



**TRANSPORT
SCOTLAND**
CÒMHDHAIL ALBA

Scottish Transport Statistics 2023

Transport Environment

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Introduction

This chapter provides information about the impact of transport on certain aspects of the environment with a focus on greenhouse gas emissions and air quality. Statistics include atmospheric pollutants and emissions of greenhouse gases by types of transport as well as details of emissions levels of road vehicles. Data from other chapters within Scottish Transport Statistics are referred to in the analysis.

Key points

- In 2021 (the most recent year available), transport (including international shipping and aviation) accounted for 28% of Scotland's greenhouse gas emissions under the definition set out in the Climate Change Scotland Act.
- Road transport made up 75% of transport greenhouse gas emissions.
- In 2022 there were 21,980 Ultra Low Emission Vehicles registered in Scotland for the first time – 23% up on 2021.
- In 2021, transport accounted for 59% of emissions of oxides of nitrogen, 17% of particulate matter PM₁₀ and 22% of particulate matter PM_{2.5}. As at 26 October 2023, there were 42 active Air Quality Management Areas related to these pollutants.

Main Points

Air pollutant emissions

The main pollutants of current concern in Scotland are:

- Nitrogen oxides (NO_x);
- Particulate matter (PM₁₀ and PM_{2.5});
- Sulphur dioxide (SO₂);
- Non-methane volatile organic compounds (NMVOCs);
- Ground-level ozone (O₃); and
- Ammonia (NH₃).

Of these pollutants, transport is a significant contributor to emissions of oxides of nitrogen and particulate matter. Transport is also linked to ground level ozone, which is a secondary pollutant produced by chemical reactions involving oxides of nitrogen.

Historically, transport was also a major contributor to emissions of lead and non-methane volatile organic compounds (NMVOCs). The significant decline in lead emissions (98% since 1990) has been mainly driven by the progressive phasing out of leaded petrol. The lead content of petrol was reduced from around 0.34 g/l to 0.143 g/l in 1986. From 1987, sales of unleaded petrol increased, particularly as a

result of the increased use of cars fitted with three-way catalysts. Leaded petrol was phased out from general sale at the end of 1999. For NMVOCs, transport sector emissions declined significantly during the 1990s due to the increased use of catalytic converters and fuel switching from petrol to diesel cars. (Chart 13.1a – note that the jump observed in 2005 is due to a revision of the figures for 2005 onwards, as detailed in the notes and definitions section 13.3.6).

Emissions of nitrogen oxides (NO_x) were estimated to be 83kt in 2020 of which transport accounted for 59%. Since 1990, transport emissions have declined by 68%. Transport emissions have declined due to a number of reasons including the requirement for new petrol cars to be fitted with three-way catalysts since 1989 and, in more recent years, “Euro standards” for new cars have driven a reduction in emissions, although studies show that the diesel Euro 5 cars have not performed as well as expected. Since 2008, there has been a general reduction in the emissions from passenger cars, mainly driven by improvement in catalyst repair rates. In 2021, diesel cars and light goods vehicles (LGVs) accounted for 27% of NO_x emissions from transport compared with less than 2% in 1990 (Table 13.1a).

Emissions of PM₁₀ were estimated to be 12kt in 2021, of which transport accounted for 17%. Since 1990, transport emissions have declined by 71%. For particulate matter, the main source of transport emissions is non-exhaust emissions from tyre and brake wear and road abrasion. In 2021, these accounted for 62% of PM₁₀ emissions from transport compared with 14% in 1990. Since 1990, exhaust emissions from road transport have decreased by 89% due to the penetration of new vehicles meeting tighter PM₁₀ emission regulations (“Euro standards” for diesel vehicles were first introduced in 1992). Over the same period emissions from shipping fell by 87% (Table 13.1a).

Emissions of PM_{2.5} were estimated to be 7kt in 2021 of which transport accounted for 22%. Trends in emissions of PM_{2.5} from transport follow a similar pattern to those for PM₁₀. PM_{2.5} accounts for all road transport exhaust emissions and most of such emissions from shipping but only around 49% of PM_{2.5} emissions are due to road abrasion and tyre and brake wear.

There has been a notable difference in the changes observed for NO₂, PM₁₀ and PM_{2.5} for 2019 to 2020 compared to the earlier year-to-year changes. From 2012-2019 the annual decreases for all three pollutants have been below five percent. By contrast the decreases from 2019 to 2020 were 13 percent for NO₂, 12 percent for PM₁₀ and 10 percent for PM_{2.5}. This is likely to have been strongly influenced by the reduction in vehicle use during the restrictions which were in place during 2020 due to the Covid-19 pandemic. However, between 2020 and 2021 there were increases of 1 percent for NO₂, 7 percent for PM₁₀ and 6 percent for PM_{2.5}.

Air quality

Concentrations of air pollutants are sampled at automatic monitoring sites and the information is held in the “Scottish Air Quality Database” on the “Air Quality in Scotland” website (<http://www.scottishairquality.co.uk/>). The data section of the “Air Quality in Scotland” website provides detailed information on all sites while the publication section of the website includes reports showing trends. Table 13.b in this publication shows concentrations of nitrogen dioxide, ozone and PM10 at a mixture of urban and rural monitoring sites with long time series. Air quality is monitored against standards set as air quality objectives (see environment section of the user guide).

Nitrogen dioxide (NO₂)

For many of the selected monitoring sites, nitrogen dioxide concentrations show a downward trend. In 2022 three of the 8 selected operational sites that recorded nitrogen dioxide concentrations with a data capture rate of over 75% had the lowest concentrations recorded over the period 2011-2022. In 2022, 73 sites in Scotland recorded nitrogen dioxide concentrations with a data capture rate of over 75%, of which 61 were roadside or kerbside locations. None of these 73 sites had concentrations in excess of the air quality strategy objective of 40 µg/m³ as an annual mean (Table 13.1b).

Ozone (O₃)

Though transport emissions contribute to ozone formation, levels of ozone are generally higher in rural areas due to the long-range transportation of primary pollutants from urban sources. In addition, ozone reacts with nitric oxide, which is more abundant in urban areas due to traffic emissions, to form nitrogen dioxide; therefore ozone levels are usually lower in urban areas. While at the selected monitoring sites there has been some indication of a downward trend in the number of occurrences of maximum daily concentrations exceeding 100 µg/m³, this has since levelled off. There appears to be no clear trend in average annual concentrations. In 2022, all of the 9 sites in Scotland recording ozone with a data capture rate of over 75% met the air quality objective of no more than 10 occurrences of the maximum daily concentrations exceeding 100 µg/m³ (Table 13.1b)

Particulate matter (PM₁₀)

PM₁₀ concentrations show a general downward trend at the selected sites. In 2022, of the 71 sites in Scotland recording PM₁₀ with a data capture rate over 75%, no

sites had concentrations greater than the air quality objective of 18 $\mu\text{g}/\text{m}^3$ as an annual mean. One site (Edinburgh St John's Road) exceeded the air quality objective set as 7 occurrences of a daily mean above 50 $\mu\text{g}/\text{m}^3$. (Table 13.1b)

Air Quality Management Areas

Whenever it appears that one or more of the air quality objectives is unlikely to be met by the required date, the local authority concerned must declare an Air Quality Management Area (AQMA) covering the area of concern. The authority must then prepare and implement an action plan outlining how it intends to tackle the issues identified. Table 13.1c summarises active AQMAs and the pollutants of concern. As at 26 October 2023, there were 42 active AQMAs, all but one of which related to either NO₂ or PM₁₀, or both. (Table 13.1c)

Greenhouse gases

In 2021, Transport (*including* international aviation and shipping) accounted for 12 million tonnes of carbon dioxide equivalent (MtCO_{2e}). This represents 27.9% of total net greenhouse gas emissions allocated to Scotland in the *Greenhouse Gas Inventories*, 2% higher than 2020. Total net emissions from *all* sources increased by 4% between 2020 and 2021 rising from 40.0 MtCO_{2e} to 41.6 MtCO_{2e}, with transport total emissions having increased from 10.3 MtCO_{2e} to 11.6 MtCO_{2e}, an increase of 12%. Within Transport emissions, Road Transportation accounted for approximately 75.5% of the transport total. Heavy Goods Vehicles and Light Goods Vehicles were the other significant contributors to transport emissions accounting for 15.7% and 15.4%, respectively. International Aviation and Shipping contributed roughly 6.0% and domestic aviation 2.6% of transport's total emissions. The contribution from domestic shipping, 14.8%. It should be noted that these estimates use a methodology designed to produce internationally-comparable figures so apparent year-to-year fluctuations could be due in part to limitations in or changes to the underlying data or calculations. See *Table 13.2* for more detail and emissions from earlier years and the user guide for more detail on the methodology used.

Figure 13.2 shows transport emissions over time, by mode. Estimated car emissions have fallen by 24% since 2006. Traffic levels (vehicle km) have increased slightly over the last few years so the reduction in emissions seen will be due to the introduction of more fuel efficient vehicles as well as other more fuel efficient driving, particularly in the business fleet. More detail on car emissions is set out from paragraph 2.16 of this chapter while more details on traffic volumes by mode can be found in chapter 5 of STS. Details of personal modal choice can be found in chapter 11.

The *Greenhouse Gas Inventories* report the emissions of the six gases that are listed under the Kyoto Protocol. In the case of transport, the quantities of gases involved are relatively small except for carbon dioxide, which accounts for about 99 per cent of transport's total. (*Table 13.3*).

Table 13.4 presents some comparisons between the UK as a whole and Scotland. Overall, Scotland's transport emissions account for 9% of the UK total. At 14% Scottish bus emissions are above a proportionate share of the UK total, while domestic aviation, at 16%, is also above that benchmark.

Estimates of carbon dioxide emissions per passenger-km for different modes of transport are available only for GB/UK as a whole. The lowest emitting modes of land transport per passenger-km are coaches at 27 gCO_{2e}; and light rail and tram at 29 gCO_{2e}. Both diesel and petrol cars are the highest emitters per passenger-kilometre and account for 164-170 grams of CO₂ per passenger kilometre (*Table 13.5*). The basis of these estimates is described in the environment section of the user guide.

Car emissions

Newly registered cars are becoming more fuel efficient and thus generally emit fewer emissions per kilometre. Figure 13.3 shows the steady downward trend in average CO₂ emissions for newly registered cars in Scotland. Average CO₂ emissions in Scotland for new car registrations has fallen by 11 per cent over the last ten years. However, since a low of 120 for CO₂ in 2016 there has been a steady rise to 128.9 in 2020 before falling back to 119 in 2022. (*Table 13.6a*)

The proportion of newly registered cars with emissions of 150g/km or lower has decreased from 83 per cent in 2012 to 80 per cent in 2022. Cars with emissions of over 191g/km have increased from 3.4 per cent of new cars in 2012 to 3.8 per cent. These changes are at least in part the result of changes to vehicle excise duty bandings made by the UK Government in recent years.

Ultra low emission vehicles (ULEV)

The number of ultra-low emission vehicles registered in Scotland for the first time in 2022 was 21,980, 23% up on the corresponding figure for 2021 (17,900). At the end of 2022 there were 64,447 ULEVs registered in Scotland (*Table 13.7 and 13.8*)

Registrations by type of vehicle

The overwhelming majority (95 per cent) of vehicles licensed for use on the roads in Scotland are still powered by either petrol or diesel. Historically petrol powered

vehicles have been outsold by diesel vehicles although in recent years petrol vehicles have been outselling diesel. Overall though there are more petrol vehicles on the road than diesel ones. While 33 per cent of all diesel vehicles are body types other than cars only 6 per cent of petrol vehicles were not cars. (*Table 13.9 and 13.10*)

Electric Vehicle (EV) charge points

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The shift to electric vehicles is an important part of responding to the climate emergency and improving air quality in our towns and cities. To help incentivise this shift, we have invested over £65 million in ChargePlace Scotland, Scotland's public charging network, which now has more than 2,700 publicly available charge points. Scotland is leading the way on electric vehicle charging infrastructure. The latest figures show that Scottish electric vehicle drivers benefit from 77 public charge points per one hundred thousand people, compared to 75 in England (regional totals and London excluded), 66 in Wales and 23 in Northern Ireland.

A map showing the locations of the charging points in Scotland is available here <https://chargeplacescotland.org/cpmap/> (*Table 13.11*)



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