

Greater Wellington Region On-road Transport Emissions

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Greater Wellington Region On-road Transport Emissions

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Prepared by

AECOM Name 2
Address 1, Address 2, Address 3, Address 4, Address 5
T 000 000 0000 F 000 000 0000 www.aecom.com
ABN 00 000 000 000

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 Checker/s Adam Swithinbank
 Verifier/s Anthony Hume

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Executive Summary

This section details the additional analysis undertaken to further breakdown Greater Wellington's on-road transport sector Greenhouse Gas (GHG) emissions which represented 35% of Greater Wellington's total gross emissions in the 2021/22 financial year Emissions Inventory.

The focus of this additional analysis addresses emissions produced from on-road transport in the 2021/22 financial year and examines trends in on-road transport emissions from 2018/19 to 2021/22. Within on-road transport emissions, this assessment looks at the relative contribution of each vehicle type (Cars, Commercial Vehicles, Buses) to Greater Wellington's transport emissions.

The calculations are based on fuel sales in the region, Vehicles Kilometres Travelled (VKT) and emissions data from Waka Kotahi, and fleet changes data from various sources. The total emissions align with the results of the 2021/22 Emissions Inventory.

Key findings of this additional analysis include:

2021/22 Transport Emissions by vehicle type

- Cars represent 63% of Greater Wellington on-road transport emissions, and 16% of Greater Wellington total gross emissions.
- Light commercial vehicles represent 20% of Greater Wellington's on-road transport emissions and 5% of Greater Wellington's total gross emissions.
- Heavy commercial vehicles represent 15% of Greater Wellington's on-road transport emissions and 4% of Greater Wellington's total gross emissions.
- Electric cars currently represent 0.08% of Greater Wellington on-road transport emissions (803 tCO₂e). Electric cars accounted for 0.79% of on-road VKT in 2021/22.
- Cars represent 72% of all Vehicle Kilometres Travelled (VKT) in Greater Wellington but represent 63% of all on-road emissions in Greater Wellington.
- 25-50+ tonne heavy vehicles represent 4% of all Vehicle Kilometres Travelled (VKT) in Greater Wellington but represent 12% of all on-road emissions in Greater Wellington.
- Wellington City represents 31% of Greater Wellington's on-road emissions. The areas with the lowest proportion of the region's emissions are Carterton, South Wairarapa, and Masterton.
- Wellington City has the lowest on-road emissions per capita followed by Lower Hutt and Upper Hutt. The highest emissions per capita are found in South Wairarapa and Carterton.

Changes in Transport Emissions, 2018/19 to 2021/22

- On-road transport emissions decreased 9% between 2018/19 and 2021/21, with COVID-19 restrictions impacting the 2019/20 and 2021/22 years. We expect 2022/23 to have higher on-road transport emissions than 2021/22.
- Car emissions decreased 10% between 2018/19 and 2021/21.
- Light commercial vehicle emissions decreased by 4% while heavy commercial vehicle emissions decreased by 7% between 2018/19 and 2021/21
- Hybrid car emissions increased by 172%, from 0.5% to 1.5% of all on-road transport emissions.
- Electric car emissions increased by 198%, from 0.02% to 0.08% of all on-road transport emissions.
- On-road emissions decreased in all areas of the region, however the rate of change differed. The greatest percentage change in on-road transport in the region was in Kāpiti Coast (-15%) and Wellington City (-12%), with the lowest percentage changes in Lower Hutt (-2%) and Upper Hutt (-2%). The largest on-road emissions change was in Wellington City where emissions reduced by 41,177 tCO₂e between 2018/19 and 2021/22, followed by Kapiti Coast (-21,210 tCO₂e).

1.0 Methodology

The basis for this assessment is the results presented in the Greater Wellington Region Emissions Inventory for the financial year 2021/22 (July 1st to June 30th). The emissions for on-road transport have been calculated based on the sale of petrol and diesel within the geographic area for each year, and then these have been broken down by sector and vehicle type using data provided by Waka Kotahi and the Energy Efficiency and Conservation Authority (EECA).

Data provided by Waka Kotahi covering an estimate of emissions (by gas) for each territorial authority by vehicle class in 2018/19 has been used to assess the relative contribution of vehicle class types to on-road transport emissions in Greater Wellington in 2018/19. Waka Kotahi Vehicles Kilometres Travelled (VKT) and other national and regional vehicle fleet data from Ministry of Transport covering the years from 2018/19 to 2021/22 has been used to estimate changes in on-road emissions during this period, aligning with the results of the 2021/22 Emissions Inventory.

Emissions related to energy use from electric vehicles (EVs) is included in the Stationary Energy sector and not included in transport emissions in the Emissions Inventory due to lack of available data at the time of calculation. However, the total emissions presented here include the EV emissions contribution. These emissions have been calculated using an average electricity consumption per km travelled and are based on the carbon intensity of the national electricity grid in 2021/22.

All calculated emissions have been converted to tonnes of CO₂ equivalent (tCO_{2e}) to allow direct comparison with the results of the Community Carbon Footprint.

Definition of on-road vehicle categories¹:

- Light duty vehicles:
 - Cars: passenger cars and sports utility vehicles (SUVs). This includes passenger cars and SUVs used for commercial purposes (e.g. taxis).
 - Light commercial vehicles: Utes and vans with gross vehicle mass up to 3.5 tonnes
- Heavy duty vehicles:
 - Heavy commercial vehicles: commercial vehicles with gross vehicle mass higher than 3.5 tonnes
 - Buses with gross vehicle mass higher than 3.5 tonnes

Key Limitations

- On-road transport data is limited at the local level for recent years, so this assessment utilises national, regional, and local data to present results at the local level for 2019/20 to 2021/22.
- There will be differences in methodology and assumptions between the calculation of on-road emissions in the Emissions Inventory and in Waka Kotahi's dataset. The results presented here take the Waka Kotahi data and adjust it to align with the Emissions Inventory results to account for this.
- The electricity contribution to plug-in hybrid vehicle emissions has not been calculated for this assessment, however it is assumed to have a minimal impact on results.
- Data used for this assessment is based on modelling results provided by Waka Kotahi, there are inherent assumptions within all modelling.

¹ <https://www.nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Air-quality/Planning-and-assessment/Vehicle-emissions-prediction-model/VEPM-6.3-technical-report-2022.pdf>

2.0 On-Road Transport Emissions in 2021/22

On-road transport emissions are those relating to cars, commercial vehicles (including utes, trucks, and large commercial vehicles), and buses on-roads. On-road transport is the largest contributor to Transport emissions, representing 74% of Transport emissions and 26% of Greater Wellington's total gross emissions. This is followed by marine, air, and off-road transport.

Table 1 and Figure 1 detail on-road transport emissions per vehicle category. The results show that cars in Greater Wellington tend to be fuelled by petrol while Commercial Vehicles and Buses almost exclusively use diesel. Buses are almost exclusively diesel fuelled (excluding some electric buses in Wellington City) and contribute 2% of total vehicle emissions to the city. The buses category includes public transport, school buses, and private commercial buses (including tourist coaches).

Electric Vehicle (EV) car use is currently low within the Greater Wellington resulting in an extremely small contribution to on-road transport emissions (803 tCO_{2e} or 0.08% of on-road transport emissions). Note that sales and use of electric vehicles have increased since 2018/19 and are expected to increase further but will still represent an extremely small contribution to on-road transport emissions, especially as they produce vastly lower emissions in use than other vehicle types.

In Greater Wellington, the largest contributor to on-road transport emissions are cars, representing 63% of on-road transport emissions, and 16% percent of Greater Wellington's total gross emissions. Commercial vehicles represent 35% of on-road transport emissions, and 9% percent of Greater Wellington total gross emissions.

Table 1 On-road transport emissions by vehicle type and fuel type in 2021/22 (tCO_{2e})

Vehicle Type	Petrol	Diesel	Electric	Total	% of Total
Cars	569,366	57,807	803	627,976	63%
Commercial Vehicles	32,914	315,777	17	348,708	35%
Buses	-	16,170	238	16,408	2%
Total	602,280	389,754	1,058	993,092	
% of Total	61%	39%	0.11%		

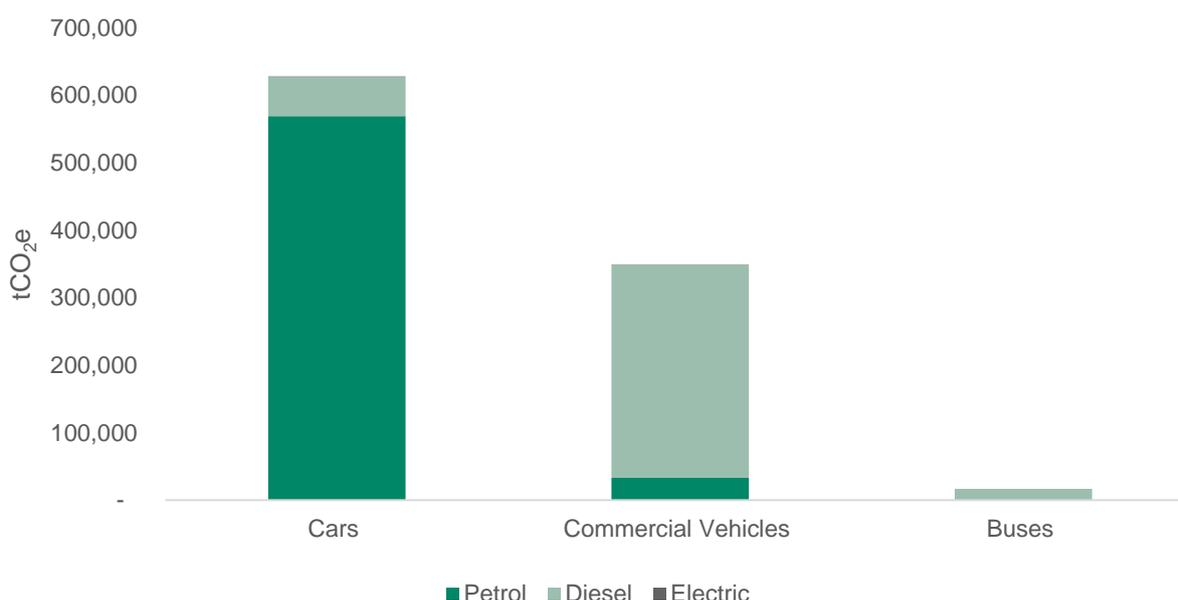


Figure 1 On-road transport emissions by vehicle type and fuel type in 2021/22

Emissions from these vehicle types can be broken down further by vehicle class. Table 2 details on-road transport emissions per vehicle class.

Table 2 On-road transport emissions by vehicle class in 2021/22 (tCO₂e)

Vehicle Class	GHG Emissions (tCO ₂ e)	% of Total
Cars	627,976	63%
Light Commercial Vehicles <3.5 Tonne	202,901	20%
Heavy Vehicles 3.5-25 Tonne	31,255	3%
Heavy Vehicles 25-50+ Tonne	114,552	12%
Bus Urban 15-18 Tonne	14,937	2%
Bus Coach >18 Tonne	1,471	<1%
Total	993,092	100%

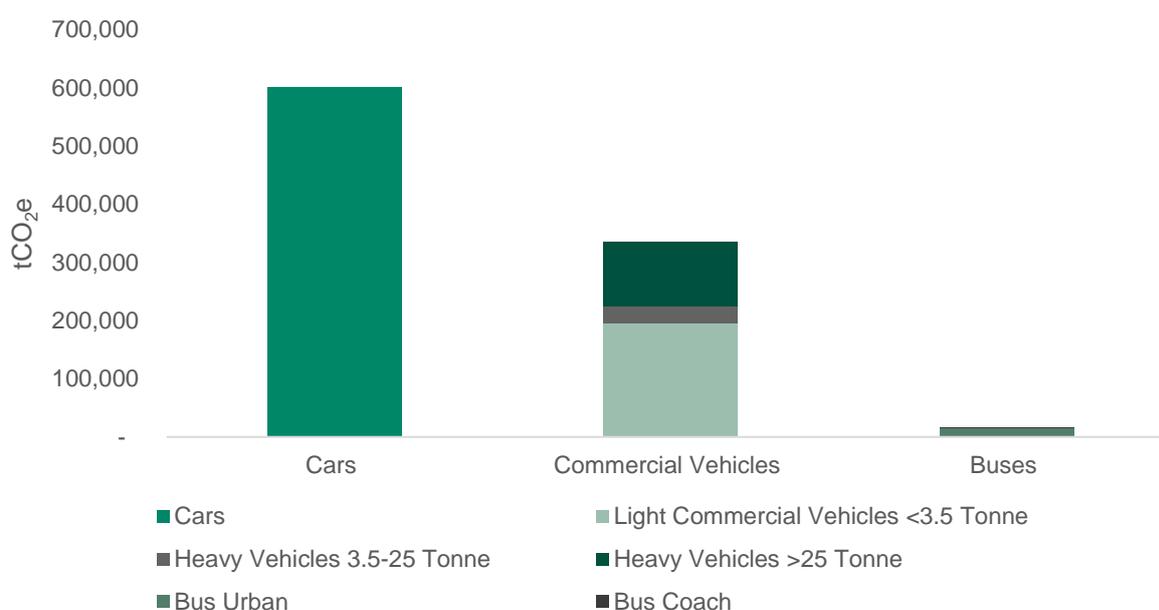


Figure 2 On-road transport emissions by vehicle class in 2021/22

Alongside total transport emissions, we can also look at emissions compared to distance travelled by different vehicle types. Table 3 shows the emissions per vehicle class as above but also includes the Vehicle Kilometres Travelled (VKT) by each vehicle class in Greater Wellington and shows the average GHG emissions per VKT for each vehicle class. The average GHG emissions per VKT figure was calculated from the distance travelled (as per the Waka Kotahi data) and reported emissions (calculated from fuel sales and broken-down using Waka Kotahi emissions data).

Cars represent 72% of all VKT in Greater Wellington but represent 63% of all on-road emissions in Greater Wellington. This is due to the relatively low average tCO₂e per VKT of cars compared to heavier vehicles (which is also partly due to the use of petrol rather than diesel for cars). Despite 25-50+ tonne heavy vehicles representing 4% of all VKT in Greater Wellington these vehicles represent 12% of all on-road emissions in Greater Wellington. It is important to note that these figures do not consider the weight of freight, or the number of people, being moved per vehicle, where larger vehicles may be more efficient per tonne of freight moved than smaller vehicles, or where busses may be more efficient per person than cars.

Efforts to reduce the kilometres travelled by all vehicles should be considered to reduce emissions from on-road transport. This could include enabling and encouraging increased public transport use or diverting freight from roads onto rail and marine transport options. Efforts to improve the fuel efficiency of all vehicles should also be considered.

Table 3 On-road transport vehicle class VKT, emissions, and calculated average emissions per VKT

Vehicle Type	Vehicle Kilometres Travelled (VKT)	GHG Emissions (tCO ₂ e)	Average tCO ₂ e per VKT*
Cars	2,752,983,682	627,976	0.0002
Light Commercial Vehicles <3.5 Tonne	792,230,479	202,901	0.0003
Heavy Vehicles 3.5-25 Tonne	86,091,386	31,255	0.0004
Heavy Vehicles 25-50+ Tonne	160,424,210	114,552	0.0007
Bus Urban 15-18 Tonne	18,136,022	14,937	0.0008
Bus Coach >18 Tonne	2,752,646	1,471	0.0005
Total	3,812,618,426	993,092	0.003

2.1 Differences across the region

On-road emissions vary across the region. Wellington City represents 31% of Greater Wellington's on-road emissions, with the Lower Hutt representing the next largest proportion at 19%. The areas with the lowest proportion of the region's emissions are Carterton, South Wairarapa, and Masterton.

For all areas of Greater Wellington, cars represent the largest proportion of on-road emissions, with the highest proportion in Wellington City (66%) and Lower Hutt (65%). In Masterton, Carterton, and South Wairarapa cars represent between 51% and 52% of on-road emissions, with commercial vehicles (light and heavy) representing 46% of on-road emissions, this is the highest proportion of commercial vehicles in the region.

Table 4 On-road transport emissions by vehicle type for the territorial authorities in Greater Wellington

Vehicle Type	Wellington City	Lower Hutt City	Porirua City	Kāpiti Coast District	Upper Hutt City	Masterton District	South Wairarapa District	Carterton District
Cars	201,685	124,866	88,009	77,262	51,664	36,921	25,875	21,694
Commercial Vehicles	100,966	61,399	45,350	39,149	26,207	33,303	23,053	19,282
Buses	4,503	2,477	2,355	2,000	1,277	1,707	1,099	990
Total	307,153	188,742	135,714	118,410	79,148	71,931	50,027	41,967

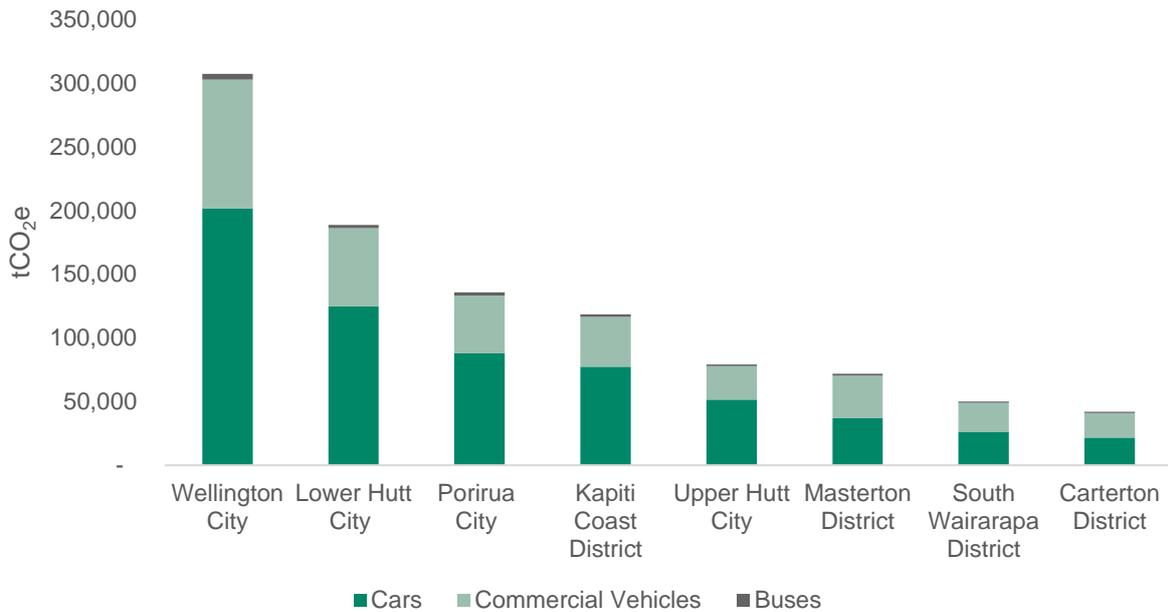


Figure 3 On-road transport emissions by vehicle type in 2021/22

When we account for population differences, Wellington City has the lowest on-road emissions per capita followed by Lower Hutt and Upper Hutt. The highest emissions per capita are found in South Wairarapa and Carterton. Lower public transport access, longer distances to travel between home, work, leisure, and amenities, and a greater proportion of higher emitting vehicles (such as utes) contributes to the high per capita on-road emissions in South Wairarapa and Carterton.

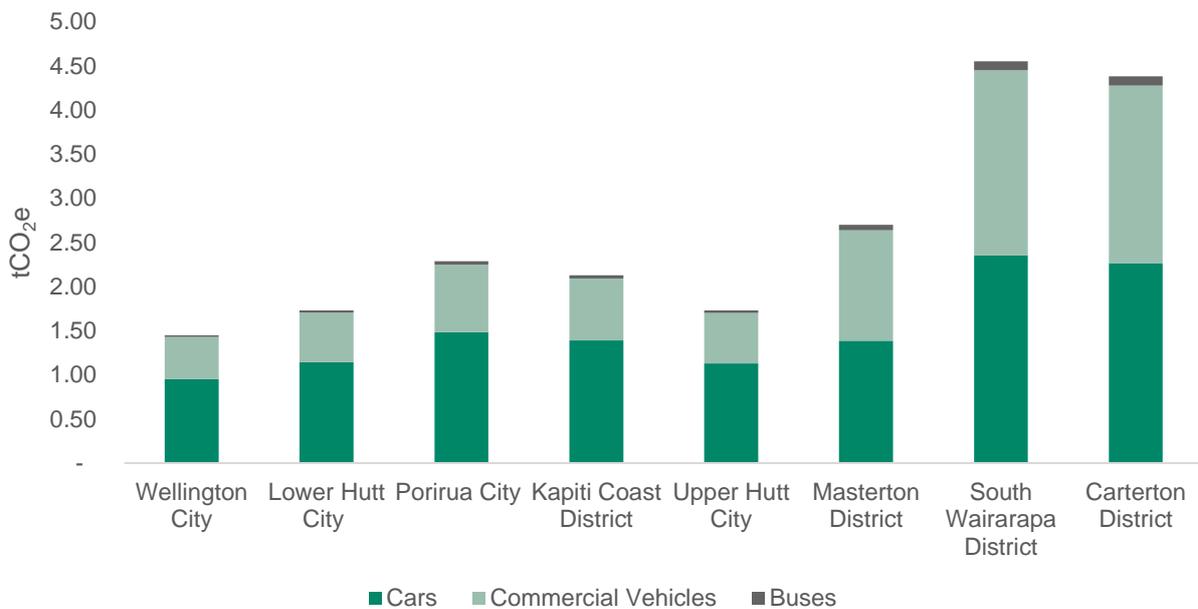


Figure 4 On-road transport emissions per capita by vehicle type in 2021/22

3.0 On-Road Transport Emissions Change from 2018/19 to 2021/22

Transport emissions decreased by 18% between 2018/19 and 2021/22 (290,361 tCO₂e). This was driven by a 158,572 tCO₂e decrease in Jet Kerosene (aircraft fuel) emissions and a 97,500 tCO₂e reduction in on-road fuel use emissions. On-road fuel use emissions (petrol and diesel) decreased by 9%, with an 11% decrease in on-road petrol emissions.

This section displays the change in on-road transport emissions from 2018/19 to 2021/22.

Table 5 Change in on-road transport emissions by vehicle type (tCO₂e)

Vehicle Type	2018/19	2019/20	2020/21	2021/22	% Change (2018/19 to 2021/22)
Cars	701,282	627,546	691,490	627,976	-10%
Commercial Vehicles	367,176	343,119	372,680	348,708	-5%
Buses	21,405	18,828	18,121	16,408	-23%
Total	1,089,862	989,492	1,082,291	993,092	-9%

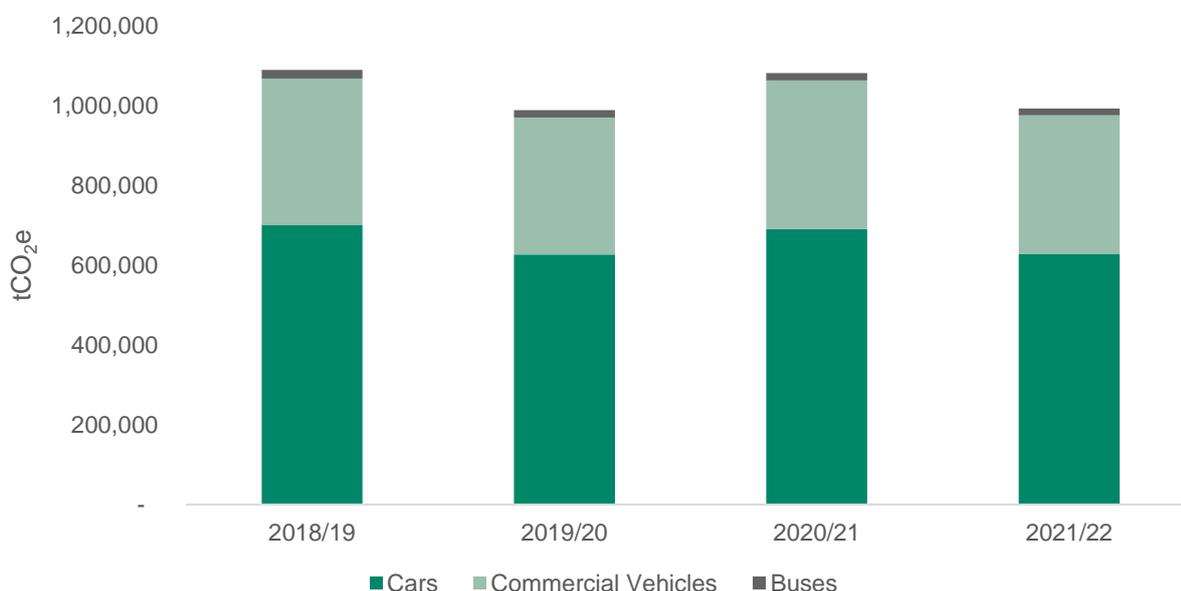


Figure 5 On-road transport emissions by vehicle type 2018/19-2021/22

The results show that the main cause of decreased on-road transport emissions between 2018/19 and 2021/22 is a 10% reduction in car emissions (-73,306 tCO₂e). By looking at the results we can see the impact of COVID-19 travel restrictions in Greater Wellington in 2019/20 and 2021/2022, particularly affecting car emissions. During these years there were period of time where travel was restricted. Commercial vehicle emissions appear to have been less affected by the COVID-19 restrictions. With no significant disruptions to travel in 2022/23, we expect 2022/23 to have higher on-road transport emissions than 2021/22.

Despite a significant decrease in car emissions, the total VKT for the Region as provided by Waka Kotahi has increased by 1% between 2019/20 and 2021/22. This is potentially driven improvements to average vehicle efficiency, including by the increased use of electric and hybrid vehicles, whose VKT has increased by 195% and 197% respectively. We also see a decrease in average emissions per VKT from 2018/19 to 2021/22 for cars (-11%), commercial vehicles (-10%) and busses (-8%). This suggests

potential improvements to driving efficiency of vehicles. It is however important to note that the VKT figures used for this calculation are based on data supplied by Waka Kotahi and may not reflect transport movements in the Region as accurately as the exact fuel sales data used to calculate the emissions reported in the Emissions Inventory for each year. Caution should be taken when examining emissions per VKT.

Table 6 Change in average emissions per vehicle kilometre travelled (tCO₂e per VKT)

Vehicle Type	2018/19	2019/20	2020/21	2021/22	% Change (2018/19 to 2021/22)
Cars	0.0003	0.0002	0.0003	0.0002	-11%
Commercial Vehicles	0.0004	0.0003	0.0004	0.0003	-10%
Buses	0.0009	0.0009	0.0008	0.0008	-8%

Table 7 Change in on-road transport emissions by vehicle class (tCO₂e)

Vehicle Type	2018/19	2019/20	2020/21	2021/22	% Change (2018/19 to 2021/22)
Car Petrol	628,853	560,118	616,794	554,904	-12%
Car Diesel	66,845	60,322	62,833	57,807	-14%
Car Hybrid	5,315	6,719	11,333	14,462	172%
Car Electric	269	387	530	803	198%
Light Commercial Vehicles	210,325	198,348	217,437	202,901	-4%
Heavy Commercial Vehicles	156,851	144,771	155,243	145,807	-7%
Buses	21,405	18,828	18,121	16,408	-23%
Total	1,089,862	989,492	1,082,291	993,092	-9%

When we look at car emissions in more detail, the majority of the emissions change is due to a 12% (-73,948 tCO₂e) reduction in petrol car emissions. The next largest emissions change is from heavy commercial vehicle where emissions decreased by 7% between 2018/19 and 2021/21 (-11,044 tCO₂e).

Notably, bus emissions decreased by 23%, potentially due to improvements in the efficiency of busses, and the transition to electric busses in Wellington City.

The only vehicle types whose emissions increased during this time are hybrid and electric cars. There has been a large growth in the number of these vehicles in Greater Wellington and emissions have grown in line with this increase. However, these vehicles still represent a very small proportion of on-road emissions and are vastly lower emitting than the equivalent internal combustion engine vehicles.

On-road emissions decreased in all areas of the region, however the rate of change differed. The greatest percentage change was in Kāpiti Coast (-15%) and Wellington City (-12%), with the lowest percentage changes in Lower Hutt (-2%) and Upper Hutt (-2%). The largest on-road emissions change was in Wellington City where emissions reduced by 41,177 tCO₂e between 2018/19 and 2021/22, followed by Kapiti Coast (-21,210 tCO₂e).

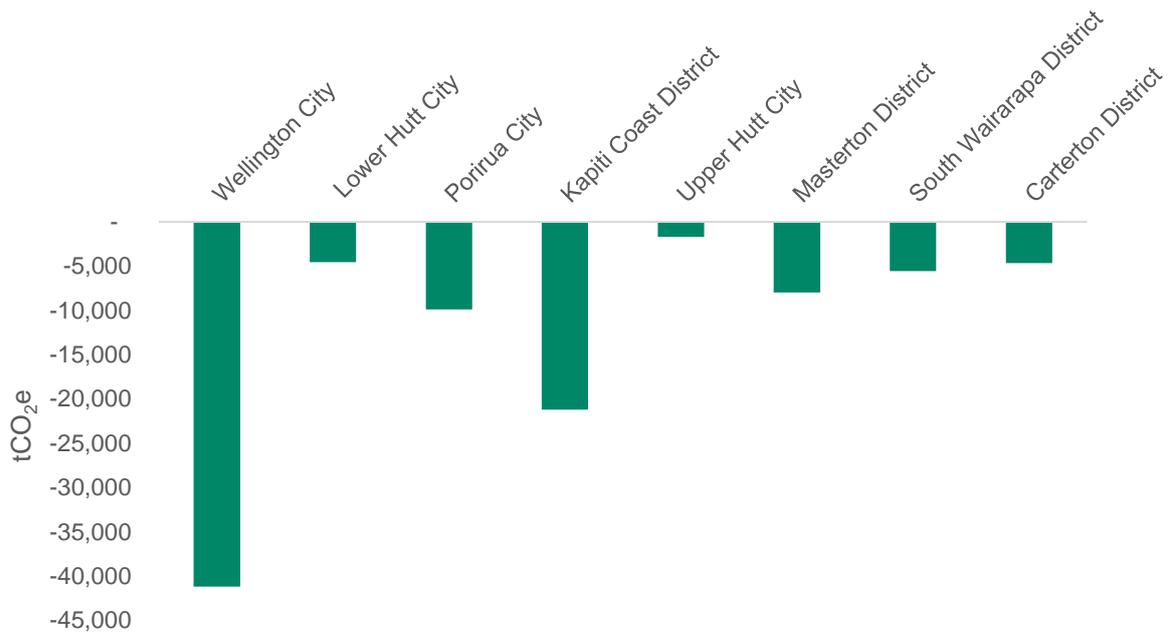


Figure 6 Change in on-road transport emissions by vehicle type 2018/19-2021/22

4.0 Limitations

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