Department of Infrastructure and Regional Development 2015, 'Traffic congestion and cost trends for Australian capital cities', Canberra, Australia https://bitre.gov.au/publications/2015/files/is_074.pdf Accessed 3 December 2018.

Transport and Energy

Indicator	Status (UNKNOWN / POOR / FAIR / GOOD)	Trend	Data Quality
T:02 Greenhouse gas emission and emission intensities from transport	○ ● ○ ○	→	DATA QUALITY: Good

Data Custodian TfV

As noted in the Climate Change Impacts chapter and Energy chapter, the transport sector contributed 20% of Victoria's GHG emissions in 2016, with transport emissions increasing in-line with population growth since 2009. Transport emissions have grown by 39% since 1990, and the sector has had the highest proportional increase in emissions in Victoria over the period.

Road transportation is the major source of emissions from this sector, accounting for 90% of transport emissions in 2016. This is a result of the use of motor vehicles as the main mode of transport for passengers and freight.

Figure T.3 compares the GHG emissions intensity (emissions per kilometre travelled) estimated for various transport modes for 2008 and 2017. There has been a range of increases and decreases in the emissions intensity of various transport modes.

In terms of passenger travel, light vehicles contribute 91% of passenger travel kilometres in Victoria, and 94% of the transport GHG emissions. While cars increasingly emit fewer GHGs due to technological improvements, lower emissions are not reflected in average occupancy emissions, which may be attributable to reduced average car occupancy (that is, each car is carrying fewer people per trip, on average).

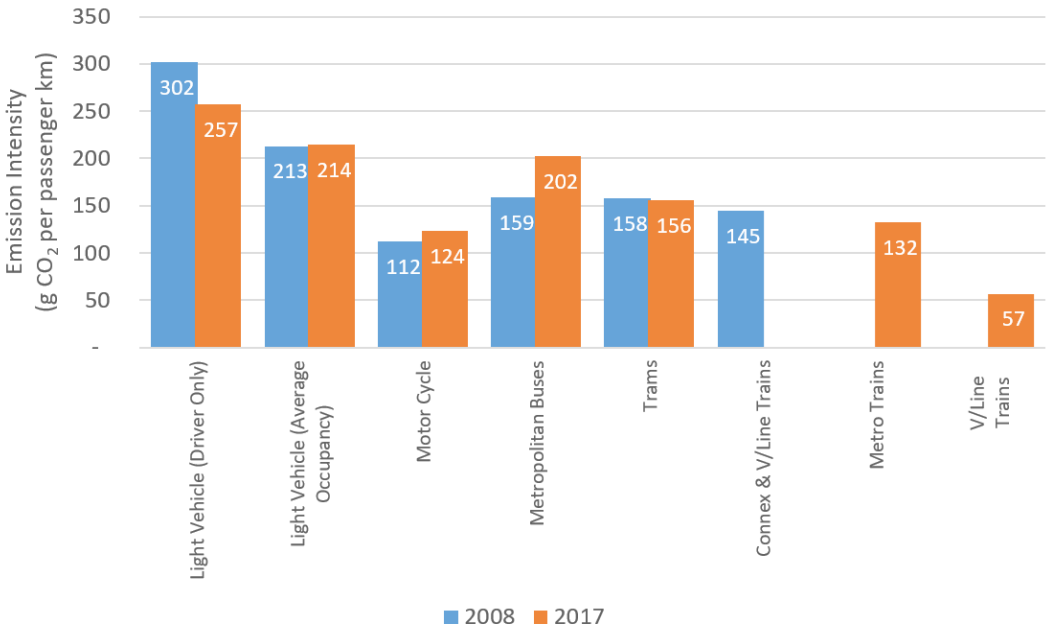

Figure T.3 Estimated GHG emissions intensity (grams CO_2-e per passenger kilometre) for 2008 and 2017
(Data source: TfV, 2018)

Low or net-zero carbon-energy vehicles are emerging as a viable alternative to internal combustion engines. However, transitioning the vehicle fleet away from internal combustion engines is likely to take decades.

A notable reduction in GHG emissions per passenger kilometre has been observed on the rail network. This reduction can be attributed to greater passenger loadings associated with the increased popularity of rural rail travel following upgrades to the V/Line system. System improvements, including the Rural Fast Rail Project, Regional Rail Link and investment in VLocity trains, have driven these emissions reductions per passenger. However, total GHG emissions have increased from V/Line trains, due to significant increases in the number of services. This also means an increase in diesel pollutants and noise.

Emissions from buses per passenger kilometre have increased since 2008, which is likely due to bus services increasing faster than patronage in the intervening period. GHG emissions from trams remain unchanged, but are expected to fall to nearly zero with the launch of solar-powered trams late in 2018, when all tram energy began being purchased from renewable energy. As renewable energy increases its contribution to the energy grid, GHG emissions per passenger kilometre for metro trains will also reduce.

Freight will heavily influence future transport emissions trends. In association with population growth, freight volumes are predicted to increase from about 360 million tonnes in 2014 to nearly 900 million tonnes in 2051.[22] Most of the growth in freight volumes will take place in metropolitan Melbourne.

The status assessment for this indicator has been listed as poor, due to the transport sector having the biggest proportional increase in GHG emissions from 1990 to 2016, as well as not having a reduction in emissions that other sectors (for example, stationary energy) have recorded in recent years. The trend assessment has been listed as stable, representing no significant change in total transport GHG emissions for the most recent five-year period.

21. DELWP, 'Victoria In Future one page profiles', East Melbourne, Victoria https://www.planning.vic.gov.au/land-use-and-population-research/victoria-in-future-2016/victoria-in-future-one-page-profiles Accessed 3 December 2018.
22. Transport for Victoria 2018, 'Delivering the Goods', Melbourne, Victoria https://transport.vic.gov.au/-/media/tfv-documents/ports-and-freight/delivering-the-goods.pdf?la=en&hash=3AE9573B325C4886DD60408E190F55E8 Accessed 3 December 2018.

Indicator	Status	Trend	Data Quality
T:03 Air pollution from transport	 Fair for motor vehicles and Unknown for rail and shipping	 Trend: Improving (motor vehicles); Unclear (rail and shipping)	 DATA QUALITY Poor (only one major roadside air-monitoring station; no air-quality monitoring data available for rail and shipping)

Data Custodian EPA Victoria

Victoria has only one air-monitoring station near a busy road – the Melbourne CBD station on the northern side of the city centre. Initial results recorded at this monitoring station indicate that air-pollution ($PM_{2.5}$ – particles less than 2.5 micrometres in diameter) levels are not much different to inner-city monitoring stations at Alphington and Footscray. Decreasing motor-vehicle pollution has been linked to improved air quality (see indicator AQ:02 Carbon monoxide and nitrogen dioxide), which has been reflected in the trend assessment of improving for motor vehicles.

Twelve-months of air-monitoring and noise-monitoring was completed in a residential area immediately next to Francis Street in Yarraville (in Melbourne's inner-west) in 2012 and 2013.[23] This followed monitoring conducted in the region during 2001 and 2002.[24,25,26,27] The monitoring was designed to assess air-quality and noise-quality associated with the large number of trucks using the road each day. Air-pollution levels in 2012 and 2013 breached the annual standard for $PM_{2.5}$ and the pollution was measured at greater concentrations compared with EPA Victoria's other fixed air-monitoring stations in Melbourne's inner-city.[28,29] Noise levels were measured at levels high enough to impact residents.[30] Based on World Health Organization Guidelines for community noise, road-traffic noise-levels measured in Francis Street were high enough to cause annoyance and disturb speech and sleep.[31] VicRoads has gradually introduced, and increased, truck curfew timings and locations in Melbourne's inner-west during the past two decades to ease pollution levels.[32]

Particle pollution associated with traffic along unsealed roads near the Brooklyn Industrial Precinct was a major contributor to one of Victoria's most significant air-pollution hotspots.[33] Road-sealing works have reduced the magnitude and frequency of poor air quality in Brooklyn; however, it still remains Victoria's biggest air-pollution hotspot in terms of the number of days exceeding air-quality standards (see indicator AQ:03 Particle pollution (PM_{10} and $PM_{2.5}$)). As unsealed roads are progressively being sealed, particularly in built-up areas, re-suspended dust and its health impacts are more likely to decrease than increase.

23. EPA 2013, 'Francis Street monitoring program – Final report', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/1546%201.pdf Accessed 3 December 2018.
24. EPA 2001, 'Air Monitoring at Francis Street, Yarraville', Carlton, Victoria.
25. EPA 2001, 'Traffic Noise Measurement – Francis Street, Yarraville, 2001', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/820.pdf Accessed 3 December 2018.
26. EPA 2003, 'Air monitoring at Francis Street, Yarraville during 2002', Carlton, Victoria.
27. EPA 2003, 'Traffic noise measurements, Francis Street, Yarraville, 2002', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/897.pdf Accessed 3 December 2018.
28. EPA 2013, 'Francis Street monitoring program – Final report', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/1546%201.pdf Accessed 3 December 2018.
29. Ibid
30. Ibid
31. Ibid
32. VicRoads, 'Truck curfews and the Inner West', Melbourne, Victoria, https://www.vicroads.vic.gov.au/business-and-industry/heavy-vehicle-industry/registration-permits-curfews-and-compliance/truck-curfews/truck-curfews-in-the-inner-west Accessed 3 December 2018.
33. EPA 2016, 'Brooklyn air quality update: effectiveness of road sealing', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/1627.pdf Accessed 3 December 2018.

EPA Victoria previously released projections for the state's air-quality,[34] reported in SoE 2013. The key findings for motor vehicles were:

- total vehicle exhaust emissions are decreasing because of the introduction of better vehicle exhaust controls
- the trend towards improved exhausts is happening faster than the growth in vehicle traffic, resulting in a net reduction in total exhaust emissions from cars and trucks over time
- road dust, caused by the movement of vehicles on roads during dry weather, is expected to increase in-line with traffic growth.

No air-monitoring studies have been conducted to specifically monitor air pollution from rail emissions, although the air-monitoring station at Geelong South is located near the railway line that V/Line trains use to travel through Geelong. No adverse air-quality results associated with train travel have been recorded at Geelong South.

The status assessment for motor vehicles has been listed as fair to reflect the air pollution being measured in association with motor vehicle traffic in Melbourne's inner-west.

34. EPA 2013, 'Future Air Quality in Victoria: Final Report, 2013', Carlton, Victoria https://www.epa.vic.gov.au/~/media/Publications/1535.pdf Accessed 3 December 2018.

Future Focus

Monitor noise and air for thorough, timely information

Additional research must be undertaken to acquire data and understand the impacts of transport noise on Victorians. A logical starting point would be a real-time noise-monitoring network across Victoria, with a strong focus on monitoring near major transport hotspots, including busy roads, under flight-paths and along public transport routes. The noise-monitoring network would need to be established in conjunction with regular strategic noise-mapping that provides the spatial distribution of noise levels, allows for the identification of hotspots and estimates the population exposure and resulting health burden.

The other significant issue associated with transport is ambient air quality. This is closely related to population exposure, which is set to dramatically increase in line with population growth and planning strategies that aim to locate medium and high-density housing developments near metropolitan activity centres. This means that many more people are likely to be living near major roads, which might reduce travel times, but could increase exposure to air pollution from motor vehicles and the risk of respiratory illness. The risk of asthma increases by 50% for Australians that live within 200 m of a major road.[35] EPA Victoria currently monitors air quality alongside only one major roadway in Victoria (in Melbourne's CBD), which is insufficient to understand the impact of air pollution in Victoria associated with motor vehicles.

Recommendation 17: That EPA Victoria, in coordination with other Victorian Government agencies, improve transport-related air and noise monitoring, including:

- **developing a real-time noise-monitoring network across Melbourne (with a view to expansion across larger cities in regional Victoria), focusing on monitoring near major transport hotspots that include busy roads, flight paths and along public transport routes**
- **increasing the number of roadside air-monitoring stations**
- **publishing the noise and air data on the internet in real-time.**

Note: this recommendation complements recommendation 3: Improve air-quality assessment capability.

35. Bowatte G et al. 2017, 'Traffic-related air pollution exposure is associated with allergic sensitization, asthma, and poor lung function in middle age', Journal of Allergy and Clinical Immunology, 139(1), pp. 122-129.e1.

Accounting for the Environment

Transport is a source of pollution and a user of energy. Under the System of Environmental-Economic Accounting (SEEA), pollution is categorised as a residual flow from the economy to the environment. Transport pollution includes noise, odour, GHGs and other air emissions.

In environmental-economic accounting, air emissions from transport can be reported in air-emissions accounts where they are attributed to households, government, the transport industry or other industries. This allows consistency with the sector classifications used in the traditional System of National Accounts (SNA). Over time, air emissions accounts can be compared with economic activity reported in the SNA to track the emissions intensity of sectors and industries. Accounts information can also be used to evaluate efforts by government, industry and households to reduce emissions. (Air-emissions accounts are discussed further in the Air Quality chapter.)

The transport sector is also a user of energy. Under the SEEA, energy-use accounts report the use of different energy products (such as oil or electricity) by different sectors and industries consistent with the SNA, including the transport industry. Over time, energy accounts can be used to track how the energy-use profile of the transport industry is changing – for example, with the increased uptake of electric vehicles or improvements in the efficiency of energy-use by the transport industry.