MODULE 3 | 3.1

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Integrated Transport Planning

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Key findings

Demand trends

- While transport system performance has historically been evaluated based on automobile travel conditions, a new paradigm is emerging that is based on access – or people's ability to reach goods, services and activities.
- The shares of passenger transport modes vary depending on location. Some cities have prioritised more sustainable modes through a variety of measures and investment.
- With the onset of the COVID-19 pandemic, public transport ridership fell sharply, while the use of other transport modes increased, as did working from home.
- The modal split for freight transport was not as affected during the pandemic, although this varied by location. Cargo bikes are increasingly seen as a more sustainable alternative for delivery vans in many cities.
- Pandemic-related mobility restrictions and higher fuel prices following the Russian Federation's invasion of Ukraine contributed to changes in travel behaviour during 2020-2022, particularly teleworking and ride-hailing.
- Time spent commuting each day can reveal the degree of efficiency within a transport system, encompassing distances, connectivity, reliability and availability of transport options. Average commute times vary highly between and within countries.
- By 2021, traffic congestion had returned to pre-pandemic levels in many cities, although globally it was still 10% lower than in 2019, with peak-hour traffic also declining.
- The implementation of accessibility measures has been fragmented and often incomplete. Such measures include inclusive accessibility to public transport for diverse users, such as the elderly and people with disabilities or difficulties and other special needs. People of different genders often have different transport needs and face varying concerns and constraints, which are often heightened in low- and middle-income countries.
- In a 2021 index analysing major cities around the world, London, Madrid, and Paris were ranked the top cities for transport availability. The top cities for improving transport availability between 2018 and 2021 were Beijing, Moscow, Madrid, Milan and Tokyo.
- Transport expenditures often make up a high share of household budgets, and freight costs vary widely, placing a burden on low-income users in particular. Among low- and middle-income regions, Latin America and the Caribbean reported the highest share of household spending on transport, at 17% as of 2019. In parts of Africa, higher freight costs are due to the low quality of infrastructure, poor regional connectivity, and inefficient logistics, among other issues
- Increased fuel prices and inflation in recent years have had only a minor impact on distances travelled but have placed a growing financial burden on drivers and operators of transport services.
- As of early 2023, London remained the world's most expensive city for public transport fares, while several other cities were offering free public transport to make it more affordable and to reduce private vehicle trips.

Emission trends

- The implementation of integrated transport planning has been shown to play an important role in reducing transport emissions and minimising the use of resources.
- Due mainly to the impacts of the COVID-19 pandemic, transport experienced the greatest decline in carbon dioxide (CO_2) emissions (13%) in 2020 among combustion sectors, although it also showed the strongest rebound in 2021. Estimates for 2022 indicate that CO_2 emissions from ground transport (road and rail) nearly recovered to pre-pandemic levels, whereas aviation emissions (domestic and international) were still 20% below 2019 levels.
- To reduce emissions and pollution and to improve air quality, several cities and countries around the world have deployed low-emission zones (LEZs), ultra-low-emission zones (ULEZs) and zero-emission zones (ZEZs) in recent years. In some cases, these zones apply specifically to freight vehicles.
- Transit-oriented development is in place in many regions, as decision makers recognise that encouraging the use of public transport and active travel can greatly reduce transport emissions. The 2022 Sixth Assessment Report from the Intergovernmental Panel on Climate Change highlighted the potential of public transport-focused development and mixed land use to reduce greenhouse gas emissions 23-26% by 2050.

Policy developments

- A sustainable transport hierarchy can be helpful in integrated transport planning and policy making, as it prioritises planning and investment decisions to favour sustainable modes over expensive and resource-intensive modes that often dominate in automobile-centric models.
- Effective and cost-efficient strategies to reduce transport emissions rely on a mix of policies. In a growing number of cities, measures to promote sustainable modes of transport and to reduce the negative impacts of urban mobility have been encapsulated and expanded on in sustainable urban mobility plans (SUMPs). By the end of 2022, the MobiliseYourCity Partnership had supported the preparation of 31 SUMPs and 9 NUMPs (national urban mobility plans).
- Supporting the objectives of SUMPs, transit-oriented development has advanced through policy and funding measures in recent years. As of late 2022, the Indian cities of Chandigarh, the Pune Municipal Corporation and Navi Mumbai had successfully implemented transit-oriented development in their urban planning masterplans. The US government announced USD 13.1 million in grants in late 2022 to help cities plan for transit-oriented development.
- Some national and sub-national governments have set vehicle travel reduction targets and in some cases require that all major transport and land-use planning decisions support these targets. Many more jurisdictions have adopted targeted bans on sales of internal combustion engine vehicles.
- The number of active LEZs in Europe increased 40% between 2019 and 2022 and is projected to grow another 58% by 2025. Developments in LEZs elsewhere have been less extensive. By mid-2021, several dozen cities had implemented or planned to implement ZEZs or near-ZEZs, mostly in Europe but also in China and India. Some cities have chosen to establish specific zero-emission zones for freight transport (ZEZ-Fs), ranging from urban delivery vans to medium- and heavy-duty trucks.

Overview

Integrated transport planning supports and connects various types of travel to maximise the efficiency of moving goods and people and to address other aspects, such as equity. The concept of integrated transport planning has received increasing attention in recent years, particularly as the COVID-19 pandemic created an opportunity to rethink transport in cities. Whereas conventional, mostly automobile-centric transport systems have been fragmented, often with low efficiency and reliability, governments and the private sector have pursued a variety of improvements to create more seamless and integrated systems, particularly in locations where public transport and active travel compete with private vehicles.[1]

Integrated land-use and transport planning seeks to achieve a sustainable transport system through:

- prioritising the needs of all users, ensuring equity within and between generations;
- permitting basic needs of individuals and society to be achieved safely;
- ensuring affordability, efficiency and choice of transport modes;
- promoting sustainable transport options that support human and ecosystem health;
- optimising land use, minimising noise production, and limiting emissions, waste and use of non-renewable resources; and
- facilitating the creation of a vibrant and sustainable economy.[2]

While transport system performance has historically been evaluated based on automobile travel conditions, a new paradigm is emerging that is based on access – or people's ability to reach goods, services and activities.[3] In an integrated transport system, the arrangement of transport infrastructure is key to ensuring access[i], and improving access and mobility is key for poverty reduction and increased participation in economic and social activities.[4] Moreover, while many plans for reducing transport emissions have focused mainly on "clean" vehicles and fuels and investing in related subsidies – essentially maintaining an automobile-centric approach – studies have shown that these measures alone cannot achieve emission reduction targets.[5] Rather, prioritising measures that lead to avoiding unnecessary trips and shifting to more sustainable modes can maximise emission reductions and wider sustainability benefits.[6]

As a result, many plans are starting to give greater consideration to vehicle-travel reduction strategies as part of more people-centred holistic approaches aimed at satisfying the mobility needs of people and cities and achieving a better quality of life. At the local level, such strategies are often contained in sustainable urban mobility plans (SUMPs) – strategic frameworks designed to improve quality of life by addressing major challenges related to urban transport.[7] Similarly, sustainable urban logistics plans (SULPs) focus on city-level logistics to achieve sustainable freight operations in overall urban mobility planning.[8] At the country level, national urban mobility policies and investment programmes (NUMPs) serve as strategic frameworks to enhance the capabilities of cities to meet their mobility needs in a sustainable way.[9]

A variety of other planning tools are available to decision makers to address the interconnections between transport, land use and other factors to support the creation of sustainable transport systems, including:

- **Transit-oriented development** – the creation of compact, walkable, pedestrian-oriented, mixed-use communities centred around high-quality public transport systems.[10]
- **Complete streets** – an approach to planning, designing, building, operating and maintaining streets that enable safe access for all people who need to use them, including pedestrians, cyclists, motorists and public transport riders of all ages and abilities.[11]
- **Low-, ultra-low and zero-emission zones** – areas where access for more-polluting vehicles is restricted.[12]
- **Transport demand management incentives** – various policies and programmes that encourage travelers to use the most efficient option for each trip.[13]
- **Safe system approach** – designing the road system to account for human error and vulnerabilities to avoid injury and death.[14]
- **Parking policy reforms** – reducing parking mandates and pricing parking more efficiently so motorists pay directly for using parking facilities, with higher prices at peak times and locations.[15]

i The report uses the term "access" to refer to access to goods, opportunities and services, while "accessibility" (often "universal accessibility") looks at the degree to which a location can be reached from or by other different locations and used in a safe and equitable way by all users.

Demand trends

A basic planning principle is that "what gets measured gets managed". It is therefore important to select and track appropriate sustainable transport performance indicators that reflect specific needs and objectives. Most conventional transport performance indicators reflect an automobile-centric paradigm, evaluating transport performance based primarily on traffic speeds, delays and crash rates; however, indicator sets are evolving to include and prioritise additional factors, in line with more sustainable and integrated transport planning.

Table 1 summarises transport performance indicators that reflect economic, social, and environmental objectives, including some that are most important, and others that may be appropriate in some situations.[16] Many of these indicators are discussed below, based on data availability.

In an integrated transport system, modes compete or complement each other depending on costs, access, reliability, speed, safety, comfort and other factors.[17] However, many current policies and planning practices tend to favour private automobile travel over other more affordable, inclusive and resource-efficient modes.

Commonly used transport statistics tend to undercount active travel, which is typically far more common than most statistics indicate (*see Section 3.2 Walking and Section 3.3 Cycling*). Most travel surveys overlook or undercount non-commute trips, longer trips, travel by children, recreational travel, and the walking and cycling links of automobile and public transport trips. For example, a three-stage commute that involves biking, public transport and walking is generally coded as simply a public transport trip, and the trips between parked vehicles and destinations are ignored even if they involve several blocks of walking on public streets. Thus, if walking and cycling are recorded as having commute modal shares of 5-10%, the actual shares may be more like 10-30% of total trips.[18]

The shares of passenger transport modes vary depending on location. Some cities have prioritised more sustainable modes through a variety of measures and investment (*see Policy Developments section*).

- Cities with the highest shares of private car use included Tshwane and Cape Town (South Africa) and Auckland (New Zealand), with shares well over 80% as of 2022.[19]
- In 2022, as many as 47% of trips in London (UK) and Paris (France) were accomplished through walking, while Zurich (Switzerland) and Tokyo (Japan) had the highest shares of public transport (35% and 28%, respectively) (see Figure 1).[20]

With the onset of the COVID-19 pandemic, public transport ridership fell sharply, while the use of other modes increased, as did working from home.

- In the European Union (EU), the share of people using public transport fell from 17.5% in 2019 to 12.8% in 2020.[21]
- The share of public transport trips in the United Kingdom declined from 13% in 2019 to 5% in 2020, with rail the hardest hit.[22] Transport by car, van and taxi increased from 85% to 92.5%, while cycling grew more modestly from 1% to 1.4%.[23]
- In the United States, public transport use fell from an already low share of under 5% in 2019 to 3.2% in 2020 and 2.5% in 2021.[24] However, the share of people driving alone also fell, from 76% in 2019 to 69% in 2020 and 68% in 2021; meanwhile, working from home increased from 6% in 2019 to 16% in 2020 and 18% in 2021.[25]

The modal split for freight transport was not as affected during the pandemic, although this varied by location (*see Spotlight 4 The Role of Companies in Decarbonising Global Freight and Logistics*).[26] **Cargo bikes are increasingly seen as a more sustainable alternative for delivery vans in many cities** (*see Section 3.3 Cycling*).

Pandemic-related mobility restrictions and higher fuel prices following the Russian Federation's invasion of Ukraine contributed to changes in travel behaviour during 2020-2022, particularly teleworking (telecommunications used as a substitute for physical travel, including telecommuting, on-line schooling, e-shopping and e-medicine) and ride-hailing.[27] Studies indicated that the benefits of telecommuting in reducing work-related travel (and therefore emissions) could be offset by counter-effects, such as increased private travel and non-work-related energy use.[28] Also, a divide between income groups became more apparent across several regions during the pandemic, as people in more affluent urban areas could more easily telework and have goods delivered.[29] However, teleworking can contribute to integrated transport planning objectives of decreasing the need for motorised travel.

- A study of 100 countries found that 40-60% of workers were working from home during March-May 2020.[30] In mid-April 2020, trips to workplaces in all regions fell 40%, with a particularly large decline in high-income countries, possibly due to the higher availability of teleworking arrangements.[31]
- A US study estimated that teleworking saved 60 million hours per workday by eliminating daily commuting and found that 45% of employees stayed in remote or hybrid working arrangements through at least late 2020.[32]
- In Africa, organisations and businesses began revising their practices to accommodate remote work, although not as quickly as in other regions.[33] In Nigeria, announcements for remote working positions increased steadily in the year following the onset of the pandemic.[34] As of early 2022, an estimated 42% of African employees were working remotely at least one day a week.[35]

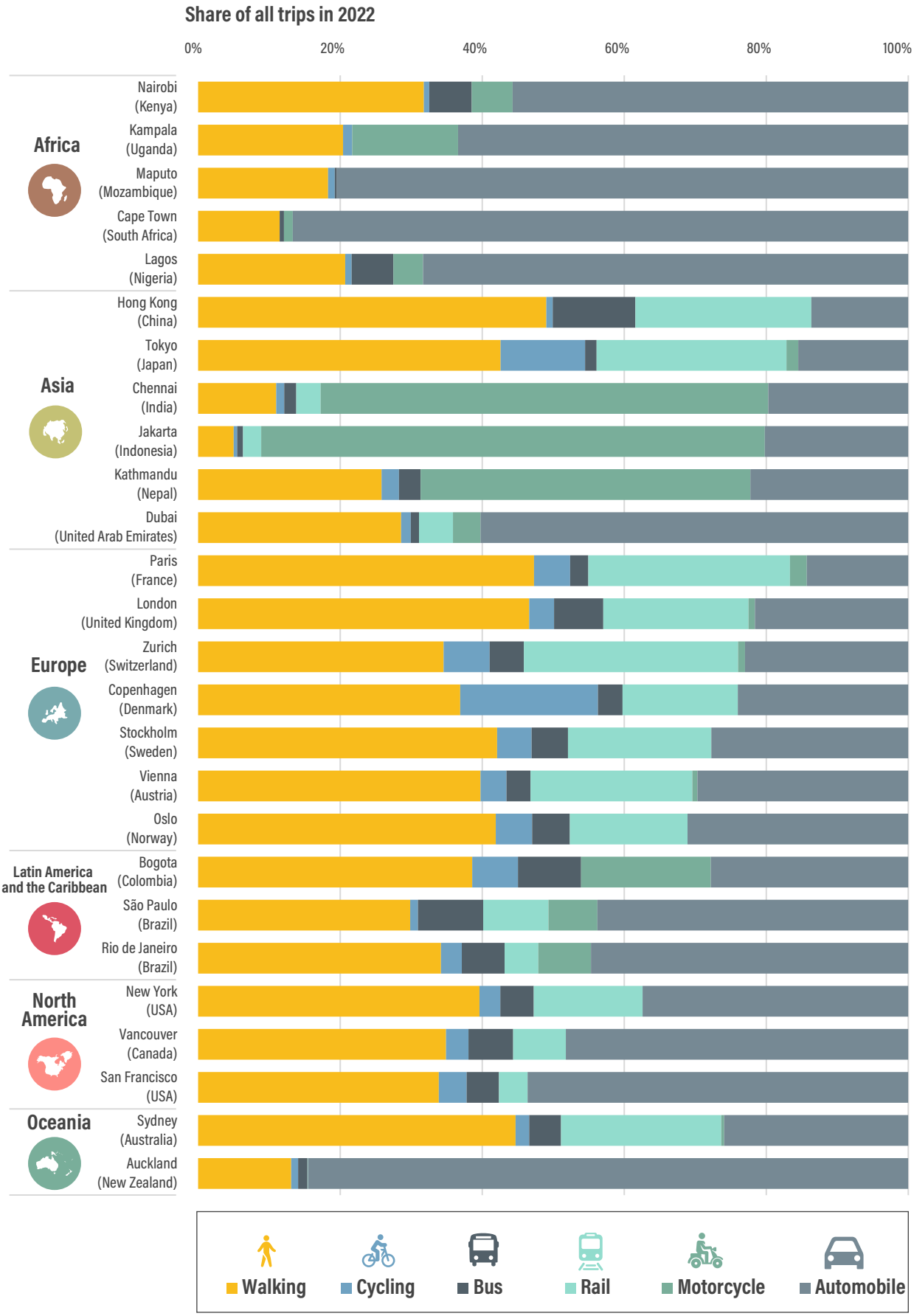
TABLE 1. Selected indicators for sustainable, integrated transport systems

Source: See endnote 16 for this section.

	Economic	Social	Environmental
Most important (should usually be used)	Personal mobility (annual person-kilometres and trips) and vehicle travel (annual vehicle-kilometres), by mode (active, automobile and public transport)	Trip-to-school mode share (active transport is desirable)	Per capita energy consumption, by fuel and mode
	Freight mobility (annual tonne-kilometres) by mode (truck, rail, ship and air)	Per capita traffic crash and fatality rates	Energy consumption per freight tonne-kilometre
	Land-use density (people and jobs per unit of land area)	Quality of transport for disadvantaged people (disabled, low income, children, etc.)	Greenhouse gas emissions
	Average commute travel time and reliability	Affordability (portion of household budgets devoted to transport, or combined transport and housing)	Air pollution emissions (various types), by mode
	Average freight transport speed and reliability	Overall transport system satisfaction rating (based on objective user surveys)	Air and noise pollution exposure and health impacts
	Per capita congestion costs	Universal design (transport system quality for people with disabilities and other special needs)	Land paved for transport facilities (roads, parking, ports and airports)
	Total transport expenditures (vehicles, parking, roads and public transport services)		Stormwater management practices
Helpful (should be used if possible)	Quality (availability, speed, reliability, safety and prestige) of non-automobile modes (walking, cycling, ride-sharing and public transport)	Portion of residents who walk or cycle sufficiently for health (15 minutes or more daily)	Community livability ratings
	Number of public services within 10-minute walk, and job opportunities within 30-minute commute of residents	Portion of children walking or cycling to school	Water pollution emissions
	Portion of households with internet access	Degree cultural resources are considered in transport planning	Habitat preservation in transport planning
		Housing affordability in accessible locations	Use of renewable fuels
		Public transport affordability	Transport facility resource efficiency (such as use of renewable materials and energy-efficient lighting)
			Impacts on special habitats and environmental resources
Planning process	Comprehensive (considers all significant impacts, using best current evaluation practices, and all suitable options, including alternative modes and demand management strategies)		
	Inclusive (substantial involvement of affected people, with special efforts to ensure that disadvantaged and vulnerable groups are involved)		
	Based on *access* rather than *mobility* (considers land use and other factors)		
Market efficiency	Portion of total transport costs that are efficiently priced		
	Neutrality (public policies do not arbitrarily favour a particular mode or group) in transport pricing, taxes, planning, investment, etc. Applies *least cost planning*.		

FIGURE 1. Modal split of passenger transport in selected cities, by transport mode, 2022

Source: See endnote 20 for this section.



- A survey across 20 European cities revealed that, in most places, around a quarter or more of people were working from home more frequently in 2021 than pre-pandemic.[36] In Portugal and Ireland – where measures supporting teleworking were implemented – the highest shares of respondents who increased their teleworking frequency were in Lisbon, Porto and Dublin.[37]

For those not working from home, **time spent commuting each day can reveal the degree of efficiency within a transport system, encompassing distances, connectivity, reliability and availability of transport options. Average commute times vary highly between and within countries** depending on factors such as modal choice and infrastructure, among others.

- In India, the average daily commute time for travelling 5-10 kilometres in urban areas in 2019 was 27 minutes, with walking being the most common mode, followed by personal motorbike.[38]
- Italy had an average daily travel time of 58 minutes in 2019, which fell to 48 minutes in 2020, in part due to pandemic-related mobility restrictions.[39]
- The average time spent commuting in Japan in 2021 was 23 minutes per day for women and 38 minutes per day for men – levels that have been roughly stable for several decades.[40]
- In the United States, average commute times varied only slightly by region as of 2019, ranging from 25 minutes in the Midwest to 31 minutes in the Northeast.[41]
- In the United Kingdom, the average daily time spent travelling was 28 minutes as of 2020 but varied by transport mode.[42] The average commute by national rail took 63 minutes, other rail 49 minutes, bus 40 minutes, car or motorcycle 25 minutes, cycling 22 minutes and walking 16 minutes.[43]

Public transport reliability can play a role in commute time and is important in an integrated transport system to keep travel flowing smoothly. Some places have focused on greatly improving reliability. For example, Singapore's mass rapid transit network decreased the number of delays experienced from 15-16 per year in 2015-2017 to just 9 in 2018 and only 3 by 2021.[44]

By 2021, traffic congestion had returned to pre-pandemic levels in many cities, although globally it was still 10% lower than in 2019, with peak-hour traffic also declining.[45] However, as of 2022 traffic delays exceeded pre-pandemic levels in 39% of US and 42% of European urban areas.[46] Congestion has been shown to have significant economic and public health costs, which has led some jurisdictions to adopt congestion pricing.[47] (*See Section 3.6 Road Transport.*)

Many places have harnessed the potential of **digitalisation** to contribute to a more efficient and integrated transport system. Integrating multiple transport modes and services into a single, on-demand service with a unified payment system is referred to as **mobility-as-a-service** (MaaS).[48] MaaS has become increasingly popular since 2020, driven in part by pandemic-related developments and by growing government support for digital payment systems (see *Section 3.4.3 App-Driven Shared Mobility*).[49]

While "access" is the overall concept of allowing better access to goods, opportunities, and services, "accessibility" looks at the degree to which a location can be reached from or by other different locations and used in a safe and equitable way by all users. **The implementation of accessibility measures has been fragmented and often incomplete. Such measures include "inclusive accessibility" to public transport for diverse users, such as the elderly and people with disabilities or difficulties and other special needs (also called universal design).**[50]

- As of 2020, 98% of bus stations and 94% of light rail stations in US urban areas were deemed accessible, in compliance with the Americans with Disabilities Act (ADA).[51] Vehicle accessibility in the United States also has improved greatly in recent decades, with the share of accessible buses increasing from 51% in 1993 to 99% in 2020, light rail from 41% to 92%, and commuter rail from 32% to 82%.[52]
- In Canada, 92% of bus stations and 93% of rail stations met ADA standards as of 2018.[53] However, people with disabilities, difficulties or long-term conditions still reported facing many barriers related to transport during 2019-2021, with the biggest barriers being waiting in lines, finding information and making reservations on websites.[54]
- Train station accessibility in Paris (France) improved significantly between 2007 and 2017, with the number of stations accessible to people with reduced mobility growing from 73 to 173.[55] However, the city's subway system remains largely inaccessible.[56]
- By 2019, 92% of the subway system in Barcelona (Spain) was wheelchair accessible – covering 144 of its 157 stations – with a goal to reach 100% by 2024.[57]
- The public transport system in Seattle (USA) was deemed completely accessible by 2022.[58]

People of different genders often have different transport needs and face varying concerns and constraints, which are often heightened in low- and middle-income countries.[59] Women and girls face increased risk of harassment or personal safety concerns on public transport, as do transgender and non-binary people.[60] For rural households in the lowest-income countries, the burden of transport is estimated to be four times greater for women than men, and women carry an estimated 90% of the physical burden.[61] In low- and middle-income countries, walking remains the primary mode of travel for women (due to access and affordability), followed by cycling and animal-drawn

carriages.[62] Even in urban areas, other modes are not inclusively accessible due to cost or inconvenient locations.[63]

- In a 2018 survey in India, women who owned a personal motor vehicle reported that they would be more likely to use public transport if it were more affordable (35% of respondents), had better coverage (27%), and were more comfortable (18%), more frequent (10%) and safer (6%).[64]
- A 2022 survey in Tirana (Albania) revealed that women are much more dependent than men on the bus system, particularly for getting to and from work.[65]
- In London (UK), more than 60% of transgender and non-binary people reported experiencing discrimination when using public transport in 2021.[66]
- Ensuring security in public transport can entail high costs. For example, security costs among public transport companies in France rose from a total of EUR 148 million (USD 158 million) in 2011 to EUR 200 million (USD 213 million) in 2020.[67]

An integrated transport system increases the availability of mobility options to improve access to jobs and services for all people.[68]

- In a 2021 index analysing 25 major cities around the world, London, Madrid and Paris were ranked the top cities for transport availability, with each having major railway connections, road networks, cycling lanes and pedestrian infrastructure.[69] The top cities for improving transport availability between 2018 and 2021 were Beijing, Moscow, Madrid, Milan and Tokyo.[70]
- As of 2020, more than 91% of Germany's population had easy access to public transport, measured by residences having a bus stop within a distance of 600 metres or a train within 1,200 metres and with at least 20 daily departures from the stop or station.[71]

Transport expenditures often make up a high share of household budgets, and freight costs vary widely, placing a burden on low-income users in particular. A sustainable integrated transport system must be accessible to users of all income levels.

- **Among low- and middle-income regions, Latin America and the Caribbean reported the highest share of household spending on transport, at 17% as of 2019**.[72]
- In the United Kingdom, transport costs had the highest share in average household expenditures in 2019, reaching an annual average of GBP 4,420 (USD 5,330); they also accounted for the largest share of the increase in average household spending between 2012 and 2019.[73]
- In the United States, annual household spending on transport was second only to housing in 2021, totalling an average of nearly USD 11,000 on transport.[74] Rural households tended to spend more on transport than urban households and had a higher share of transport in household budgets (17%, compared to 13% in urban areas), while low-income households had the greatest transport cost burden (27%, compared to 10% in the highest-income households).[75]
- In 2020, total consumer spending on transport was highest in the United States, at more than USD 1.2 million, followed distantly by China (USD 507,524), Germany (USD 246,730), Japan (USD 207,900) and Brazil (USD 165,356).[76]
- In West Africa and landlocked countries in Central Africa, freight transport costs are 1.5 to 2.2 times higher than in South Africa and the United States, **due to the low quality of infrastructure, poor regional connectivity, and inefficient logistics, among other issues**.[77]

Increased fuel prices and inflation in recent years have had only a minor impact on distances travelled but have placed a growing financial burden on drivers and operators of transport services (*see Section 3.6 Road Transport*)**.**[78]

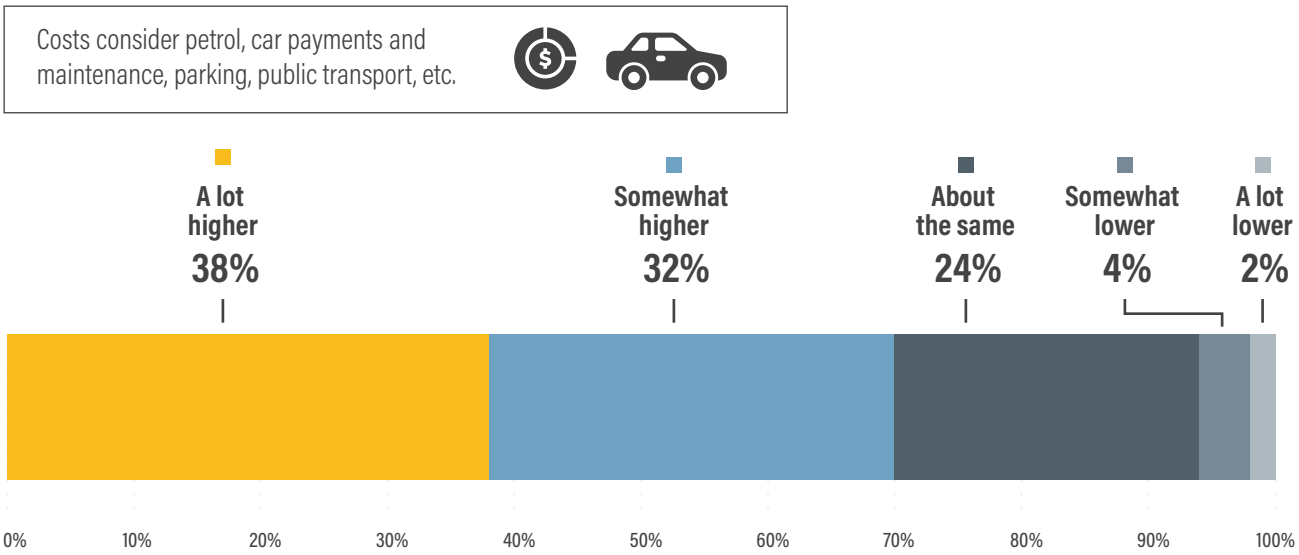
- In a survey of 20,000 people across 30 countries, 70% reported perceiving higher prices for fuel, car payments, vehicle maintenance, parking and public transport during a six-month period in 2021 (see Figure 2).[79] Prices were most often perceived to have increased in Latin America, Central and Eastern Europe, Türkiye, and South Africa, whereas Japan and China were least likely to have perceived price increases.[80]
- In 2022, Hong Kong (China) became the city with the most expensive fuel in the world, marking the highest prices globally for both petrol (USD 3.10 per litre) and diesel (USD 2.86 per litre) in August.[81] For diesel prices, Hong Kong overtook Norway, with the increased fuel costs reflecting factors such as high government taxes on fuel and the large numbers of cars on the road.[82]
- Venezuela remained the country with the lowest average fuel prices (USD 0.02 per litre) in 2022, as a result of the country's vast oil reserves and large government subsidies.[83]
- Transport costs continued to increase in 2023 in some places. In the United Kingdom, 73% of people surveyed reported an increase in fuel costs between 2022 and 2023, while 21% reported an increase in public transport costs.[84]

As of early 2023, London remained the world's most expensive city for public transport fares, while several other cities were offering free public transport to make it more affordable and to reduce private vehicle trips. Many places also have experienced recent steep increases in parking prices, which in one study were found to be correlated with higher use of public transport (*see Section 3.6 Road Transport*).[85]

- In 2023, London (UK) had the highest monthly ticket price for public transport globally, at USD 271, followed distantly by New York (USA) at USD 127, Toronto (Canada) at USD 116 and Melbourne (Australia) at USD 114.[86] Mumbai (India) was

FIGURE 2. Average perceived increase in transport costs across 30 countries, 2021

Source: See endnote 79 for this section.



among the cities with the lowest-cost monthly public transport passes in 2023 at USD 15.[87]

- London (UK) also ranked first in a 2018 study on the average cost of public transport use (bus, tram or metro), at USD 5.66, followed by Stockholm (Sweden) at USD 5.43, Copenhagen (Denmark) at USD 4.64 and Oslo (Norway) at USD 4.49.[88] The cities with the lowest average cost were Cairo (Egypt) at USD 0.11, followed by Kyiv (Ukraine) at USD 0.18, Mumbai (India) at USD 0.23, Jakarta (Indonesia) at USD 0.26 and Mexico City at USD 0.29.[89]
- Among the cities offering free public transport in 2023 were Valletta (Malta), Luxembourg and Tallinn (Estonia).[90]
- A 2021 study in the US state of California concluded that subsidies for public transport would be the most effective tool in reducing vehicle-kilometres travelled.[91]

Emission trends

Road transport, particularly passenger transport, accounts for the majority of transport energy demand and transport emissions.[92] (*See Section 4.1 Transport Energy Sources and Section 3.6 Road Transport.*) Moreover, as of 2021, fossil fuels continued to supply 96% of transport energy demand, a share that has remained virtually unchanged for a decade (despite greater use of biofuels and electric vehicles), due mainly to rising overall transport demand.[93]

The implementation of integrated transport planning has been shown to play an important role in reducing transport emissions and minimising the use of resources. At the same time, it is urgent to reduce the need for motorised travel and to shift to more sustainable fuels and transport modes.

Due mainly to the impacts of the COVID-19 pandemic, transport experienced the greatest decline in carbon dioxide (CO_2) emissions (13%) in 2020 among combustion sectors, although it also showed the strongest rebound in 2021.[94] **Estimates for 2022 indicate that CO_2 emissions from ground transport (road and rail) nearly recovered to pre-pandemic levels, whereas aviation emissions (domestic and international) were still 20% below 2019 levels.**[95] Transport CO_2 emissions vary greatly by region, with North America contributing the highest per capita levels (4.8 tonnes), followed by Oceania (2.4 tonnes) and Europe (1.6 tonnes) in 2021.[96]

Road vehicle size and type, as well as dependency on personal road vehicles, greatly influences emission levels, with larger vehicles typically having higher emission intensity, and hybrid and electric vehicles typically reducing emissions by one- to two-thirds depending on the fuel source.[97] Larger vehicles such as sport utility vehicles (SUVs) and trucks pose an increasing risk to decarbonisation, leading the International Energy Agency to recommend that the auto industry decrease vehicle size.[98] (*See Section 3.6 Road Transport and Section 4.2 Vehicle Technologies.*)

To reduce emissions and pollution and to improve air quality, several cities and countries around the world have deployed low-emission zones (LEZs), ultra-low-emission zones (ULEZs) and zero-emission[i] zones (ZEZs) in recent years. In some cases, these zones apply specifically to freight vehicles (*see Policy Developments section*). Although the primary aim often is to mitigate congestion and poor air quality, the zones also can lead to reduced CO_2 emissions and improved health and social equity.[99] However, deployment has faced public opposition, enforcement difficulties and challenges in establishing clear criteria for determining vehicle eligibility.[100] Nevertheless, use of such zones is seen as a big step towards improving urban air quality, and implementing cities have reported significant reductions in emissions.[101]

- In Europe, areas with LEZs have experienced reductions in nitrogen dioxide (NO_2) emissions of around 20%, and in some cases as high as 40%.[102] However, older zones based on the Euro 4 and 5 emission standards for diesel vehicles have seen fewer reductions, due mainly to the mismatch between the emissions for these vehicles in test conditions versus real-world use.[103]
- Madrid (Spain) reported a reduction in NO_2 concentrations of 15 micrograms per cubic metre after implementing its LEZ, targeting Euro 3 petrol and Euro 4 diesel vehicles.[104]
- In Germany, concentrations of particulate matter (PM_{10}) fell 15% in Munich and 10% in Berlin following a ban on pre-Euro 4 diesel and Euro 1 petrol vehicles.[105]
- An analysis of the LEZ in Lisbon (Portugal) reported reductions in both NO_2 concentrations (22%) and PM_{10} (29%).[106]
- In Glasgow (UK), the Scottish Environment Protection Agency noted that between 2018, when the city introduced its LEZ, and 2019, the number of hours where NO_2 concentrations exceeded 100 micrograms per cubic metre fell by nearly half.[107]
- In the ULEZ of London (UK), roadside NO_2 fell 44% compared to levels prior to the use of emission-based charging measures.[108]

i Limiting traffic to only vehicles that emit zero *tailpipe* emissions.

Transit-oriented development is in place in many regions, as decision makers recognise that encouraging the use of public transport and active travel can greatly reduce transport emissions.[109] The impact of transit-oriented development on emissions can be significant, as such development is typically designed to be compact, walkable and mixed-use to minimise the need for car ownership and use.

- The 2022 Sixth Assessment report from the Intergovernmental Panel on Climate Change highlighted the potential of public transport-focused development and mixed land use to reduce greenhouse gas emissions 23-26% by 2050.[110]
- The US government published a plan in early 2023 that features the role of transit-oriented development in reducing emissions and mitigating climate change.[111]
- A 2022 study in Dhaka (Bangladesh) highlighted that in low- and middle-income countries, a focus on public transport to fully capitalise on environmental benefits remains a challenge for planners.[112]

Policy developments

The COVID-19 pandemic brought significant challenges for the transport sector, including reductions in the number of people travelling, increased health and safety concerns, and economic impacts on transport operators. In response, governments around the world implemented a range of transport policy measures aimed at promoting sustainable modes of transport; enhancing public transport infrastructure, services and safety; reducing viral transmission; and encouraging active travel and remote working. Implementation of these measures has had far-reaching effects on how people travel – leading to more people-centred transport systems in many places – and will likely shape the future of transport for years to come.

A sustainable transport hierarchy can be helpful in integrated transport planning and policy making, as it prioritises planning and investment decisions to favour sustainable modes over expensive and resource-intensive modes that often dominate in automobile-centric models (see Figure 3)**.**[113]

Effective and cost-efficient strategies to reduce transport emissions rely on a mix of policies. In Europe, for example, the policy combinations for decarbonising road transport are varied and have had equally varied results in reducing emissions.[114] The most successful combine carbon or fuel taxes with incentives for the purchase of cleaner vehicles and show that it is possible to reduce emissions by amounts consistent with EU zero-emission targets.[115] However, prioritising measures that incentivise active travel and public transport can maximise emission reductions and co-benefits, beyond what is possible from focusing on vehicles and fuels alone.[116] There is often latent demand for non-automobile travel modes, as those who would prefer to use other modes may be lacking alternative options where they live.[117]

FIGURE 3. Sustainable transport hierarchy

Source: See endnote 113 for this section.

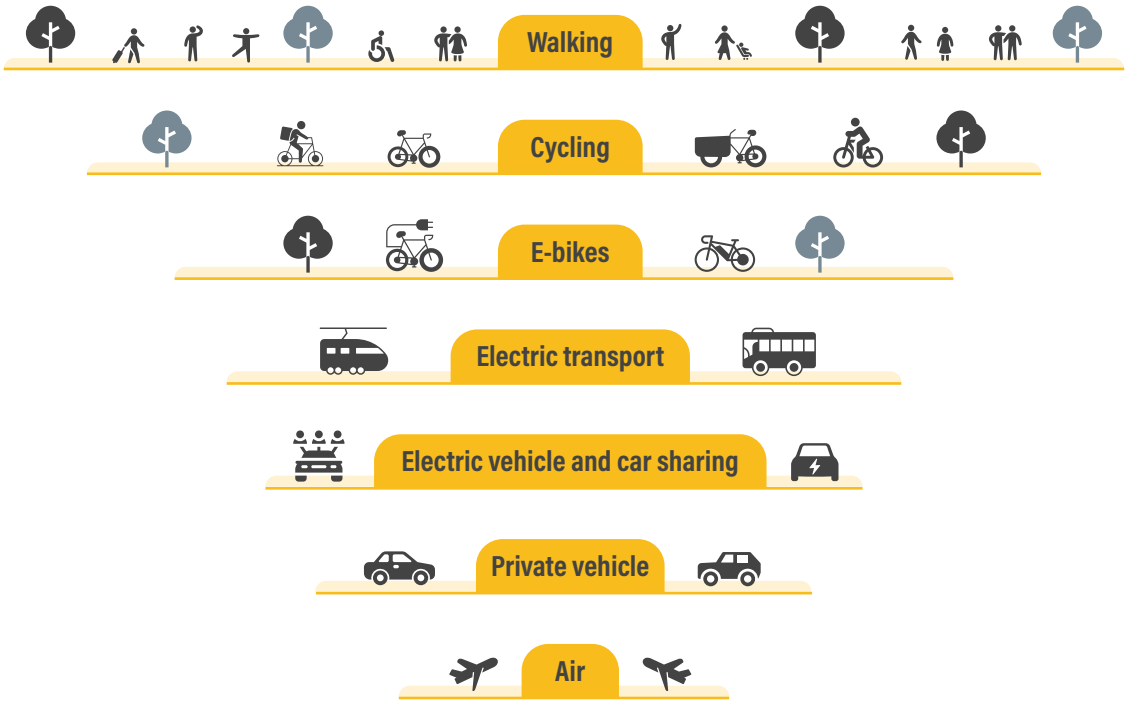
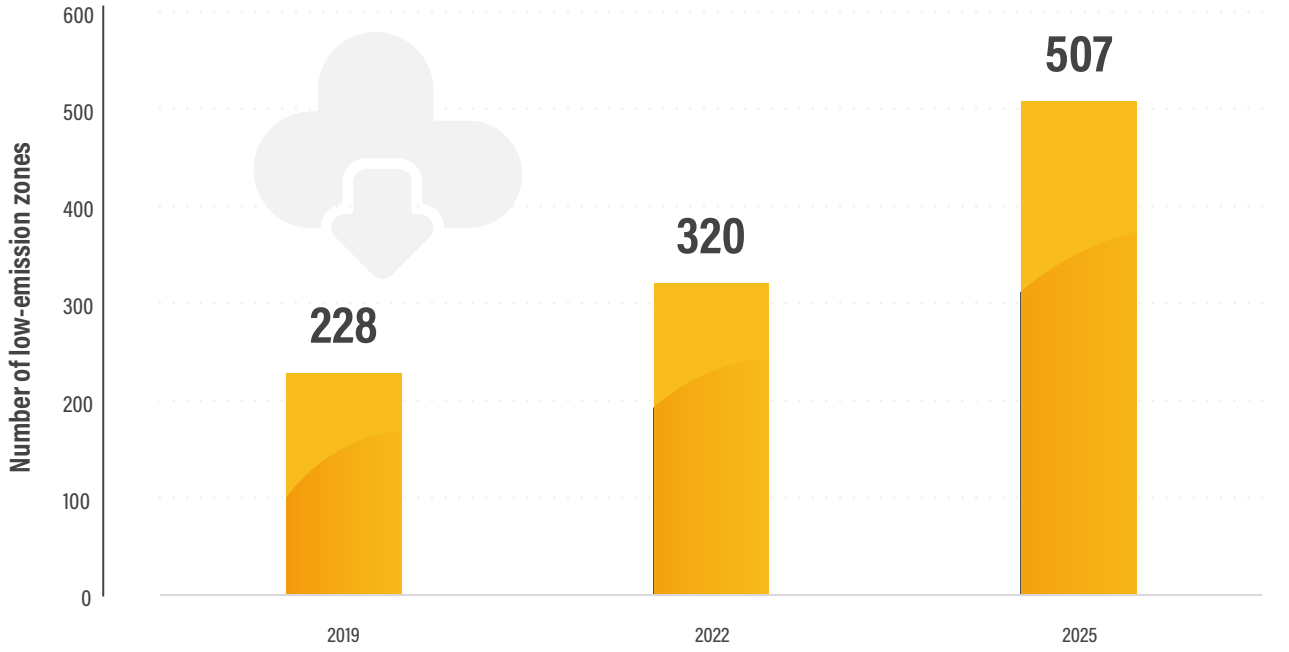


FIGURE 4. Active and planned low-emission zones in Europe, 2019, 2022 and 2025

Source: See endnote 133 for this section.



In a growing number of cities, measures to promote sustainable modes of transport and to reduce the negative impacts of urban mobility have been encapsulated and expanded on in sustainable urban mobility plans (SUMPs). These plans seek to make cities more liveable and environmentally friendly, with benefits including reduced carbon emissions and traffic congestion, and improved air quality and public health. By carefully balancing the needs of residents, businesses, and the environment, SUMPs can help cities become more sustainable and resilient in the face of growing urbanisation and climate change.[118]

- **By the end of 2022, the MobiliseYourCity Partnership had supported the preparation of 31 SUMPs and 9 NUMPs (national urban mobility plans)**, of which 16 SUMPs and 5 NUMPs were completed.[119] This included 12 SUMPs in Africa, 8 in Asia, 8 in Latin America and 3 in Eastern Europe, while NUMPs were prepared in 2 African countries, 2 in Asia and 5 in Latin America.[120]
- In Utrecht (Netherlands), the cycling action plan outlined in the city's SUMP helped create a strong cycling culture; Utrecht topped the Global Bicycle Cities Index in 2020 and 2022 and has ranked in the top three on the Copenhagenize Index of the world's most cycle-friendly cities since 2013.[121]
- A first application of the SUMP concept in China was launched in Foshan in 2021, with the goal of increasing the share of walking, cycling and public transport in the city from 52.1% in 2019 to 70% by 2035.[122]
- In early 2022, Istanbul (Türkiye) completed the country's first SUMP, which was also the first SUMP in a megacity globally, covering a population of nearly 16 million.[123]
- In Mexico, the Guadalajara Metropolitan Area launched the Metropolitan Emerging Mobility Strategy in 2021 as an update to its SUMP, with a focus on adjusting to the "new normal" after the pandemic.[124]
- In 2022, the Metropolitan Area of Medan (Indonesia) completed its SUMP, featuring a USD 3.2 billion investment plan for developing a modern public transport system for one of the country's largest metropolitan areas, with the goal of shifting 15% of trips to public transport.[125]
- Since adopting its SUMP in 2020, Tirana (Albania) has successfully implemented several actions, including extending and improving the bus network, providing financial and regulatory incentives for hybrid and electric taxis, and expanding cycling infrastructure.[126]

Supporting the objectives of SUMPs, transit-oriented development has advanced through policy and funding measures in recent years.

- **As of late 2022, the Indian cities of Chandigarh, the Pune Municipal Corporation and Navi Mumbai had successfully implemented transit-oriented development in their urban planning masterplans.**[127]
- **The US government announced USD 13.1 million in grants in late 2022 to help cities plan for transit-oriented development**, while the US state of California and British Columbia (Canada) revised laws to support it.[128]
- At the local level, Chicago (USA) passed legislation supporting transit-oriented development in a stated attempt to fight segregation and gentrification.[129]

Some national and sub-national governments have set vehicle travel reduction targets (as in New Zealand and Scotland) and in some cases require that all major transport and land-use planning decisions support these targets (as in California).[130] **Many more jurisdictions have adopted targeted bans on sales of internal combustion engine vehicles** *(see Section 4.2 Vehicle Technologies).* As of 2022, 23 countries had targets for 100% bans on sales of internal combustion engine vehicles – five of which also had targets for 100% renewable power – while several other jurisdictions had lower targeted shares.[131] (*See Section 3.6 Road Transport.*)

To spur the adoption of cleaner vehicles, many cities, particularly in Europe, either expanded or strengthened their low-emission zones (LEZ), implemented ULEZs or shifted completely to ZEZs as part of strategies for transport demand management during 2020-2022. To reduce resistance to these measures, some governments have introduced these zones incrementally and grown them progressively over time, either by increasing the strictness of policies or by expanding the geographic coverage. Ideally, governments should ensure that the zones support walkability and public transport for residents, and that businesses have access to safe, cost-competitive and low-emitting solutions for last-mile delivery.[132]

The number of active LEZs in Europe (the EU-27, United Kingdom and Norway) increased 40% between 2019 and 2022, from 228 to 320 zones (see Figure 4).[133] **By 2025, it is projected to grow another 58%** (to 507 zones), as laws mandating or supporting LEZs in France, Poland and Spain enter into force.[134]

- At least 27 of the LEZs in force in Europe as of 2022 were expected to be expanded or strengthened to reflect heavier restrictions on polluting vehicles.[135]
- In 2022, France announced that the country's LEZs would expand from 11 to 43 urban areas by 2025 – covering all large cities and towns – and that fines would increase more than tenfold.[136]

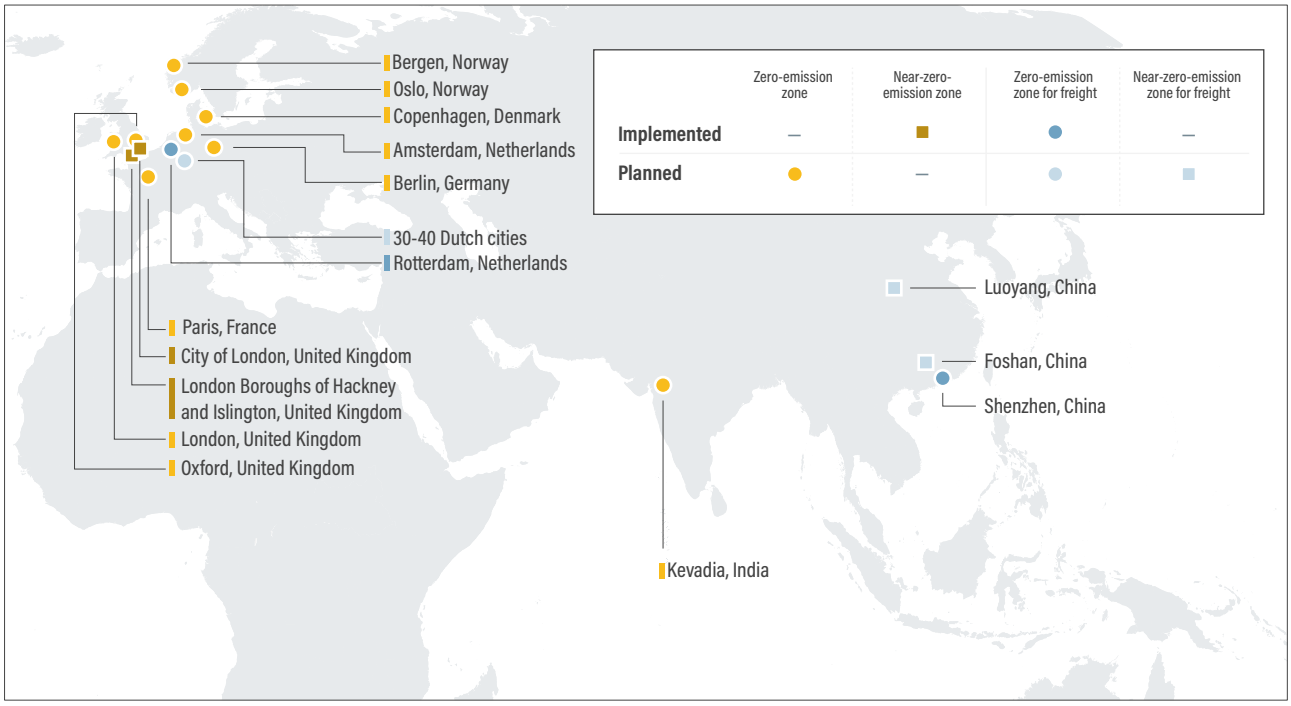
- The LEZ in Brussels (Belgium) was strengthened in 2022 to restrict the circulation of Euro 4 vehicles, the latest in a series of gradually tightened restrictions since the zone was introduced in 2018.[137]
- In 2022, Glasgow (UK) published plans to strengthen enforcement in its LEZ by mid-2023.[138]
- London announced that its ULEZ would be expanded from the city centre to all London boroughs in 2023, to cover 18 times its original size and 4 million people.[139] As of August 2021, 95% of heavy-duty vehicles operating in London were compliant with the more stringent LEZ standards introduced that March.[140]

Developments in LEZs elsewhere have been less extensive than in Europe.

- Jakarta (Indonesia) began implementing an LEZ pilot in the Kota Tua Tourism Area in early 2021, which covers a relatively small area (around 12 hectares) compared to LEZs in cities such as Beijing and London.[141] A study found that support for expansion of the LEZ to other locations in Jakarta was shaped by the level of the population's trust in government and its institutions, the level of environmental concern, as well as personal and social norms regarding LEZ implementation.[142]
- In China, in addition to LEZ policies (in place in 13 cities as of 2020), cities use permits and restrictions on freight access as popular measures to advance zero-emission freight goals and reduce congestion.[143]

FIGURE 5. Implemented and planned zero-emission zones and variants as of July 2022

Source: See endnote 154 for this section.



By mid-2021, several dozen cities had implemented or planned to implement ZEZs or near-ZEZs, mostly in Europe but also in China and India.[144] Gradually converting LEZs into ZEZs can complement transport policies that promote a switch to active modes such as walking and cycling and support the electrification of public transport, taxis, shared and private vehicles, and delivery vans.[145]

- As of mid-2022, 36 cities (mostly in Europe and the United States) had committed to the C40 Cities Green and Healthy Streets Declaration, aiming for zero emissions in a major area of their cities by 2030; establishing a ZEZ is a clear pathway to reaching that commitment.[146]
- In the United Kingdom, Oxford implemented a ZEZ in 2022, the City of London historic and financial district launched one in 2020, and the London boroughs of Islington and Hackney did so in 2018.[147]
- Copenhagen (Denmark) has taken a phased approach with its LEZ, launching it in 2020 and strengthening it in 2022, with plans to pilot a ZEZ beginning in 2023.[148]
- As of 2021, Berlin (Germany) planned to convert its LEZ into a ZEZ, covering 88 square kilometres in the inner city.[149]
- In 2020, Bergen (Norway) aimed to become fossil fuel-free by 2030, notably through a ZEZ covering the entire downtown area, to be phased in starting in 2023.[150] The ZEZ in Oslo (Norway), scheduled to enter into force in 2023, commenced with a "Car-Free City Life" area where pedestrians and cyclists have priority over private cars; the measure is set to expand to other areas of the city by 2026.[151]
- Amsterdam (Netherlands) plans to transform its ZEZ, in place since 2020, into a ZEZ by 2030.[152]
- In 2021, Kevadia (India) announced plans to develop the country's first ZEZ – referred to as an "electric vehicle only" area – in the vicinity of a main tourist attraction, the Statue of Unity.[153]

Some cities have chosen to establish specific zero-emission zones for freight transport (ZEZ-Fs) – ranging from urban delivery vans to medium- and heavy-duty trucks – to alleviate the contribution of freight transport to air pollution and emissions (see Figure 5).[154]

- In 2021, the Netherlands announced an aim to implement ZEZ-Fs in 30-40 of the country's largest cities by 2025.[155] As of 1 January 2025, any city in the Netherlands would be permitted to designate areas as a ZEZ-F.[156]
- Copenhagen (Denmark) intends to pilot a ZEZ-F, referred to as a "zero-emission delivery zone", that would apply to vans by 2023 and trucks by 2025.[157]

- A ZEZ-F pilot in Shenzhen (China), implemented in 2018 with a focus on light-duty trucks, covers 22 square kilometres (1.1% of the total city area) and was scheduled to expand in mid-2023.[158]
- In 2021, Luoyang (China) adopted a near-ZEZ-F scheme, to be implemented in 2023, that applies to urban delivery trucks and covers the city centre.[159]
- In the US state of California, the Los Angeles Cleantech Incubator and the City of Santa Monica partnered to deploy the country's first ZEZ-F in early 2021, referred to as a "zero-emission delivery zone" and covering a one-square-mile commercial area.[160] While the ZEZ-F is voluntary, the partners hope it will serve as a blueprint for other cities to implement similar zones.[161]

Partnership in action

- As of early 2023, the **MobiliseYourCity Partnership** had partnered with 31 cities in Africa on mobility projects, including the development of two SUMPs in Cameroon and one NUMP in Tunisia, directly enabling more than EUR 170 million (USD 181 million) in international loans and grants; additional SUMPs were being prepared in Côte d'Ivoire, Ethiopia and Ghana.[162]
- **Germany's Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)** supported Foshan (China) and Tirana (Albania) in developing their SUMPs, in addition to elaborating policy recommendations for the design of a SUMP in Kuala Lumpur (Malaysia).[163]
- The **Institute for Transportation and Development Policy (ITDP)** has worked with several African cities to provide technical advice on improving transport systems, influence policy and raise awareness of the ability of sustainable transport to reduce emissions, poverty and social inequality.[164]
- **ICLEI–Local Governments for Sustainability** has set up an "ecologistics community" to encourage sustainable urban freight in cities around the world and has developed indicators to serve as a guide for local governments.[165]

3.1
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