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This section covers trends in motorised individual road transport and topics of road vehicle activity, vehicle sales, autonomous road vehicles, congestion and road safety. Road-based public transport is covered in *4.5 Public Transport*, and informal collective transport services are covered in *4.6 Informal Transport*.

Road Transport



KEY FINDINGS

- Road transport is a crucial part of transport and mobility systems globally, yet persistent challenges remain in terms of sustainability, resilience, access and safety. Increasing resilience and access to roads is critical to development, connectivity, equity and economic growth.
- Road transport is the largest contributor to greenhouse gas emissions of all transport sub-sectors – contributing nearly three-quarters (74%) of total transport emissions in 2023. Thus, policies aimed at reducing these emissions are essential to achieve decarbonisation goals and meet climate targets.
- Automobiles and motorised two- and three-wheelers are often the largest source of air and noise pollution in cities, with significant impacts on people's health and well-being as well as on the environment. An estimated 99% of the global population is exposed to particulate matter ($PM_{2.5}$) levels above the safe guidelines of the World Health Organization (WHO), with low- and middle-income countries experiencing the worst exposure.
- High demand for motorised road transport can lead to declining road safety, with a greater likelihood of road crashes and fatalities. In 2021, an estimated 1.2 million people died in road traffic crashes globally, and 50 million people were left injured, with most fatalities occurring among vulnerable road users such as pedestrians, cyclists and motorcyclists.
- Low- and middle-income countries bear the brunt of these impacts, accounting for 93% of road deaths, with Africa seeing the highest rate of 18.8 fatalities per 100,000 people, above the global average of 15 fatalities per 100,000 people.
- With 85% of the world's lower-income population living in rural areas, governments have increasingly recognised the importance of improving rural transport and creating rural-urban connections to narrow the development gap.
- Fossil fuels continued to account for around 95.4% of the energy used in road transport in 2023 – a share that has barely changed *in the past five decades* – and vehicle-centric models persist. A fundamental shift is necessary to transform this long-engrained approach to road transport.
- Alongside policies to advance zero-emission vehicle use, fuel efficiency standards, and renewable energy, governments at all levels need to prioritise policy and behaviour change measures that encourage shifts towards rail and inland waterways for freight transport and towards walking, cycling, informal (shared) and public transport for passenger transport – while reducing the need for total vehicle travel.



KEY FINDINGS



Demand, use and access

- emand for both passenger and freight road transport has increased in recent years, characterised by shifts in mode share to more road vehicles, changes in patterns of vehicle-kilometres travelled, mainstreaming of electric vehicles (EVs), and increasing interest in artificial intelligence (AI) and autonomous vehicles.
- Global demand for passenger transport grew 10% between 2019 and 2025 (modelled values), reaching 68.3 trillion passenger-kilometres in 2025. Road transport alone accounted for an estimated two-thirds (67%) of passenger mobility globally in 2025, although this share varies highly by location and to some degree urban density.
- In 2022, the absolute number of cars grew to a global average of 219 four-wheeled vehicles per 1,000 people, with much higher averages in North America (805), Europe (588) and Oceania (587). In many low- and middle-income countries, most of the vehicle growth has been in two- and three-wheelers, which tend to outnumber cars in these locations.
- Despite advances in road infrastructure and connections, more than 1 billion people globally did not have access to all-weather roads as of 2019, particularly in low- and middle-income countries and in rural places. Only 38% of the global rural population had access to all-weather roads as of 2019.
- Global freight activity grew an estimated 8% between 2020 and 2025 (modelled values), surpassing 171 trillion tonne-kilometres in 2025. Around 10% of total freight activity in 2025 was transported by road, below the shares for maritime transport (74%) and rail (11%). However, one estimate found that road transport accounted for 22% of total freight activity in 2019.
- Emerging countries, particularly in Asia, continued to see increases in freight activity, although most of Asia's freight transport growth was in maritime shipping.
- Road vehicles regained their popularity as production and sales soared to pre-pandemic levels. Sales of all vehicles approached 93 million in 2023 – surpassing 2019 levels (92 million) – after falling sharply to 80 million in 2020 and growing only slightly to 82-83 million during 2021-2022.
- Electric car sales (including plug-in hybrid electric vehicles) reached a sales share of 22% in 2024, totalling a record 17.5 million units. However, growth was slower than in previous years due to stagnating sales in Europe, as government support was reduced or eliminated in some markets and EU-level carbon dioxide (CO_2) targets were not strengthened.
- Larger vehicles such as sport-utility vehicles (SUVs) and pick-up trucks continued to rise in popularity (both conventional and electric models), due to their status appeal in many markets, potential comfort enhancements, and greater marketing efforts by manufacturers due to the larger profit margins.
- In 2023, SUVs surpassed a 50% market share in advanced economies for the first time and accounted for 48% of car sales globally, posing a growing challenge for public space, road safety and emissions. Global SUV revenues were projected to reach USD 1 trillion by 2025.
- Global demand for two- and three-wheelers has continued to increase. Models with internal combustion engines (ICE) remain dominant in most markets, although electric models have gained ground, especially in Asia. Asia has led in two-wheeler growth, with annual sales of ICE models projected to grow 1.6% in 2024 to reach 57 million and then fall to around 56 million by 2028.
- Despite the increase in electrification, global transport energy demand grew more than 21% between 2010 and 2023, with most of this growth being met by fossil fuels. Oil products supplied around 90% of the energy demand for transport in 2023. Road transport alone accounted for 75% of transport energy consumption and 48% of global oil demand that year.
- However, while global oil demand for transport continued to grow annually to 2023, growth in oil demand for road transport continued to decline (with no growth in 2024), due mainly to changes in the Chinese market.
- Integration of AI in passenger cars continued to advance, with the global market reaching USD 41 billion in 2024 and projected to grow nearly three-fold to USD 114.5 billion by 2029.

KEY FINDINGS



Sustainability and climate trends

- As access to convenient public transport and rail has faltered – and as ridership has struggled to recover from pre-pandemic levels in many locations – this has resulted in rising private car and motorcycle use, increased congestion, and worsening pollution and greenhouse gas emissions.
- The persistence of the car-centric paradigm has led to more vehicles on the road, as well as to increasing vehicle size and decreasing vehicle occupancy, which have in turn offset any gains in fuel efficiency.
- Achieving net zero greenhouse gas emissions globally by 2050 will require large emission reductions in the transport sector as a whole and particularly from passenger vehicles and heavy trucks. To reach global net zero goals, CO_2 emission intensity must be reduced more than 94% for trucks and 98% for cars compared to 2020 levels, according to the International Energy Agency's (IEA) Net Zero scenario.
- The road transport sector accounted for 74% of transport greenhouse gas emissions in 2023 and remained far from being on track to a net zero scenario, with constant annual emissions growth of 1.8% to 2% for most years between 2010 and 2023. Road transport emissions neared their pre-pandemic (2019) levels already in 2022 and surpassed them in 2023, reaching 6.2 gigatonnes of CO_2 equivalent.
- Transport emissions from road freight have outpaced those from road passengers, as emissions from road freight grew 23% and from road passengers 16% from 2010 to 2023. This suggests that policies pursuing efficiency improvements and electrification have had a stronger impact for passenger vehicles than freight vehicles. CO_2 emissions from road passenger transport reached 3.75 gigatonnes in 2023, while emissions from road freight reached nearly 2.46 gigatonnes.
- As larger passenger vehicle sizes have gained popularity, their rising energy consumption has posed a growing risk to decarbonisation, leading the IEA to recommend that the auto industry decrease vehicle size. SUVs alone were responsible for more than one-quarter of the total growth in oil consumption globally during 2022-2023.
- Road transport emissions are extremely unequally distributed among countries, with high-income countries contributing the bulk of emissions. The countries with the highest levels of per capita road transport CO_2 equivalent emissions in 2023 were Luxembourg (6.4 tonnes), Qatar (5.1 tonnes), Saudi Arabia (4.4 tonnes), the United States (4.2 tonnes) and the United Arab Emirates (4 tonnes).
- Emission standards have helped limit emissions to some extent where they have been implemented, but much of the world remains uncovered by such standards.
- Decarbonising the power grid is critical for achieving transport decarbonisation, with the aim of supplying cleaner energy for both EV charging and battery production.
- Road safety, health and climate change are interrelated and can influence each other in various ways, with the most direct and severe impacts occurring from road crashes and air pollution.
- Factors contributing to the slow decline in road deaths and injuries include increased road congestion, higher speeds, driver distraction and fatigue from longer commute times.
- Efforts to improve the resilience of road infrastructure have lagged, even as economic losses from infrastructure damage due to climate-related events grew an estimated seven-fold between the 1970s and 2010, to USD 1.6 trillion.
- Traffic congestion returned to pre-pandemic levels already by 2021, and most cities have experienced worsening congestion since 2022.
- Autonomous vehicles have the potential to decrease transport emissions if they are shared and regulated; however, increases in vehicle size and distances travelled could lead to higher emission growth, although these impacts are uncertain.

KEY FINDINGS

Policy and investment developments

- Successful strategies to reduce road transport emissions and create healthier, more sustainable urban and rural areas include a mix of the Avoid-Shift-Improve (A-S-I) framework for both passenger and freight transport.
- Among "Avoid" and "Shift" policies, a few jurisdictions have adopted targets to reduce vehicle travel, particularly at the sub-national level.
- Building roads and establishing urban-rural connections can support economic development; however, if these are not pursued with a sustainable, resilient vision, they can lead to unsustainable auto-centric, sprawling development.
- Investment in inland transport infrastructure (road, rail and inland waterways) has been decreasing in some countries, although several continue to invest heavily in road transport.
- Policies have been adopted at various levels to address road safety, particularly aimed at speed management and sometimes linked to improving the sustainability of transport systems. Research has shown that lowering average speed limits by just 5% can result in a 20% reduction in road deaths.
- Between 2023 and 2025, an increasing number of jurisdictions adopted targets for reducing average vehicle emissions, as well as scrappage policies that help governments accelerate fleet renewal, reduce emissions and encourage the adoption of cleaner, more efficient vehicles.
- In some places, rules for vehicle emission reductions include flexibilities around compliance that hinder their effectiveness, while in other cases emission rules have been weakened or removed altogether.
- EV adoption has been the most common measure for reducing emissions in the road transport sector, since EVs produce far fewer emissions than traditional petrol vehicles but allow for continuation of the auto-centric model. In addition, several governments have adopted targets for full or partial ICE vehicle bans or EV targets, although typically these are only for vehicle sales rather than the overall stock.
- As EV uptake increases, governments have taken steps to support the deployment of charging infrastructure and battery swap stations. However, they may need to develop new taxation approaches to replace the losses in income from fuel taxes on ICE vehicles.
- By 2023, the number of countries with support measures for EVs surpassed those with biofuel blending mandates, which until then had been the most common policy for decarbonising road transport.
- The deployment of EVs will not address concerns such as traffic congestion, urban sprawl and the amount of public space devoted to vehicles. In some places, increases in parking fees in recent years have been correlated with higher use of walking, cycling and public transport.
- For freight transport, low-carbon options include the adoption of fuel-efficient technologies and alternative fuels, carbon pricing mechanisms, promotion of multi-modality, cargo consolidation centres, last-mile sustainable urban logistics and autonomous deliveries. Although policy progress has been slower for freight than passenger vehicles, some advances towards reducing emissions occurred in recent years.





Photo: Dennis Schroeder / NREL

Context, challenges and opportunities

Road transport is a crucial part of transport and mobility systems globally, yet persistent challenges remain in terms of sustainability, resilience, access and safety. Adaptation of road transport infrastructure to climate change continues to receive a small share of global climate finance, while the impacts of natural hazards on transport systems have increasingly large costs. Climate-related impacts have disproportionate effects on low- and middle-income countries, where inadequate roads often already restrict the movement of people and goods.

Increasing resilience and access to roads is critical to development, connectivity, equity and economic growth. Road transport remains the dominant mode for freight movement globally, highlighting the vulnerabilities for trade and commerce with increasing climate change impacts, extreme weather and geopolitical events.[1]

Road transport is the largest contributor to greenhouse gas emissions of all transport sub-sectors – contributing nearly three-quarters (74%) of total transport emissions in 2023.[2] Thus, policies aimed at reducing these emissions are essential to achieve decarbonisation goals and meet climate targets. To achieve an economy with net zero greenhouse gas emissions, road transport must also be net zero. Although some progress has been made through policy adoption and technological advancement, the pace and scale of global emission reductions remain insufficient to meet current net zero targets.[3]

Automobiles and motorised two- and three-wheelers are often the largest source of air and noise pollution in cities, with significant impacts on people's health and well-being as well as on the environment.[4] An estimated 99% of the global population is exposed to particulate matter ($PM_{2.5}$) levels above the safe guidelines of the World Health Organization (WHO), with low- and middle-income countries experiencing the worst exposure.[5] Resulting health costs have continued to rise, as mounting evidence has linked road transport emissions to long-term conditions including asthma, heart disease, dementia and stroke.[6] Auto-centric economies also support sedentary lifestyles, contributing to increased frequency of diabetes, chronic kidney disease and chronic obstructive pulmonary disease.[7]

High demand for motorised road transport can lead to declining road safety, with a greater likelihood of road crashes and fatalities.[8] In 2021, an estimated 1.19 million people died in road traffic crashes globally, and 50 million people were left injured, with most fatalities occurring among vulnerable road users such as pedestrians, cyclists and motorcyclists.[9] Road traffic crashes are the eighth leading cause of death worldwide and the primary cause of death for

young people aged 5-29.[10]

Low- and middle-income countries bear the brunt of these impacts, accounting for 93% of road deaths, with Africa seeing the highest rate of 18.8 fatalities per 100,000 people, above the global average of 15 fatalities per 100,000 people.[11] Annual road deaths globally fell 2% on average during 2010-2019, but this was still well below the 50% reduction target set under the United Nations Decade of Action for Road Safety.[12] The need to accelerate action has resulted in a shift in strategy between the first and second Decades of Action for Road Safety.[13]

With 85% of the world's lower-income population living in rural areas, governments have increasingly recognised the importance of improving rural transport and creating rural-urban connections to narrow the development gap.[14] Efforts to make roads more resilient to climate change also have continued, particularly in rural areas, with growing support from climate finance, although far below necessary levels.

Fossil fuels continued to account for around 95.4% of the energy used in road transport in 2023 – a share that has barely changed *in the past five decades* – and vehicle-centric models persist.[15] **A fundamental shift is necessary to transform this long-engrained approach to road transport.** Resistance to change remains a barrier in most places, even though examples reveal how sectoral transformation can occur, as well as the resulting benefits to climate, air quality, health, congestion relief, etc.

Alongside policies to advance zero-emission vehicle use, fuel efficiency standards, and renewable energy, governments at all levels need to prioritise policy and behaviour change measures that encourage shifts towards rail and inland waterways for freight transport and towards walking, cycling, informal (shared) and public transport for passenger transport – while reducing the need for total vehicle travel.[16] Some governments have begun taking strong actions to encourage such advancements, and co-ordination has improved through international frameworks. However, efforts remain insufficient in scale and pace and are far from what is needed to reach climate, sustainability and health goals.

Demand, use and access

Demand for both passenger and freight road transport has increased in recent years, characterised by shifts in mode share to more road vehicles, changes in patterns of vehicle-kilometres travelled, mainstreaming of electric vehicles (EVs), and increasing interest in artificial intelligence (AI)[i] **and autonomous vehicles.** Factors driving these trends include population growth, urbanisation, economic development, and concerns about air pollution and climate change. However, some locations – such as Paris (France) – have supported shifting away from motorised vehicles towards more people-centred planning, due to factors such as inflation, fuel prices, congestion, and the prioritisation of healthier and more sustainable cities.[17] Similarly, shifts from road to rail or inland waterways are being encouraged in some places. (See 4.2 Integrated Transport Planning.)

Global demand for passenger transport grew 10% between 2019 and 2025 (modelled values), reaching 68.3 trillion passenger-kilometres in 2025.[18] **Road transport alone accounted for an estimated two-thirds (67%) of passenger mobility globally in 2025, although this share varies highly by location and to some degree urban density.**[19] In many major cities (mostly in high-income countries), car ownership per capita has declined due to effective and convenient public transport services, and some cities ramped up their support for walking and cycling following the outbreak of the COVID-19 pandemic.[20]

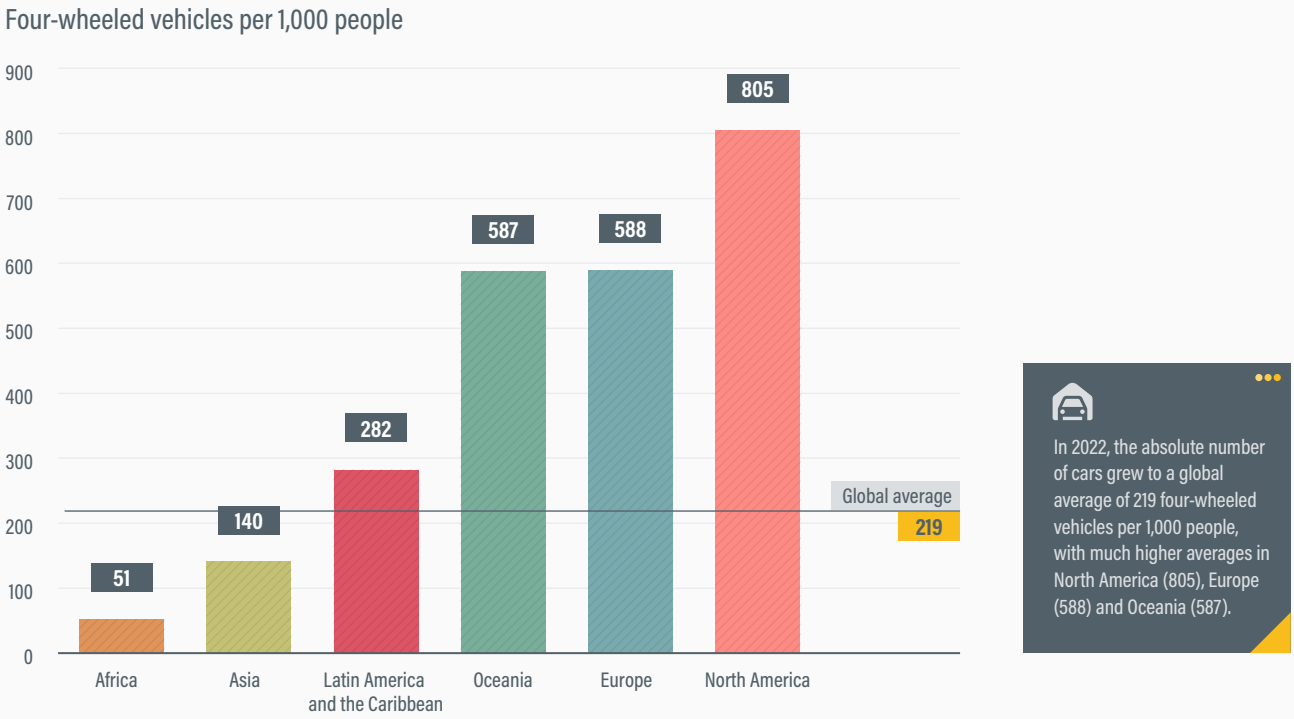
- Total passenger-kilometres travelled in private cars rose more than 10% between 2019 and 2024 in many countries, including North Macedonia (+29%), Slovenia (+25%), Hungary (17%) and Azerbaijan (+12%).[21]
- Countries where private car use decreased during this period included Finland (-9%), Italy and the Netherlands (both -8%) and Croatia (-5%).[22]

In 2022, the absolute number of cars grew to a global average of 219 four-wheeled vehicles per 1,000 people, with much higher averages in North America (805), Europe (588) and Oceania (587) (Figure 1)**.**[23] **In many low- and middle-income countries, most of the vehicle growth has been in two- and three-wheelers, which tend to outnumber cars in these locations.** However, the lack of available data makes it difficult to track global or regional trends for motorised two- and three-wheelers.

- In Africa, the motorisation rate was 51 four-wheeled vehicles per 1,000 people in 2022, well below the global average but climbing rapidly (up 34% since 2017).[24] More than three-quarters of the region's 72 million vehicles were concentrated in just 10 countries in 2022.[25]
- In South Africa, vehicle purchases among people under age 35 fell 8% annually between 2012 and 2022; however,

i AI integration refers to the incorporation of AI technologies into vehicle systems to improve driving functionality, safety, efficiency, and user experience. It includes features such as Advanced Driver Assistance Systems, autonomous driving capabilities, in-vehicle voice assistance, and predictive maintenance and diagnostics.

FIGURE 1. Vehicle ownership rates by region in 2022



Source: See endnote 23 for this section.

the desire for vehicles remains strong, and overall finance applications for cars increased from around 722,000 in 2021 to around 826,000 in 2023.[26]

- A third of Asian countries exceeded the global average motorisation rate in 2022, with a regional average of 140 four-wheeled vehicles per 1,000 people – up from 123 vehicles during 2016-2020.[27]
- In Europe, the motorisation rate was nearly three times the global average in 2022, at 589 four-wheeled vehicles per 1,000 people – up from 554 vehicles during 2016-2020.[28]
- Latin America and the Caribbean had a motorisation rate of 282 four-wheeled vehicles per 1,000 people in 2022, with nearly half of the region's countries exceeding the global rate.[29] In Brazil, the share of households with a car increased from 74% in 2019 to 79% in 2023.[30]
- The United States reached an all-time-high motorisation level in 2022 with 805 four-wheeled vehicles per 1,000 people – 4 times the global average and 15 times higher than in Africa.[31]
- In Oceania, the motorisation rate increased from 544 four-wheeled vehicles during 2016-2020 to 587 vehicles per 1,000 people in 2022.[32]

Despite advances in road infrastructure and connections, more than 1 billion people globally did not have access to all-weather roads as of 2019, particularly in low- and middle-income countries and in rural places.[33] Only 38% of the global rural population had access to all-weather roads as of 2019.[34] The lack of all-weather roads limits people's access to basic services and economic opportunities, while many existing roads face rapid deterioration due to poor maintenance, underfunding and inefficient execution.

- The share of the rural population with access to all-weather roads totalled 42.2% in small island developing states (2019), 40.8% in Asia (2020), 35.4% in Latin America and the Caribbean (2020) and just 31.3% in Africa (2020). (See Module 3 Regional Overviews and Spotlight on Small Island Developing States.)
- In Africa, where road transport accounted for 90% of passenger travel and 80% of freight transport in 2014, only around half of all roads had been paved as of that year.[35] (See 3.1 Africa Regional Overview.)

Global freight activity grew an estimated 8% between 2020 and 2025 (modelled values), surpassing 171 trillion tonne-kilometres in 2025.[36] Around 10% of total freight activity in 2025 was transported by road, below the shares for maritime transport (74%) and rail (11%).[37] However, one estimate found that road transport accounted for 22% of total freight activity in 2019.[38] (See 4.1 Freight Transport and Logistics.) Global trade volumes fell 1.2% in 2023, although the modal split and trends varied widely by location.[39]

- Road freight transport dominates in the European Union (EU-27), representing 53.8% of total freight transport activity in 2022, followed by intra-EU maritime transport at 28%.[40] Road freight in the EU-27 decreased 2.8% in 2023 and rail freight fell 6.6% (reflecting an ongoing decline in rail's share since 1995).[41]
- In the United States, road transport accounted for the largest share of freight activity (40.6%), followed by rail (28.6%) and pipelines (19.9%) in 2022.[42] In 2023, US road freight increased 6.6% while rail freight fell 2.6%.[43]

Emerging countries, particularly in Asia, continued to see increases in freight activity, although most of Asia's freight transport growth was in maritime shipping.[44] China continued to dominate shipping in the Asia-Pacific region but has also invested heavily in expanding road infrastructure.[45] Among countries in the Organization for Economic Co-operation and Development (OECD), road freight grew sharply above pre-pandemic levels in the Czech Republic (up 66% between 2019 and 2023), Bulgaria (+61%), and Slovenia (+32%), whereas it fell in Azerbaijan (-30.5%), the Slovak Republic (-22%) and Estonia (-13%).[46]

- In China, following a government stimulus package, the number of zero-emission medium- and heavy-duty trucks and buses spiked in 2024 to total more than 230,000 units sold, attaining a market share of around 80%.[47]
- Road freight accounted for more than one-quarter of India's oil import expenses in 2024 and was projected to grow four-fold in India by 2050, highlighting the economic potential of shifting to zero-emission trucks.[48]

Road vehicles regained their popularity as production and sales soared to pre-pandemic levels. Sales of all vehicles approached 93 million in 2023 – surpassing 2019 levels (92 million) – after falling sharply to 80 million in 2020 and growing only slightly to 82-83 million during 2021-2022.[49] The top five countries for car sales in 2023 were China, the United States, India, Japan, and Germany, indicating that advanced economies (rather than low- and middle-income countries) continue to further growth in vehicle emissions and pollution.[50]

- Global sales of passenger cars exceeded pre-pandemic (2019) levels in 2023, reaching 75.3 million, and totalled an estimated 77 million in 2024.[51] This was up more than 20% from a low of 63.8 million sales in 2020, during the height of the pandemic.[52]
- Car sales were impacted in 2020 and 2021 by slower global economic growth and the Russian Federation's invasion of Ukraine – which resulted in an automotive semiconductor shortage – and in 2022, sales numbers were low due to ongoing supply chain disruptions.[53]
- In China, car sales fell sharply in 2021-2022 due to the pandemic, shortages, and fears of economic recession, but by end-2023 the market had largely bounced back, with sales 21% higher than in 2021.[54]
- In 2024, China continued to be the largest market for car sales, with more than 31.4 million units sold.[55]

Electric car sales (including plug-in hybrid electric vehicles) reached a sales share of 22% in 2024, totalling a record 17.5 million units.[56] **However, growth was slower than in previous years due to stagnating sales in Europe, as government support was reduced or eliminated in some markets and EU-level carbon dioxide (CO_2) targets were not strengthened.**[57] Electric cars have advanced towards mainstream market status in an increasing number of countries.[58] (See 5.2 Road Vehicle Electrification for more information and regional trends on EVs.)

Larger vehicles such as sport-utility vehicles (SUVs) and pick-up trucks continued to rise in popularity (both conventional and electric models), due to their status appeal in many markets, potential comfort enhancements, and greater marketing efforts by manufacturers due to the larger profit margins.[59] **In 2023, SUVs surpassed a 50% market share in advanced economies for the first time and accounted for 48% of car sales globally, posing a growing challenge for public space, road safety and emissions.**[60] **Global SUV revenues were projected to reach USD 1 trillion by 2025.**[61] In some places, interest has risen in compact SUVs, which are seen as more practical than larger vehicles, especially in cities.[62] Policies aimed at discouraging larger vehicles directly impact road safety, as pedestrians are 200% more likely to be killed by SUVs than smaller vehicles – and 90% more likely to be injured by them.[63]

- SUVs weigh up to 300 kilograms more than an average medium-sized car, take up 0.3 square metres more space, emit 20% more CO_2, and increase the demand for basic metals and critical minerals needed for battery production in electric models (see section on Sustainability and Climate Trends).[64]
- In the US market, SUV growth is due largely to cultural factors and to low fuel prices supported by substantial government subsidies, as well as tax breaks for larger vehicles.[65]
- China has seen consistent growth in its SUV market since 2020.[66]

Global demand for two- and three-wheelers has continued to increase. Models with internal combustion engines (ICE) remain dominant in most markets, although electric models have gained ground, especially in Asia. Asia has led in two-wheeler growth, with annual sales of ICE models projected to grow 1.6% in 2024 to reach 57 million and then fall to around 56 million by 2028.[67] Although manufacturers continue to launch ICE models, several leading players have

invested heavily in electric models.[68] The electric two-wheeler market was expected to reach USD 128.6 billion in 2025 and USD 181.4 billion by 2029.[69]

- In China alone, more than 4.7 million electric two-wheelers were sold in 2024, while India's sales exceeded 2 million units that year.[70]
- For electric three-wheelers, India surpassed China in 2023 to become the global market leader with 580,000 units sold, while China reached 320,000.[71]

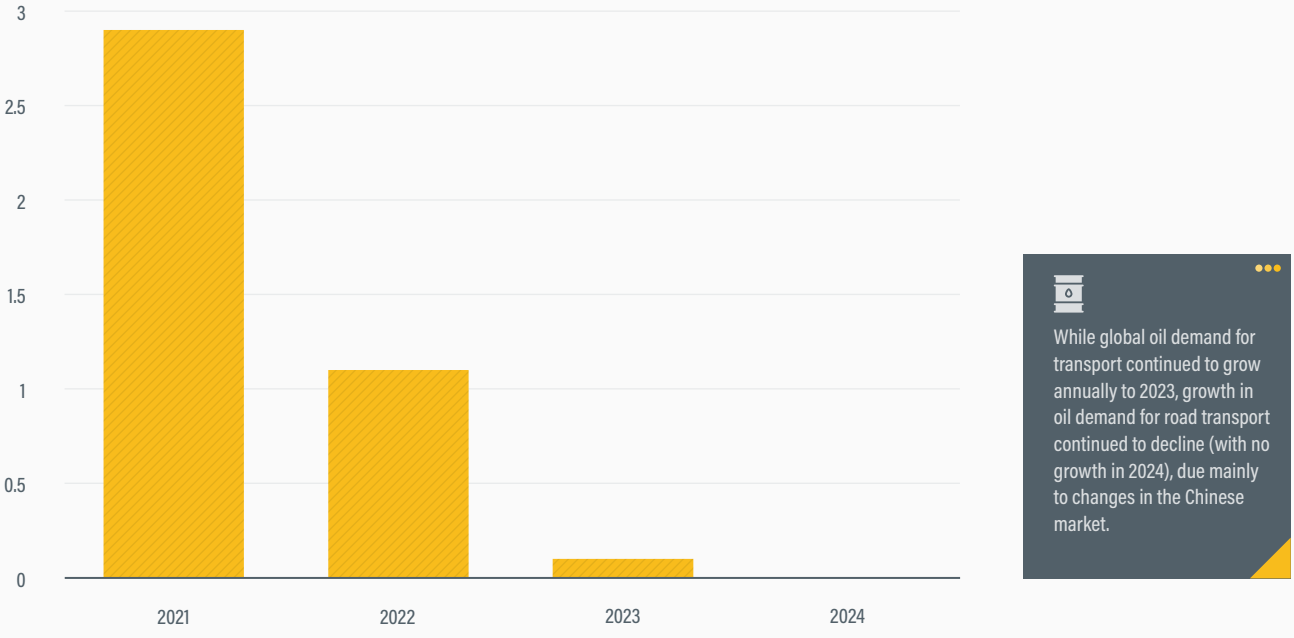
Despite the increase in electrification, global transport energy demand grew more than 21% between 2010 and 2023, with most of this growth being met by fossil fuels.[72] **Oil products supplied around 90% of the energy demand for transport in 2023.**[73] **Road transport alone accounted for 75% of transport energy consumption and 48% of global oil demand that year.**[74] (See 5.1 Transport Energy Sources.)

However, while global oil demand for transport continued to grow annually to 2023, growth in oil demand for road transport continued to decline (with no growth in 2024) (Figure 2), due mainly to changes in the Chinese market.[75] Oil use in the transport sector remained virtually unchanged in 2024 compared to 2019 levels, a trend attributed to increases in EVs, high-speed rail, efficiency improvements and teleworking.[76]

Integration of AI in passenger cars continued to advance, with the global market reaching USD 41 billion in 2024 and projected to grow nearly three-fold to USD 114.5 billion by 2029.[77] The sales share of connected vehicles in the global market increased from 93% in 2022 to 98% by 2025.[78] AI in freight and logistics has become indispensable for tasks such as route planning and forecasting of logistics planning.[79]

- The number of fully autonomous vehicles on the world's roads is expected to nearly double from 16,960 units in 2022 to 33,570 in 2025.[80]
- Level 1 (driver assistance) and Level 2 (partial) automation have become nearly ubiquitous in vehicles, increasing from a 92% market share in 2021-2022 to 97% in 2024-2025; meanwhile, Level 3 automation (performing most driving tasks but still requiring human intervention) remained in early stages.[81]

FIGURE 2. Growth in oil demand for road transport, 2021-2024



Source: See endnote 75 for this section.

Sustainability and climate trends

As access to convenient public transport and rail has faltered – and as ridership has struggled to recover from pre-pandemic levels in many locations – this has resulted in rising private car and motorcycle use, increased congestion, and worsening pollution and greenhouse gas emissions. In 2023, fossil fuels continued to account for 95.4% of the total energy demand in transport – a share that has barely changed in the past 50 years even as biofuels, EVs, fuel efficiency and renewable power have increased.[82]

The persistence of the auto-centric paradigm has led to more vehicles on the road, as well as to increasing vehicle size and decreasing vehicle occupancy, which have in turn offset any gains in fuel efficiency.[83] These trends have resulted in increased air (and noise) pollution, greenhouse gas emissions, congestion and road crashes.[84] Urban sprawl and longer supply chains have worsened the problem. Still, vehicle electrification displaced 1.3 million barrels of oil per day in 2024 – equal to around half of the Republic of Korea's oil consumption – and EV progress was considered "on track" to meet 2030 climate targets.[85]

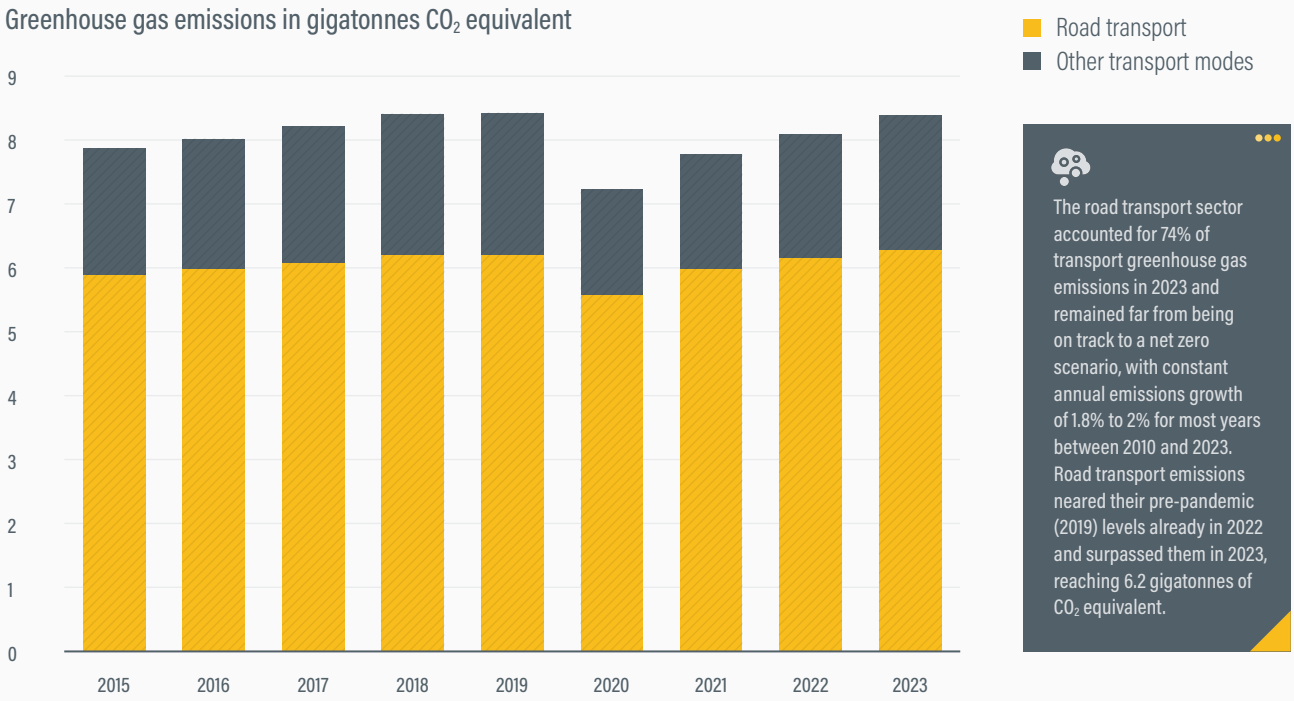
Achieving net zero greenhouse gas emissions globally by 2050 will require large emission reductions in the transport sector as a whole and particularly from passenger vehicles and heavy trucks. To reach global net zero goals, CO_2 emission intensity must be reduced more than 94% for trucks and 98% for cars compared to 2020 levels, according to the International Energy Agency's (IEA) Net Zero scenario.[86] Achieving the necessary reductions from road transport is essential for mitigating climate change but will require a concerted effort from governments, businesses and individuals.

The road transport sector accounted for 74% of transport greenhouse gas emissions in 2023 and remained far from being on track to a net zero scenario, with constant annual emissions growth of 1.8% to 2% for most years between 2010 and 2023.[87] **Road transport emissions neared their pre-pandemic (2019) levels already in 2022 and surpassed them in 2023, reaching 6.2 gigatonnes of CO_2 equivalent** (Figure 3).[88] Emissions from road transport continued to grow over the past decade despite the growth in EVs, renewable energy and regulations for cleaner vehicles.[89]

Transport emissions from road freight have outpaced those from road passengers, as emissions from road freight grew 23% and from road passengers 16% from 2010 to 2023.[90] **This suggests that policies pursuing efficiency improvements and electrification have had a stronger impact for passenger vehicles than freight vehicles.**



FIGURE 3. Greenhouse gas emissions from road transport compared to other modes, 2015-2023



Source: See endnote 88 for this section.

CO_2 emissions from road passenger transport reached 3.75 gigatonnes in 2023, while emissions from road freight reached nearly 2.46 gigatonnes.[91]

The CO_2 emission intensity of vehicles depends on factors such as the type of fuel used, vehicle size and weight, and level of fuel efficiency. Smaller, more fuel-efficient vehicles typically have lower emissions intensity than larger, less-efficient vehicles.[92] EVs bring significant emission benefits compared to ICE vehicles when considering the entire life cycle of the vehicle (from well to wheel), which accounts for resource consumption and emissions that occur during vehicle and infrastructure production in addition to operation. Measured this way, hybrid and electric vehicles can reduce emissions significantly – by around one-quarter for plug-in hybrids to more than three-quarters for battery electric vehicles powered by renewable electricity.[93] (See 5.2 Road Vehicle Electrification.)

As larger passenger vehicle sizes have gained popularity, their rising energy consumption has posed a growing risk to decarbonisation, leading the IEA to recommend that the auto industry decrease vehicle size.[94] Larger vehicles take up an increasing amount of public and private space, consume far more fuel, and contribute around 20% greater emissions than small- and medium-sized vehicles – cancelling out the energy efficiency and emission improvements made in the global passenger vehicle fleet over the past few decades.[95] Larger vehicles have become particularly popular in the United States for passenger transport, creating an ever-increasing carbon footprint. Light-duty trucks (weighing up to 8,500 pounds or 3,856 kilograms) have been the most popular passenger transport vehicle in most US states for some years and were responsible for the highest share of transport emissions in the country in 2022 (37%).[96]

SUVs alone were responsible for more than one-quarter of the total growth in oil consumption globally during 2022-2023, rising by more than 600,000 barrels per day (the equivalent of about one-quarter of Germany's oil consumption) – an increase of 20% from 2021-2022.[97] If the global SUV stock were a country, its 2023 emissions would make it the fifth largest emitter of CO_2, above the total annual emissions of Japan.[98]

Road transport emissions are extremely unequally distributed among countries, with high-income countries contributing the bulk of emissions. The countries with the highest levels of per capita road transport CO_2 equivalent emissions in 2023 were Luxembourg (6.4 tonnes), Qatar (5.1 tonnes), Saudi Arabia (4.4 tonnes), the United States (4.2 tonnes) and the United Arab Emirates (4 tonnes) (Figure 4)**.**[99] Despite vehicle emission standards in some of these

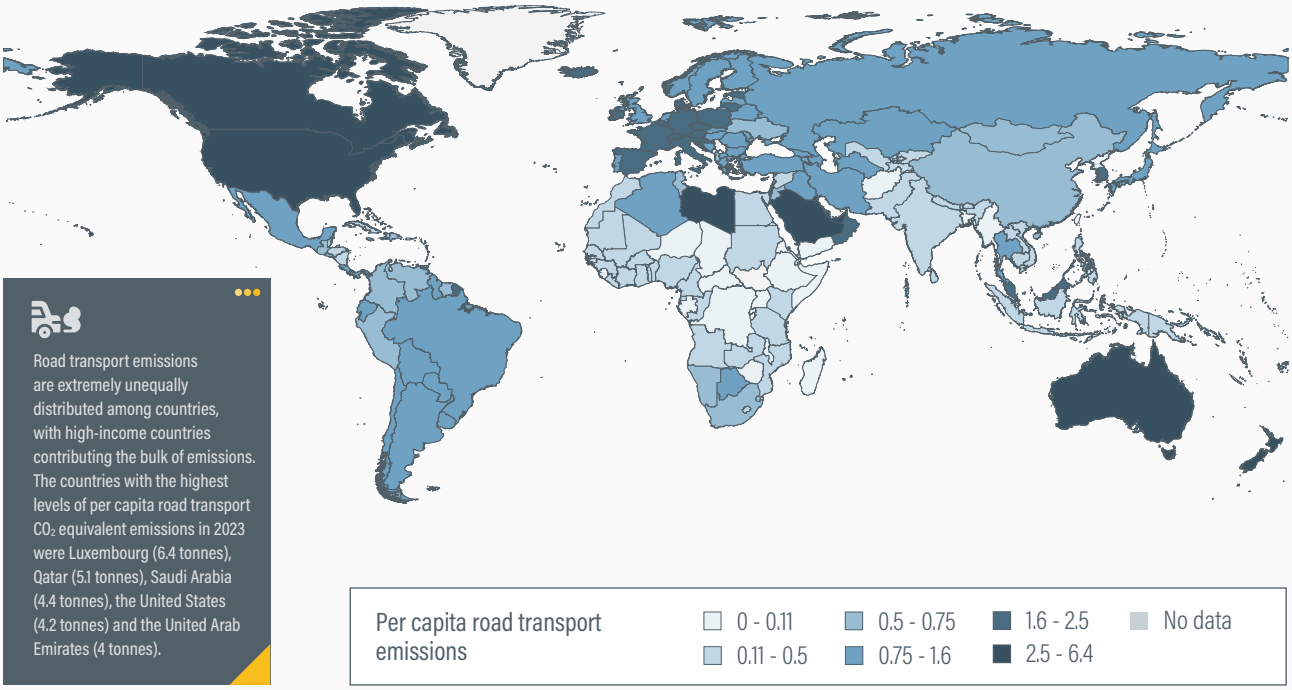
regions, their high motorisation levels and high kilometres-travelled in motorised vehicles lead to high per capita emission levels.

- The United States continued to contribute the highest transport emissions globally in absolute terms (1.74 gigatonnes of CO_2 equivalent) while also having one of the largest per capita values (4.2 tonnes) in 2023.[100]
- In Europe, where policies tend to require increasingly strict emission standards for road transport, the average CO_2 emissions of new cars sold continued to fall from 131 grams per kilometre (g/km) in 2020 and 115 g/km in 2021 to 107 g/km by 2023.[101]
- However, Europe as a whole recorded per capita transport greenhouse gas emissions of 1.66 tonnes of CO_2 equivalent in 2022, above the global average of 0.89 tonnes and the third highest among regions (after North America and Oceania).[102]
- In Australia, the emission intensity for new cars sold in 2023 averaged 150 g/km, similar to levels in Canada and the United States.[103] For all vehicles on the road in Australia in January 2024, the emission intensity was 193.7 g/km, virtually unchanged compared to new vehicles sold a decade earlier.[104]
- Australia had relatively high per capita transport emissions of 3.1 tonnes of CO_2 equivalent in 2023.[105]

Emission standards have helped limit emissions to some extent where they have been implemented, but much of the world remains uncovered by such standards. In many low- and middle-income countries, continued importation of vehicles through the second-hand market has resulted in a fleet with older vehicles that are more polluting and less safe than newer models.[106] (See Spotlight on Second-hand vehicles.)

- In 2019-2020 (latest data available), 85% of vehicles in Africa were used imports from Europe, the United States and Japan – often failing safety and emission standards in their home countries.[107] Overall, 80% of vehicles in Africa fell below Euro 4 emission standards.[108]
- In Asia, vehicle emission standards and fuel quality improvements have cut some pollutants by 2% annually between 2000 and 2022, while registrations of vehicles with emission standards at Euro 4 or above rose from 9% in 2010 to 89% in 2023.[109]
- The EU's CO_2 emission standards called for the end of ICE car sales starting in 2035 and for the near-complete phase-out of diesel heavy-duty vehicles by 2040.[110]

FIGURE 4. Per capita greenhouse gas emissions from road transport by country, 2023



Source: See endnote 99 for this section.

However, timelines have since been extended at both the EU and national levels due to fierce global competition, international tariff disputes, factory closures and job losses – potentially derailing emission reduction efforts.[111] European automakers have sought further concessions or even a complete moratorium of the ICE phase-out.[112]

- The average energy efficiency of new light-duty vehicles sold in Australia and New Zealand in 2021 trailed other high-income countries and regions such as the EU, Japan and the United States.[113] Both countries have targets to reduce emissions from new light-duty vehicles to 58–59 grams of CO_2 per kilometre by 2029.[114]

Decarbonising the power grid is critical for achieving transport decarbonisation, with the aim of supplying cleaner energy for both EV charging and battery production.[115] The electricity mix can have a substantial impact on EV emissions, with countries that have high shares of renewable or nuclear energy experiencing much lower emissions from EVs than from ICE vehicles.[116] High motorisation growth rates can contribute to lock-in of unsustainable development, whereas a transition to EVs alongside support for walking, cycling and public transport could take advantage of the transport-energy decarbonisation nexus.[117] (See 5.1 Transport Energy Sources.)

- In some regions, using an EV can reduce the average emissions per 100 kilometres by more than 90% compared to using an ICE vehicle, due to a cleaner electricity mix – such as in Switzerland (100% reduction), Norway (97%), France and Sweden (both 93%).[118]
- As of 2022, Latin America's power mix was an estimated 60% renewable electricity, with Costa Rica and Paraguay reaching shares of nearly 100% renewables; at the same time, region has one of the world's highest motorisation rates.[119]
- In countries where the electricity mix is dominated by fossil fuels, using an EV compared to an ICE vehicle can increase the average emissions per 100 kilometres, such as in Kosovo (95% increase), Poland (57%), Cyprus (39%) and Serbia (26%).[120]
- The carbon intensity of the power grid varies greatly by region, with Latin America and the Caribbean the lowest at 272.4 grams of CO_2 equivalent per kilowatt-hour in 2023, followed by North America (279 grams), Europe (283.9 grams), Africa (430 grams), Oceania (478.9 grams) and Asia (559.5 grams).[121] (See Module 3 Regional Overviews.)

Road safety, health and climate change are interrelated and can influence each other in various ways, with the most direct and severe impacts occurring from road crashes and air pollution (*Box 1 and Figure 5*)**.**[122] Speed management in particular has a direct impact on emissions and energy efficiency, as higher speeds increase the risk of traffic crashes and fatalities, and also result in higher fuel consumption, emissions and air pollution.[123] Effective speed management can reduce congestion and air pollution, leading to shorter travel times and fewer emissions from idling and stop-and-go traffic (in addition to decreasing road deaths, injuries and crashes).[124] Many countries have seen a trend towards 30 kilometre-per-hour speed limit zones in city centres and residential areas, as well as greater use of road speed limiters and speed cameras.[125] (See 1.7 Driving Health and Wellbeing Forward: The Critical Link with Transport.)



Box 1. Facts and figures on the human toll of road transport by region, with a focus on road safety and air pollution

Africa

The region has low motorisation compared to the rest of the world yet has the world's deadliest roads.

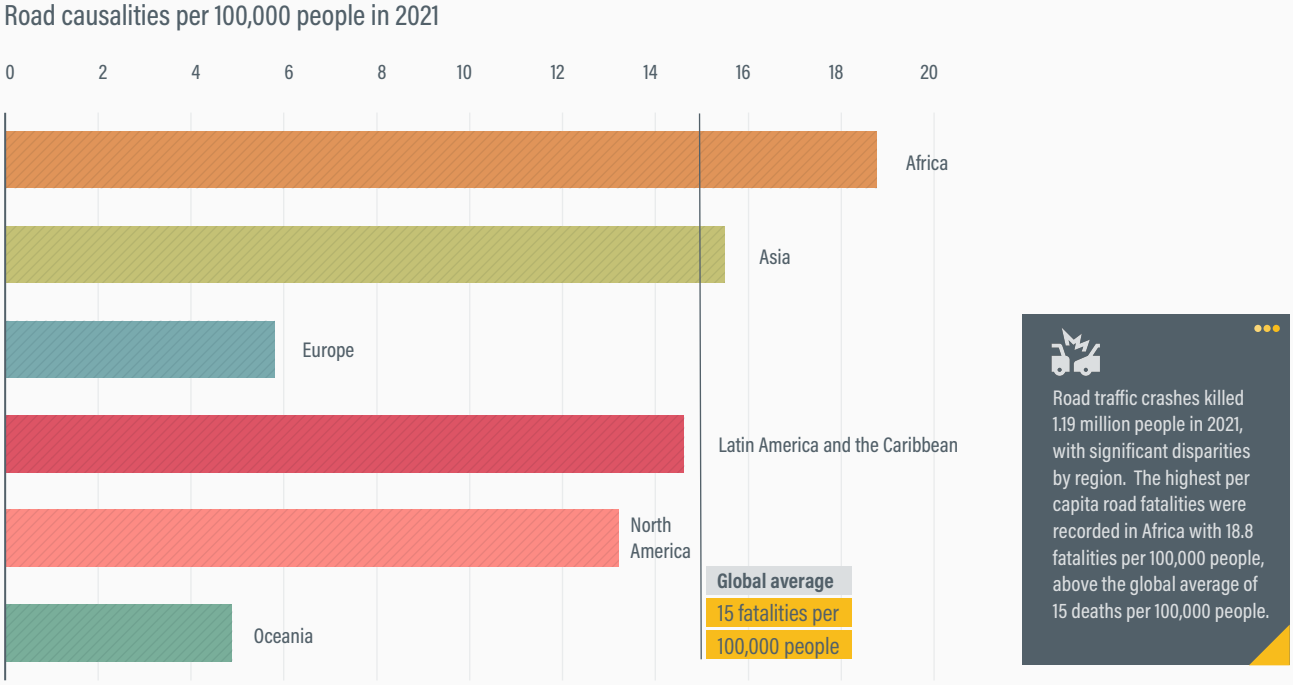
- In 2021, Africa averaged 18.8 road fatalities per 100,000 people – the highest rate globally, above the global average of 15 deaths (Figure 5).
- Over 50% of road fatalities involve vulnerable users: pedestrians, cyclists and motorcyclists.
- Several countries (e.g., Cameroon, Kenya, Morocco) are addressing road safety through policy reforms and innovative, context-specific initiatives.
- Transport caused 3.2% of air pollution and 1.01 premature deaths per 100,000 people in 2019, below the global averages of 6% and 2.3 deaths. (See 3.1 Africa Regional Overview.)

Asia

With half of the world's road deaths, road safety remains a public health challenge, while deadly air pollution from transport persists despite some progress.

- Road deaths averaged 15.5 per 100,000 people, above the global average of 15 deaths in 2021.
- Asia suffered more than half of the world's road deaths in 2021, with 35% being motorised two-wheeler users, and 22% pedestrians.
- Several countries (e.g., Laos, Nepal, the Philippines) are advancing road safety through multi-year action plans.
- 8% of air pollution comes from transport, leading to 3.2 premature deaths per 100,000 people in 2019, above the global averages of 6% and 2.3 deaths.
- Nearly all people in East and South-East Asia faced air pollution levels above the World Health Organization's (WHO) safe air standards in 2024.
- Vehicle emission standards and fuel quality improvements cut some pollutants 2% annually during 2000-2022.
- Vehicle registrations with Euro 4 or above emission standards rose from 9% in 2010 to 89% in 2023. (See 3.2 Asia Regional Overview.)

FIGURE 5. Road casualities per 100,000 people by region and compared to the global average



Europe

Despite declines, most countries are not on track to meet the region's road safety target, while harmful transport noise and pollution challenges continue to pose major health risks.

- The region has the lowest road traffic fatalities globally, at 5.8 deaths per 100,000 people, well below the global average of 15 deaths in 2021. Yet road fatalities were the leading cause of death for 5-29 year-olds in 2023. One person dies every seven minutes, and more than 62,000 people were killed on the roads every year as of 2021.
- Despite a 3% decrease in road fatalities in 2024, most EU countries are off-track to meet the region's goal of halving road fatalities by 2030.
- Transport accounted for 9% of air pollution and an estimated 4.1 premature deaths per 100,000 people in 2019, above the global averages of 6% and 2.3 deaths.
- More than 100 million Europeans were exposed to harmful transport-related noise, mainly from road traffic, in 2022, despite EU policies and regulations on motor vehicle and aircraft noise.
- Over 20% of the population lives in road traffic noise levels that exceed EU limits for harm to health and well-being; this rises to above 30% when considering stricter WHO thresholds (2024). (See 3.3 Europe Regional Overview.)

Latin America and the Caribbean

Road safety challenges persist, with pedestrians and cyclists bearing the brunt.

- The region's road traffic deaths averaged 14.6 per 100,000 people, near the global average (15); average deaths ranged from 5.1 in Trinidad and Tobago to 31.3 in Haiti in 2021.
- Pedestrians and cyclists accounted for nearly half of all road deaths in some countries in 2021.
- Only 7.8% of cities in the region met WHO air quality guidelines in 2024.
- Excessive exposure to particulate matter caused by transport contributed to nearly 180,000 premature deaths in 2019 – or nearly 6.1% of total deaths, similar to the global average (6%). (See 3.4 Latin America and the Caribbean Regional Overview.)

North America

Transport pollution remains more than double the global average, and road safety lags, with US roads among the least safe of high-income countries.

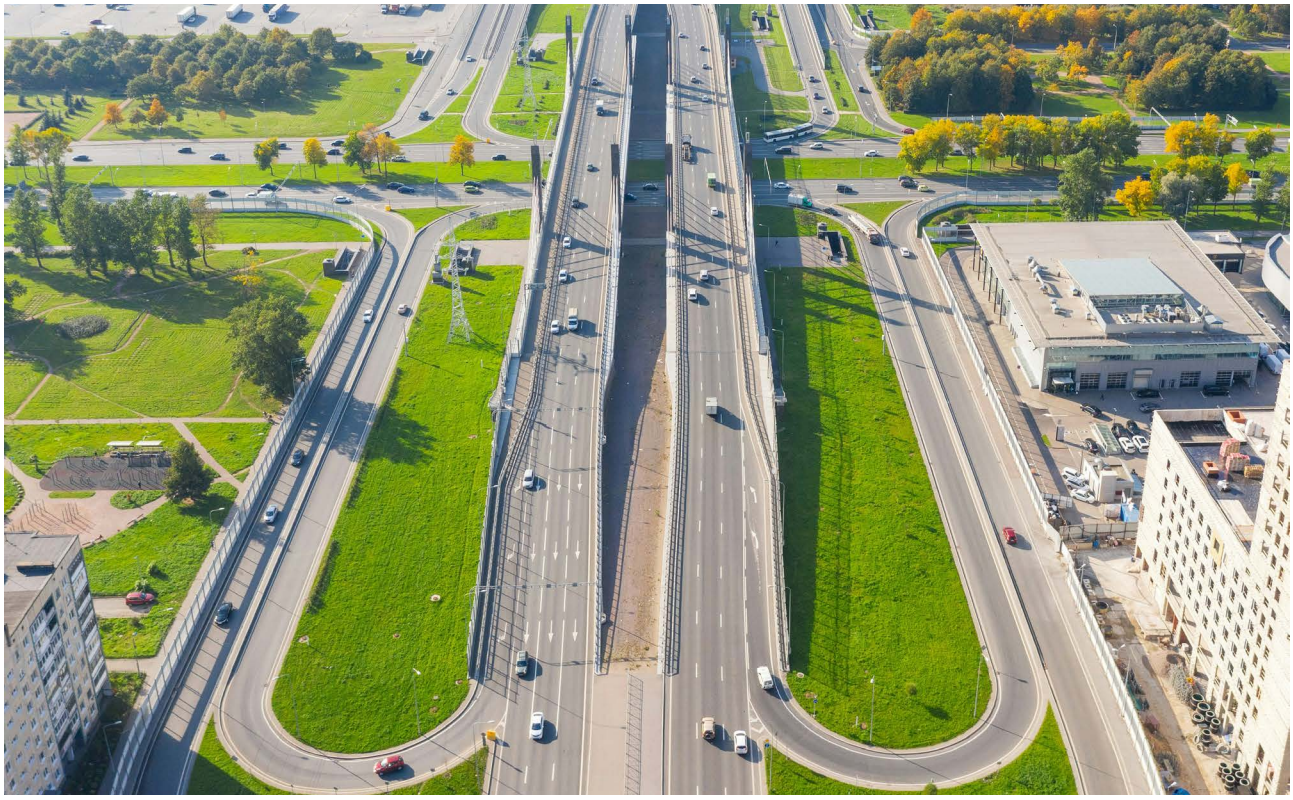
- Transport accounted for 12.6% of the region's air pollution in 2019, compared with a global average of 6%.
- In the United States, transport contributed 15% of air pollutant emissions, resulting in 2.29 premature deaths per 100,000 people, consistent with the global average of 2.3.
- In Canada, transport contributed 9.8% of air pollution, resulting in 1.01 premature deaths per 100,000, half the global average.
- North America recorded 13.2 road casualties per 100,000 people in 2021, slightly below the global average of 15 road deaths.
- Road traffic fatalities and injuries cost 1.9% of Canada's gross domestic product (GDP) and 5% of the US GDP in 2021.
- Less than 40% of roads assessed in the region meet the recommended three-star safety standards for pedestrians and cyclists, compared to 60% for motorcyclists and more than 80% for vehicle occupants.
- The United States had among the worst road safety records in 2021 among high-income countries, ranking just behind Saudi Arabia, the Bahamas and Guyana.
- In 2021, 42,939 people died in US road crashes, with around 20% of the deaths being pedestrians or cyclists; pedestrian fatalities in the country reached a record high. (See 3.5 North America Regional Overview.)

Oceania

Road deaths and transport-related air pollution are well below the world average.

- The region's transport sector contributed 2% of air pollutant emissions and 0.3 premature deaths per 100,000 people in 2019, compared to global averages of 6% and 2.3 deaths.
- Road casualties in Oceania were three times less than the global average in 2021, with 4.9 deaths per 100,000 people compared to 15 globally. (See 3.6 Oceania Regional Overview.)

Source: See endnote 122 for this section.



Factors contributing to the slow decline in road deaths and injuries include increased road congestion, higher speeds, driver distraction and fatigue from longer commute times.[126] Globally, road deaths increased 4.5% between 2020 and 2023, although they remained 5.5% below the pre-pandemic levels of 2019.[127] Most countries have maintained lower road fatality numbers, although road deaths increased 10% or more in 2023 compared to pre-pandemic levels in many places, such as Ireland (+23%), Switzerland (+22%), Türkiye (+16%), Armenia (+13%), the United States (+11%) and Estonia (+10%).[128]

Efforts to improve the resilience of road infrastructure have lagged, even as economic losses from infrastructure damage due to climate-related events grew an estimated seven-fold between the 1970s and 2010, to USD 1.6 trillion.[129] Multilateral development banks committed USD 24.7 billion for adaptation and resilience projects in 2023, and the World Bank delivered USD 10.3 billion in 2024.[130] To overcome the persistent finance gap, an estimated annual investment of USD 6.9 trillion in sustainable infrastructure will be necessary by 2030.[131]

Traffic congestion returned to pre-pandemic levels already by 2021, and most cities have experienced worsening congestion since 2022.[132] Increased transport demand can lead to greater congestion and delays and associated economic and health costs, especially when density is close to capacity.[133] One estimate found that 55% of urban areas experienced greater congestion in 2024 than in 2023, whereas just 28% of cities had a reduction in delays.[134] (See 1.7 Driving Health and Wellbeing Forward: The Critical Link with Transport.)

- In 2024, Istanbul topped the list of cities worldwide with the most hours lost due to congestion (105 hours per driver per year), followed by New York City and Chicago (102 hours each) and London (101 hours).[135]
- The losses due to congestion come at a significant cost to economic productivity, with delays in Germany and the United States averaging 43 hours lost per driver per year – around *a full work week* – and 61 hours in the United Kingdom.[136]
- Congestion in Kampala (Uganda) cost the city USD 1.5 million per day in 2020, or 4.2% of its GDP.[137]

Autonomous vehicles have the potential to decrease transport emissions if they are shared and regulated; however, increases in vehicle size and distances travelled could lead to higher emission growth, although these impacts are uncertain.[138] If autonomous vehicles are used mainly for ride hailing, carpooling, or public transport, they could help reduce the number of single-occupancy vehicles on the road and the overall vehicle-kilometres travelled. If they are privately owned and encourage sprawling development, they are likely to increase total vehicle-kilometres travelled and worsen congestion.[139]

Policy and investment developments

Successful strategies to reduce road transport emissions and create healthier, more sustainable urban and rural areas include a mix of the Avoid-Shift-Improve (A-S-I)[ii] framework for both passenger and freight transport.[140] A 2023 study on ambitious but feasible emission mitigation strategies for road transport by 2050 shows that "Avoid" and "Shift" measures would contribute as much as 18% of greenhouse gas reductions, keeping the allocated carbon budget for road transport within 1.7 degrees Celsius of global warming by 2050 (Figure 6).[141]

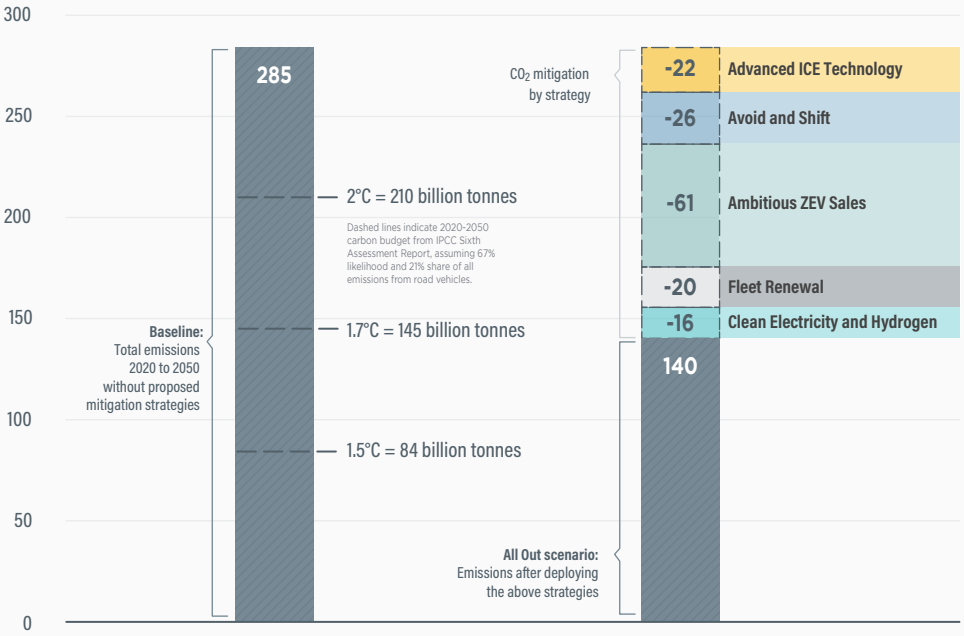
- "Avoid" measures are most important and meant to come first, followed by "Shift" and then "Improve". This prioritisation is due to not only climate benefits but also health, economic and social benefits.[142]
- The most successful "Improve" strategies combine carbon or fuel taxes with incentives for zero-emission vehicles, but prioritising measures that incentivise walking, cycling and public transport for passenger transport ("Avoid" and "Shift" measures) can maximise emission reductions and many other benefits; for freight, this means prioritising water-, rail-, and electrified road-based freight and solutions such as cargo bikes for last-mile deliveries.[143]
- Alongside "Improve" measures, support for renewable energy is crucial for decarbonising the energy supply for motorised vehicles.
- Applying the A-S-I framework can help with more holistic, sustainable planning and investment to support a shift from the auto-centric model towards more liveable environments.[144]

Among "Avoid" and "Shift" policies, a few jurisdictions have adopted targets to reduce vehicle travel, particularly at the sub-national level.

- A 2024 executive order in the US state of Maryland strengthened a target to reduce vehicle miles travelled 20% by 2050 as part of its climate strategy, including measures such as infrastructure improvements and land-

FIGURE 6. Mitigation potential of feasible emission reduction strategies for road transport

Cumulative well-to-wheel CO_2 transportation emissions (billion tonnes) projected from 2020 to 2050



Successful strategies to reduce road transport emissions and create healthier, more sustainable urban and rural areas include a mix of the Avoid-Shift-Improve framework for both passenger and freight transport. "Avoid" and "Shift" measures would contribute as much as 18% of greenhouse gas reductions, keeping the allocated carbon budget for road transport within 1.7 degrees Celsius of global warming by 2050.

Source: See endnote 141 for this section.

ii The Avoid-Shift-Improve framework has been central to sustainable, low-carbon transport for more than a decade. It follows an implicit hierarchy, with appropriate and context-sensitive "Avoid" measures (which avoid and reduce the need for motorised travel) intended to be implemented first, followed by "Shift" measures (which shift to more sustainable modes) and finally by "Improve" measures (which improve transport modes). See https://slocat.net/asi and H. Dalkmann and C. Brannigan (2007), Transport and Climate Change, Module 5e: Sustainable Transport – A Sourcebook for Policy-Makers in Developing Cities, GIZ GmbH, https://changing-transport.org/wp-content/uploads/2007_dalkmann_brannigan_transportandclimatechange.pdf.

use changes to improve alternatives to driving.[145]
- Similar regulations were adopted in 2022 in the US states of California (reducing vehicle miles travelled 25% by 2030) and Colorado (reducing vehicle miles travelled 6-9% by 2030).[146]
- In 2024, Glasgow (United Kingdom) set a target to reduce vehicle kilometres travelled 30% by 2030, while the national target in Scotland aims to reduce them 20% by 2030.[147]

Building roads and establishing urban-rural connections can support economic development; however, if these are not pursued with a sustainable, resilient vision, they can lead to unsustainable auto-centric, sprawling development.[148] Paradoxically, where road networks already exist, building more roads and widening existing roads leads to increased traffic.[149] Recognising these challenges, countries across all income levels have begun shifting their approaches and implementing rural transport programmes.

- Wales (United Kingdom) passed a new transport strategy in 2021 that subsequently guided the revision of the region's transport appraisal guidance in 2024.[150] These efforts resulted in new approaches that prioritised an accessible, sustainable and efficient transport system while discouraging large-scale road infrastructure projects.[151]
- As of 2023, 11 low- and middle-income countries had adopted UN-Habitat guidelines for strengthening urban-rural planning, and 20 had strengthened urban-rural connections.[152]

Investment in inland transport infrastructure (road, rail and inland waterways) has been decreasing in some countries, although several continue to invest heavily in road transport.[153] High-income countries in particular have had low ratios of transport infrastructure investment relative to GDP and stable investment levels – a sign of mature transport systems.[154]

- At least four countries allocated more than 2% of their GDP to transport infrastructure (nearly all of it to road infrastructure) in 2023, including Azerbaijan, China, North Macedonia and Serbia.[155]
- Among high-income countries, Hungary and Norway had the highest ratios of transport infrastructure investment to GDP in 2022 (1.8% and 1.4%, respectively) as well as the highest growth in transport investment compared to one decade earlier.[156]
- Azerbaijan, Bulgaria, Georgia and Serbia had high ratios of transport infrastructure investment to GDP due to their critical location for connectivity and trade between Central Asia and Eastern Europe; overall, China had the highest transport infrastructure investment as a share of GDP in 2022.[157]

Policies have been adopted at various levels to address road safety, particularly aimed at speed management and sometimes linked to improving the sustainability of transport systems. Research has shown that lowering average speed limits by just 5% can result in a 20% reduction in road deaths.[158] In 2023, the WHO released guidelines for reducing speeding globally to decrease road injuries and deaths.[159]

- Sub-national governments that have enacted recent speed management plans include the cities of Durango (United States) and Meaford (Canada) in 2024, and the US state of Nevada in 2022.[160]
- In 2024, Lima (Peru) launched a comprehensive urban mobility programme that included several measures aimed at reducing speeds and improving safety.[161]
- Kumasi (Ghana) launched a speed management plan in 2024 with concrete measures to strengthen road safety efforts.[162]

Between 2023 and 2025, an increasing number of jurisdictions adopted targets for reducing average vehicle emissions, as well as scrappage policies that help governments accelerate fleet renewal, reduce emissions and encourage the adoption of cleaner, more efficient vehicles. A few countries had vehicle scrappage policies that incentivised trading in an older polluting vehicle for a newer, cleaner model.

- In early 2025, Brazil implemented the first phase of emission standards with substantial limit reductions for vehicles, increasing in stringency to 2032.[163]
- Morocco adopted the Euro 6 emission standard starting in January 2023, and Thailand adopted the Euro 5 emission standard starting in January 2024.[164]
- The EU planned to impose stricter standards on auto manufacturers in 2025, with carmakers expected to close their gap in compliance with the targets during the year; most were close to meeting the targets by the first half of 2024, while some (such as Volvo Cars) had already achieved it.[165]
- US targets for reducing the average CO_2 emissions of new passenger cars contributed to a consistent decline in emissions between 2000 and 2023, with a 2035 target of 0 grams per kilometre.[166] However, manufacturers had no pressure to further reduce emissions following a significant reduction in 2021, so reductions in subsequent years occurred at a slower pace.[167]
- India enacted a scrappage policy at the national level that mandates fitness tests for older vehicles and offers incentives for scrapping unfit ones, aiming to reduce air pollution and promote safer, cleaner vehicles.[168]
- France and Romania also had scrappage policies at the national level, while at the city level, the 14 German cities

with the poorest air quality had a government-backed trade-in incentive.[169]

In some places, rules for vehicle emission reductions include flexibilities around compliance that hinder their effectiveness, while in other cases emission rules have been weakened or removed altogether.

- In 2025, the European Commission launched a new Industrial Action Plan for the automotive sector that outlines a strategy to accelerate the uptake of zero-emission vehicles in corporate fleets; however, the plan also includes increased flexibility on compliance with the emission target.[170]
- Mexico enacted a CO_2 emission standard for light-duty vehicles in 2024, but the standard's compliance flexibilities show it will be insufficient to reach the country's Nationally Determined Contribution (NDC) and 2030 decarbonisation goals.[171]
- In the United States, the new administration in 2025 reversed steps towards the decarbonisation of road transport adopted in previous administrations, including removing vehicle emission rules that would have required manufacturers to offer an increasing number of EVs.[172]

EV adoption has been the most common measure for reducing emissions in the road transport sector, since EVs produce far fewer emissions than traditional petrol vehicles but allow for continuation of the auto-centric model.[173] **In addition, several governments have adopted targets for full or partial ICE vehicle bans or EV targets, although typically these are only for vehicle sales rather than the overall stock.** During 2022-2023, total investments of USD 275 billion in EVs and USD 195 billion in batteries were announced globally, boosting confidence in the electrification of road transport across markets.[174] In the United States, the new administration withdrew a previous target for 50% EVs in new vehicle sales by 2030.[175] (See 5.1 Transport Energy Sources and 5.2 Road Vehicle Electrification.)

As EV uptake increases, governments have taken steps to support the deployment of charging infrastructure and battery swap stations. However, they may need to develop new taxation approaches to replace the losses in income from fuel taxes on ICE vehicles. The UK government estimates that much of the USD 46 billion (GBP 37 billion) in fuel and vehicle excise duties collected in 2020 would be lost as the fleet transitions to EVs (which did not face similar taxes in order to encourage uptake).[176] (See 5.2 Road Vehicle Electrification.)

By 2023, the number of countries with support measures for EVs surpassed those with biofuel blending mandates, which until then had been the most common policy for decarbonising road transport.[177] A total of 60 countries had biofuel blending mandates by the end of 2023, up from 56 countries in 2022 (but still below the 65 countries in 2021).[178] Ten countries introduced new or revised mandates in 2023, with most trends towards increasing the mandated blending shares, although these are not always enforced.[179] (See 5.1 Transport Energy Sources.)

The deployment of EVs will not address concerns such as traffic congestion, urban sprawl and the amount of public space devoted to vehicles.[180] **In some places, increases in parking fees in recent years have been correlated with higher use of walking, cycling and public transport.**[181] Parking occupies a great deal of public space, sometimes far outnumbering the actual vehicle fleet.[182] A growing number of European cities (especially in France) have implemented higher parking fees to counter the trend towards SUVs and other larger vehicles ("auto obesity").[183] (See 4.2 Integrated Transport Planning.)

For freight transport, low-carbon options include the adoption of fuel-efficient technologies and alternative fuels, carbon pricing mechanisms, promotion of multi-modality, cargo consolidation centres, last-mile sustainable urban logistics and autonomous deliveries.[184] **Although policy progress has been slower for freight than passenger vehicles, some advances towards reducing emissions occurred in recent years.** A comprehensive and integrated approach to decarbonising freight transport could provide significant environmental and social benefits, but policies targeting heavy-duty vehicles have lagged behind those for light-duty vehicles.

- As of 2025, just five countries – Canada, China, India, Japan and the United States – had national fuel economy standards for heavy-duty vehicles, and no additional countries have adopted such standards since 2017.[185]
- In 2024, the EU approved a 90% CO_2 emission reduction target for new heavy-duty vehicles by 2040.[186]
- Jurisdictions that adopted targets for zero-emission heavy-duty vehicles included Ireland (targeting 35% of registrations by 2030) and the US state of California (targeting 100% of sales by 2042).[187]
- In 2023, the United States adopted tax credits for zero-emission commercial and heavy-duty vehicles, but the future of the policy was unclear due to the change in administration in 2025.[188]
- New York City (United States) transitioned its entire heavy-duty vehicle fleet to 100% renewable diesel in 2024.[189]

Partnerships in action

- The organisation **Bridges to Prosperity** is dedicated to rural infrastructure development, connecting rural communities through trail bridges and complementary infrastructure to increase resilience and to unlock access to health care, education and markets.[190]
- The Asian Development Bank's **Green Roads Tool Kit**, published in 2024, provides a collection of good practices for development and management of roads including concerns for sustainability, resilience and inclusivity.[191]
- In 2023, **ICLEI–Local Governments for Sustainability** set up an "ecologistics community" to encourage sustainable urban freight in cities globally, including the development of indicators to serve as a guide for local governments.[192]
- The **International Road Assessment Programme (iRAP)** published new guidance in 2024 for safe and inclusive road design aimed at road engineers and infrastructure designers in the Kyrgyz Republic, Tajikistan and Uzbekistan.[193]
- The **International Transport Forum (ITF)** produced a policy report in 2023 on taxation during the transition to electric vehicles and options for reforming vehicle and road-use taxes.[194]
- The **Road Asset Management Committee** of the International Road Federation (IRF) brings together a network of practitioners to share knowledge and develop improved practices for better management of road assets globally.[195]
- **UN-Habitat** launched a small funding call in 2024 for initiatives to enhance road safety in Africa and Mediterranean cities.[196]
- The **UN Road Safety Fund** supported Senegal in 2025 through its Ten-Step Plan for Safer Road Infrastructure following successful implementation in Tanzania in 2023.[197]
- In 2023, the **World Road Association (PIARC)** published a report on case studies of rural roads for development in Africa to raise awareness and offer solutions for improving rural development and road infrastructure, highlighting the importance of roads for accessibility and mobility.[198]
- The **ZEFES project**, launched by the International Road Transport Union (IRU) in 2023, aims to demonstrate real-world applications of battery electric vehicles and fuel cell electric vehicles in Europe for long-haul freight transport.[199]



4.8
ROAD TRANSPORT

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