1 Improving access to opportunities in cities

This chapter makes the case for enhancing urban accessibility in cities as a way to build compact, greener and more inclusive cities with higher levels of well-being. It argues that urban accessibility also has the potential to support recovery efforts from the COVID-19 pandemic via transit-oriented policies. The chapter begins with a discussion on the shift from mobility to accessibility. This is followed by an examination of the policy actions cities may consider to improve sustainable access to opportunities for everyone, in particular low-income households and women, such as improvements to the transport network, housing policies, active and micro mobility as well as smart mobility projects. The chapter concludes with a discussion on how cities can improve quality of life through the urban form by exploring urban density, land use policies, connectivity and a better balance between modes of transport.

Key messages

Cities are changing their approach to transport and urban planning to improve economic efficiency, well-being levels and environmental protection. This new approach gives more emphasis to planning for people and places rather than private cars. Easing the way people access jobs, goods and services by public transport or active mobility (walking and cycling) is a key feature of compact, connected, greener and inclusive cities. The COVID-19 pandemic has exacerbated this shift that reasserts the importance of proximity to the means by which people satisfy their needs (opportunities).

Key takeaways for national and subnational policymakers are:

- Transport investment needs to be combined with complementary policies to improve access to opportunities, in particular for low-income households and vulnerable groups. Improving accessibility requires not only an efficient public transport network but also a mix of land use, housing and other urban-related policies.
- Accessibility requires a transit-oriented, affordable-housing approach that promotes the expansion of the offer of affordable housing in central areas and closer to transit hubs. Ensuring access to public transport and creating high-density, mixed-used places where local amenities are at a short distance are critical elements to improve well-being and inclusive cities.
- Building intermodal and integrated transport systems with car parking near transport hubs is an effective manner to improve the performance of the transport system. While an intermodal transport system ensures that all transport means complement each other, an integrated transport system makes travel easier and more affordable for commuters encouraging transport use.
- Encouraging and facilitating active mobility (walking and cycling) is an effective manner to complement the public transport system and potentiate green urban transport. Active mobility is the fastest and least expensive mode for many short-distance trips, but cities require to make more efficient and safer use of streets by re-allocating space to allow walking and cycling.
- Micromobility (e-micromobility) – the use of assisted mobility devices such as e-bikes and motorised scooters – is an alternative to public transport due to their flexibility and low operating costs. Cities require investing in building safe and inclusive on-street infrastructure and issue clear regulations on what constitutes micromobility and how it can be used.
- Smart mobility projects can enhance urban accessibility and reduce the negative externalities related to transport through the use of new (digital) technologies. Shared mobility, autonomous vehicles and shared mobility schemes are the next game-changer in urban mobility but require clear government guidance to ensure they contribute to the pursuits of inclusive and accessible cities.
- Accessibility needs to be planned and fostered through a gender lens. The design, function and use of the transport system and urban environments should be planned considering the needs of all travellers equally to give everyone access to their city.
- A well-designed urban form may be an effective tool to improve accessibility, increase social cohesion and promote well-being in urban areas. It requires: ensuring a sufficient level of density to make the most of the agglomeration benefits; integrating land use and transport policies through transit-oriented development strategies; building the infrastructure for pedestrian-friendly cities to improve connectivity; and offering different mobility alternatives (transport solutions) by promoting public transit, walking and cycling.

Understanding urban accessibility

Urbanisation and transport – The background

The global urban population continues to grow unabated. Metropolitan areas account for the strongest urban population growth. Two hundred years ago, only 3% of the world's population lived in cities. Since 2007, more people live in cities than in rural areas for the first time ever, giving rise to what is known as the metropolitan century (OECD, 2015[1]). Nowadays, 48% of the world's population live in cities, 24% in rural areas and 28% in towns and semi-dense areas (OECD/European Commission, 2020[2]). The most visible expression of urbanisation lies in the so-called megacities. They represent the most densely populated urban agglomerations on earth with 10 million or more inhabitants. Megacities are economic powerhouses and form hubs which are strongly integrated into the global network of goods, capital and data flow.

With the rapid population increase, cities are reaching capacity. They register a large demand for housing and correspondingly high property prices, congested transport routes and social challenges. The more people live together in a restricted space, the more difficult it becomes to transport them from A to B. There are also different forms of transport available that also differ in the amount of space they require, their CO_2 emissions, flexibility, costs and speed. The question of which form of transport is the best choice for which person and which journey is constantly changing. There are no general solutions for all cities as there are differences in planning and socio-economic development and the established structures are too complex.

In this context of the COVID-19 pandemic, improving access to goods, services, information and people in cities contributes to economic recovery, growth and development as well as citizens' well-being and quality of life. The more efficient the access to opportunities, the greater the economic benefits through economies of scale, agglomeration effects and networking advantages. Better accessibility may imply having to travel less and in a more efficient way; this may save time and contribute to environmental protection. Managing without a car is likely to become easier in major city centres as they are normally well served by a network of trains, buses, metros and trams. However, in suburban areas, most citizens still need their own form of transport to be sufficiently mobile.

Urban accessibility is a key feature of a compact city – a spatial form characterised by 'compactness' (OECD, 2012[3]). Compact cities can take different forms but according to OECD research they have three main characteristics (2012[3]). First, compact cities have dense and proximate development patterns, which refers to how intensively urban land is utilised, and proximity concerns the location of urban agglomerations in a metropolitan area. Second, in a compact city urban areas are linked by public transport systems, which indicates how effectively urban land is utilised. Public transport systems enable urban area to function effectively. And third, in compact cities there is accessibility to local services and jobs. This refers to how easily residents can reach local services and jobs either on foot or using public transport.

COVID-19 started a debate on the vulnerability of densely populated cities as the likelihood to spread the virus is higher due to close proximity among residents making it difficult to apply physical distancing measures. However, the experience of OECD countries and cities suggests that density alone is not the problem, but the structural economic, and social conditions of cities is what makes them more or less vulnerable and enable to implement effective policy responses (OECD, 2020[4]). Cities marked with inequalities, inefficient public transport services and low urban accessibility are more vulnerable than those that are better resources, less crowded, more equal, and have higher levels of accessibility to services and jobs.

Urban accessibility can be promoted through different measures. Efficiency in transport accessibility is normally based on compact and public transport-oriented policies. It may involve retrofitting and densification of established urban areas and the promotion of transit-oriented urban expansion, mostly in areas where there is already high density. Focusing on accessibility may be considered as part of an

evolutionary process in urban and transport planning but accessibility cannot be achieved without sound mobility plans, regional development plans, mixed land use plans, environmental plans and even socio-economic plans. According to research, strategies to enhance urban accessibility would normally seek to: reduce the travel intensity in cities through greater physical proximity and co-location of different urban functions; shift from private motorised modes of transport to share non-motorised modes of transport; and improve the efficiency of road-based vehicles (Rode et al., 2014[5]). And the promotion of these objectives will have to be based on sound institutional structures and planning processes as well as on effective governance arrangements.

From mobility to accessibility

Cities are changing their approach to transport and urban planning

For a long time, urban and transport planners have put a lot of emphasis on mobility when discussing the role of transport in social and economic development. Mobility refers to the ability to move freely but this is only valuable if that person can reach important destinations using their mobility (Marks, Mason and Oliveira, 2016[6]). Thus, the quest for sustainability is leading cities across OECD member and partner countries to transit from mobility-enhancing to accessibility-oriented strategies for sustainable urban planning (Gil Solá, Vilhelmson and Larsson, 2018[7]; Straatemeier, 2008[8]). This is a shift in urban planning, from viewing car transport as the means to reach services and activities distributed in the urban space to policies enabling local living and supporting environmentally friendly transport modes: public transit, cycling and walking. Planners and researchers consider accessibility planning as a key strategy to maximise the environmental sustainability and quality of life in urban areas (Coppola and Papa, 2013[9]). However, the term accessibility has been misinterpreted or poorly defined, and on many occasions is used as a synonym for mobility. The problem is that this promotes a bias towards car-oriented planning by favouring physical movement without taking into consideration the role of land use policies in improving accessibility (ITF, 2019[10]).

Accessibility planning is understood across the literature as the re-orientation of the urban structure by focusing development on places with high accessibility and making public and private transport systems more efficient (Curtis, 2008[11]; Coppola and Papa, 2013[9]). A critical difference between mobility and accessibility planning stems from the fact that former focuses on improving transport networks performance while the latter aims at maximising the access to opportunities such as workplaces, services, entertainment, education, goods and culture, for instance. However, mobility planning cannot be dissociated from accessibility as improving “access” depends largely on the performance and quality of the transport system; but its ultimate goal is not just “movement” but “access” to goods and services. Research suggests that “… [accessibility] planning should be based on the desired level of connectivity between urban functions and improving the quality of life rather than on predictions of future levels of congestion” (Inturri et al., 2017, p. 3273[12]). The focus shifts from the means (transport networks and mobility) to the ends (i.e. working studying, shopping) (Coppola and Papa, 2013[9]; Gil Solá, Vilhelmson and Larsson, 2018[7]).

Urban accessibility can be defined as the ease by which people have access to jobs, housing, shopping and in general to goods and services. It combines the proximity of opportunities and the efficiency of the transport network and therefore depends on both land use mix and the transport system. Focusing on accessibility allows linking transport planning to what people do and how private sector actors operate. Improving accessibility requires trade-offs among land use, transport options, the availability of opportunities at different times and people’s needs and abilities (Rode et al., 2019[13]). Several indicators can be used to measure accessibility, such as population, job accessibility by car or transit, access to retail or leisure opportunities, or access to green space. Highly accessible communities, particularly in compact cities such as those in Europe, are typically characterised by low daily commuting distances and travel times, enabled by multiple modes of public transport (IPCC, 2014[14]).

Planning for accessibility signals a shift from planning which focuses on the efficiency of the transport network to planning which focuses on the position and development potential of places in the wider network of cities (Straatemeier, 2008[8]). The key question planners need to answer is how to develop places in the metropolitan area that offer people and firms the means to reach more opportunities with less mobility.

A key difference is between planning for cars and planning for people and places. Accessibility, in a way, suggests that, for households and firms, the transport system itself is not important but rather the fact that it can provide them with access to spatially and temporally dispersed opportunities (Straatemeier, 2008[8]). Socio-economic changes, changing public attitudes and even technological innovations have triggered this change. Moreover, some cities have issued legislation on mobility stating the right to mobility. For example, Mexico City's Mobility Law states that residents have the right to mobility through the different transport means to satisfy their needs and that the focus of mobility should be the individual (Mexico City Government, 2014[15]).

This transition is a break from traditional transport planning. In the 1960s, transport planners used to solve urban transport problems through the classic deductive approach (data collection, defining goals and objectives, forecasting future demands). The main feature of this approach was that land use was considered a given. Planners did not advocate land use change to make the transport system more effective. In the 1980s, planners concluded that, to ensure sustainable mobility with more energy-efficient and climate-proof transport systems, a new approach was needed (Inturri et al., 2017[12]). Thus, they began to address issues of urban environmental sustainability by linking land use and transport planning (Curtis, 2008[11]).

Planning strategies could be developed to foster accessibility within the city or even region. In this way, accessibility can be used as a policy design tool to pursue broader economic, social and environmental goals, which are at the heart of present-day national and local policy discussions. The need to provide people with access to jobs or to provide firms with access to skilled workers are just some examples of these issues (Straatemeier, 2008[8]).

The shift to accessibility should not be taken for granted

Although there seems to be a shift towards enhancing accessibility as a new approach for improving lifestyle in cities, some metropolitan areas are still largely focused on mobility per se. Indeed, planning regulations and standards often support mobility rather than accessibility improvements. This is not a weakness in itself but it signals that, in some cases, planners and policymakers focus more on improving the provision and performance of the public transport system than on providing a more holistic or comprehensive solution to urban accessibility challenges. This focus could be based on a lack of interaction between agencies, e.g. the transport authority defines the mobility plans with little or no participation of the regional or metropolitan planning authority. In this situation, the transport authority has only the mandate to work on its domain. Policy-makers rarely promote new investments to foster accessibility; instead, projects are pitched based on their expected ability to reduce congestion, shorten travel times or meet projected increases in vehicle travel, focusing on the level of service and not on accessibility (Duranton and Guerra, 2016[16]). The Transportation Strategy of New York City, for instance, has a specific goal to expand mobility to sustain the city's growth (NYC Department of Transportation, 2016[17]). There is no mention of how land use and transport policies could be better linked to achieving other objectives such as providing more affordable housing in central areas. In the Madrid region, the transport strategy is not linked to other urban development because there is no regional development authority nor a regional development strategy that guides economic, land use, transport, housing and environment policy at the regional scale. In Spain, the Sustainable Urban Mobility Plan is the main planning tool for setting mobility policies at the urban level in the Madrid region. A key feature of this plan is that it gives priority to managing travel demand by increasing the volume and capacity of the transport system but not to how people could access goods and services.

The strong focus on mobility suggests that cities are still giving a lot of importance to the means and not to the end (the access to goods and services). Undoubtedly, people want to move faster, safely and comfortably, which are the features any transport system should have. However, people do not use public transport for the pleasure of doing it but because they need to get to a destination where they can access opportunities. Accessibility does not necessarily imply movement; information and communication technology (ICT) can in many cases provide access to services and goods without people needing to leave their homes. Accessibility in cities depends on the creation of the conditions for a more balanced modal split. The transport system should be designed in a way that more people regardless of age, disability, gender and socio-economic background can have access to.

It may be argued that mobility policies allow cities to focus on immediate problems, facilitating the movement of people by ordering transport, traffic and moving more people across the city. But the case studies developed by the OECD in cities such as Madrid, Prague and Vancouver suggest that if mobility policies are to be effective, they need to be complemented and co-ordinated with other urban development policies such as housing, land use, economic development and the environment. Mobility alone may not be sufficient to ensure the sustainability of urban development.

Improving (sustainable) access for everyone

In the majority of the 32 European metropolitan areas in England (United Kingdom, UK), France, Italy and Spain, low-income households benefit less from access to opportunities than high-income households, largely because of differences in the way opportunities are distributed across cities. The ratio between the average number of opportunities in an 8 km radius around a neighbourhood for high-income and low-income neighbourhoods is higher in metropolitan areas where high-income households enjoy better accessibility. In metropolitan areas where access is the least inclusive, residents of high-income neighbourhoods live surrounded on average by almost twice as many opportunities than residents of low-income neighbourhoods (Table 1.1). This ratio is less than one in metropolitan areas featuring inclusive access to opportunities, implying that residents of low-income neighbourhoods have more opportunities close to them than residents of high-income neighbourhoods. Although better transport performance alone (i.e. more frequent service on public transport or faster travel speeds) do not help to overcome accessibility gaps, there are currently no other systematic differences between neighbourhoods of different income levels that would widen those gaps. Nowadays proximity of people to opportunities is the most promising way of bridging accessibility gaps. To leverage the potential of transport performance in improving accessibility levels, investment into transport infrastructure needs to be more targeted towards those neighbourhoods particularly penalised by the uneven distribution of opportunities in cities.

Table 1.1. Inclusiveness and the distribution of opportunities in metropolitan areas

Ratio between average proximity in high-income and low-income neighbourhoods

Metropolitan areas where richer neighbourhoods have better car and public transport accessibility	1.9
Metropolitan areas where richer neighbourhoods have better accessibility by public transport but not by car	1.2
Metropolitan areas where richer and poorer neighbourhoods have similar levels of accessibility	0.9
Metropolitan areas where poorer neighbourhoods have better car and public transport access	0.7

Note: The threshold for "better" accessibility in Income Group A with respect to Income Group B is at least 25% higher accessibility in Group A compared to Group B, i.e. a large difference between the 2 groups. Average proximity in high- and low-income neighbourhoods corresponds to the number of shops located in the surrounding 8 km of an average neighbourhood, where the average is population-weighted. Transport data refers to 2018 and income data to the closest year available.
Source: Data on transport accessibility are from ITF (2019[18]), "Benchmarking Accessibility in Cities: Measuring the Impact of Proximity and Transport Performance", https://doi.org/10.1787/4b1f722b-en.

Transport investment needs to be combined with complementary policies for it to be effective at improving accessibility for everyone. Based on the analysis presented in this report, improvements in the performance of the transport system do not seem to translate into better accessibility for low-income residents and can therefore be accompanied by complementary policies such as the densification of the commercial offer in low-income neighbourhoods. However, this solution appears less viable for activities that by their own nature require a higher degree of localisation, e.g. jobs. For these activities, transport investment – accompanied by measures aimed at preserving housing affordability – remains an effective way to improve low-income families' accessibility.

Improvements in the performance of the transport network

The performance of the existing public transport network can be enhanced by means of greater capacity, increased speeds or higher frequency:

1. One example of public transport capacity improvements is the replacement of single-decker vehicles with double-decker ones. This is the case of the famous fleet of London buses or Ouigo high-speed trains in France.
2. Speed improvements are not always easy to operationalise, especially when public transport vehicles circulate in mixed traffic. The creation of dedicated bus lanes can be an effective way to improve public transport speed performance.
3. Frequency improvements can also raise the efficiency of the existing network. However, there exists a natural limit beyond which further increases in frequency can pose safety concerns. Improvements in speed help relax the constraints imposed on public transport frequency by safety concerns. Improvements in speed and frequency should therefore be seen as complementary.

Network expansion can enhance public transport performance. In cities that are reaching saturation of their local public transport network, such as in the city centre of Paris, transport policy should pursue a double objective consisting of: i) investing in alternative transport modes such as walking, cycling or micromobility in the city centre (see below); and ii) developing and/or strengthening the public transport network infrastructure in the commuting zone. These investments should aim at complementing the radial structure of the public transport system that characterises several cities with ring-type connections reducing the extent of disconnection between peripheral neighbourhoods.

Transport investment alone is not sufficient for closing accessibility gaps between rich and poorer neighbourhoods and needs to be accompanied by efforts to improve proximity for everyone. If in the surrounding neighbourhoods there are few opportunities for residents, access to opportunities will remain low in spite of a potentially perfectly operational public transport system.

Increasing the proximity of people and opportunities

A mix of policies favouring densification around newly developed infrastructure and mixed land use can increase the proximity of people and opportunities. Densification policies need to account for the growing scarcity of public space, especially in city centres. Relaxing height regulations provide the opportunity to obtain densification without necessarily reducing the amount of public space in city centres. Greater progress in this direction can be achieved by OECD member countries, whose city centre density tends to be higher on average (ITF, 2017[19]), as opposed to non-member countries.

Densification policies require a great amount of co-ordination with transport infrastructure development and co-ordination should accompany all stages of this development, from planning to execution. For instance, *ex ante* co-ordination can help avoid low-density development in an area designated by the public authorities to become a public transport hub. *Ex post* co-ordination should instead focus on orienting private developers' efforts towards areas that were recently subject to public transport performance improvements (OECD, 2017[20]).

Mixed land use refers to a situation in which different land uses, e.g. residential, commercial or industrial, are co-located. Mixed land use reduces commuting time by reducing the need for long-distance commuting in the first place and favours the adoption of transport modes different from private cars, such as walking, cycling or public transport. Mixed land use requires a strategy for inducing different types of activities to locate in the same area. The strategy can also be triggered by the development of new transport infrastructure: there are examples of cases where investments into local transport infrastructure revived local business dynamism by attracting new businesses. Policymakers seeking to increase the availability of certain amenities in given areas (e.g. shops, bars, restaurants, etc.) need to be ready to adopt complementary policies mitigating the potential subsequent increase in housing costs, owing to the fact that high-income residents might prefer living closer to these amenities.[1]

Ageing will make mixed land use increasingly important. Given that mobility of older people is limited, policies favouring greater nearness between people and opportunities can be an effective tool to improve accessibility and well-being for everybody, without leaving behind the rising share of older people in the population. For example, mixed land use in the form of so-called “complete communities” is a pillar of Calgary’s Municipal Development Plan, developed in 2009 to support the 100-year vision established in 2006 by the city of Calgary, imagineCALGARY. ImagineCALGARY is the response to the growing need for sustainable urban development and mounting societal challenges in the distribution of well-being, including demographic pressures induced by the steady decline in immigration that the city has witnessed in recent decades (OECD, 2015[21]).

Accessibility for everyone requires a “transit-oriented affordable housing” approach

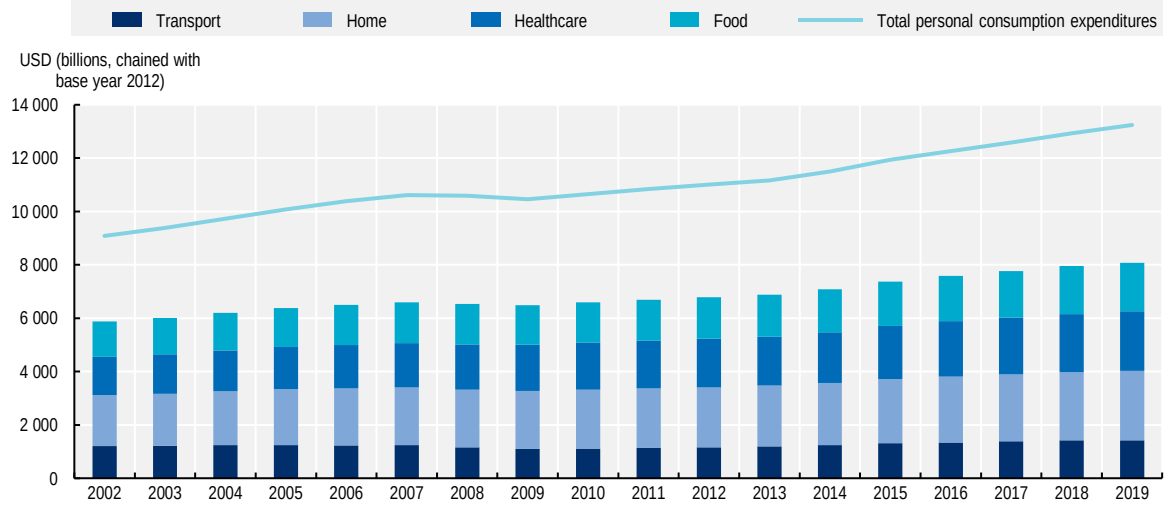
Transport policy that seeks to improve the accessibility of disadvantaged areas, for example by adding additional public transport routes, might not create benefits for current residents. Depending on how accessibility changes, land values in the area subject to public transport ameliorations will rise and high-income residents will outbid low-income ones, who might be therefore be forced to move out as the overall cost of housing rises. If low-income households own the property they live in, the gains in property prices accrue directly to them even if they decide to sell and move to other parts of the city (or another city altogether).[2] But those who rent will not see the same gains. The price rise can be however an opportunity for governments to collect funds to support the infrastructure development itself and complementary projects supporting the local community.[3]

Transport and housing policies are highly linked as fundamental elements of the urban system. The price of housing varies depending on its proximity to public transport and rapid transit services.[4] In Metro Vancouver, following transportation, the lack of affordable housing is one of the most frequently mentioned issues of growing concern for citizens. When housing and transportation costs are combined, the cost burden relative to the median pre-tax income is 40% for owners and 49% for renters, while low-income households can spend up to 67% of their pre-tax income on housing and transport costs (Metro Vancouver, 2015[22]). Thus, understanding the pattern and linkages of housing affordability and public transport is important to support the formulation of measures to foster accessibility. The affordability of daily travel, especially for lower-income groups, is associated with the households’ housing location choice. In many metropolitan areas, households make trade-offs by either choosing more affordable housing in less accessible areas with higher commuting costs (in monetary and time terms) or spending more on housing in highly accessible areas with lower transport costs. Housing and transport affordability depend on factors such as the journey to work, vehicle ownership, the quality of local transport options, income, housing locations (Dewita, Burke and Yen, 2019[23]). Affordability also depends on the quality of infrastructure such as road design. Thus, accessibility is dependent on the location of services (schools, hospitals, shopping centres, etc.) and jobs. How all these elements are combined will determine the share of the households’ budget dedicated to transport and housing. In the United States (US), for instance, households spend almost 20% of their income on housing and 11% on transportation. Housing and transportation are two of the four main categories of household expenditures in the US (Figure 1.1).

One of the measures cities adopt to improve accessibility while providing affordable transport and housing is to improve access to public transport. For this, city authorities aim to ensure that all new development is suitably located where there is good access to public transport. Residential, commercial and other developments are expected to encourage walking, cycling and the use of public transport. This is in line with the Healthy Streets Approach adopted in London. The reason is that developing locations with public transport access creates high-density, mixed-used places, where local amenities should be at short distance encouraging walking and cycling. It is expected that people living in more densely populated and developed places are more likely to use public transport, walk or cycle.

Achieving affordable housing and transport also requires creating high-density, mixed-used places. As the experience of the Île-de-France region suggests, the land around stations provides opportunities to create high-density, mixed-use places that are well connected to local services and amenities as well as jobs and locations further afield. The city of Malmö's mobility strategy suggests that providing inhabitants and commuters with the possibility to travel more sustainably requires growing and developing locations with good accessibility to public transport, infrastructure for bicycles and an attractive environment for pedestrians (City of Malmö, 2016[24]). This is a way to increase value for money and make the most of past investments in public transport infrastructure and enhance the benefits of any new investment. High-density developments, as planned in London and Vancouver, that are further away from stations can be supported by bus services and cycle lanes. Such networks can increase the catchment area of a station, provide greater employment opportunities and reduce car dependency. A city's growth potential is normally concentrated in its central business districts and town centres. Thus, as the experience of London suggests, maximising the capacity of the public transport network, extending the network to open up new areas for homes, optimising land use around stations and improving conditions for walking and cycling are means to use transport to support growth (Greater London Authority, 2018[25]).

Figure 1.1. Household consumption expenditures in the United States, 2002-19



Note: Bars show the four largest groups of expenditures. Transport includes spending on motor vehicles and parts, gasoline and other energy goods, and transportation services. Home includes spending on furnishings and durable household equipment, and housing and utilities (services). Food includes spending on food and beverages purchased for off-premises consumption, and food services and accommodations.
Source: BEA (2020[26]), *GDP & Personal Income [Database]*, https://apps.bea.gov/iTable/index_nipa.cfm.

Box 1.1. Proposals for promoting affordable housing and transport in London

London's Transport Strategy includes a series of proposals intended to embed public transport in current and future developments. There are more than 600 rail and tube stations in London and the government intends to explore options for development around them. Some of the options are converting land use from low-density uses (retail, storage, parking) to high-density mixed-use development. This change should be a catalyst for the regeneration of town centres and neighbourhoods. Some of the proposals are:

The Mayor (through Transport for London, TfL) and the boroughs will:

- Seek opportunities for densification of development supported by the public transport network, in particular around public transport stations and stops; and investment in improving station environments, interchanges and local walking and cycling networks.
- Impose high expectations of developers to deliver transport solutions that will promote a shift to active, efficient and sustainable modes, reduce road congestion, improve air quality and assist in the development of attractive and healthy places.
- Restrict car parking provision within new developments, with those locations more accessible to public transport expected to be car-free. New developments should contain high levels of cycle parking and storage, and contribute to the provision of on-street cycle parking in town centres and places of high demand.
- Support growth through transport investment and planning in the Central Activities Zone (CAZ), in and around town centres, in close proximity to stations and opportunity areas. Planning framework should set mode share targets, and boroughs and stakeholders have to demonstrate how development plans will contribute to mode-shift away from car use to walking, cycling and public transport.

Source: Greater London Authority (2018[25]), *Mayor's Transport Strategy*, http://www.london.gov.uk (accessed on 15 July 2019).

One of the risks of densification is that the price of housing close to transit areas tends to rise to the point that only people who can afford to live near transit are the least likely to depend on it. City centres, especially the well-connected parts of the centres, can exclude economically vulnerable groups. One lesson from the experience of Metro Vancouver is that one additional criterion to assess housing affordability is proximity to transit. Housing affordability has been a challenge for authorities in Metro Vancouver where house prices around transit areas have increased, making the metropolitan area one of the most expensive places to live in Canada. Metro Vancouver has the highest average monthly costs for homes with a mortgage and one of the highest monthly rents in the country. Working households in the metropolitan area can spend up to 50% of their pre-tax income on housing and transportation costs. Affordable housing in prized zones is endangered, though pressure on municipalities to increase residential density near main transit lines is growing. Rents are cheaper in other areas not close to transit zones but the transport costs make them the most expensive.

Box 1.2. Metro Vancouver affordable housing strategy

Metro Vancouver's Regional Growth Strategy calls for more density near transit hubs and urban centres to reduce reliance on cars, promote neighbourhood walkability and house the one million newcomers expected by 2040. Higher density development areas are located close to SkyTrain stations within a perimeter of 400 metres. The plans consider commercial and residential areas but sometimes it is challenging for local authorities to attract new office uses due to the lack of amenities in some of the municipalities. The suburbs of some cities need to be retrofitted as they are highly car-oriented and lack public transit infrastructure. Improving the frequency of the bus service and bike lanes as part of road-widening works is seen as one possible solution to enhance accessibility.

Expanding the Frequent Transit Network (FTN), concentrating new growth and development around existing FTN corridors, is expected to help give more households an option to be less auto-dependent and reduce their transport expenditure. To meet the challenge, authorities plan to build new rapid transit lines, new line bus corridors and more frequent bus routes throughout the region. The aim is to expand the transit-oriented locations to make the transit and affordable housing connection. But partnerships and concerted efforts are necessary to make affordable housing a reality.

Source: Metro Vancouver (2017[27]), *Transit-oriented Affordable Housing Study 2017-2019*, http://www.metrovancouver.org/services/regional-planning/housing-affordability/transit-oriented/Pages/default.aspx (accessed on 25 June 2018); Metro Vancouver (2015[22]), *The Metro Vancouver Housing and Transportation Cost Burden Study - A New Way of Looking at Affordability*, http://www.metrovancouver.org/services/regional-planning/PlanningPublications/HousingAndTransportCostBurdenReport2015.pdf (accessed on 29 June 2018).

Policies that favour densification or expand the offer of affordable housing can help the spread of benefits to different socio-economic groups. The SHIFT programme adopted in Korea in 2007 is a remarkable example of how land use and social policy need to go hand in hand for transport infrastructure investment to be effective and inclusive (OECD, 2016[28]). Housing affordability in the areas that received access to public transport infrastructure was achieved by: i) allowing both low- and middle-class families to lease apartments in these areas at financially advantageous conditions; and ii) incentivising developers to build more apartments through a mix of re-zoning and higher floor-to-area ratios. Overall, relaxing height constraints around the stations of the new bus rapid transit (BRT) system in 2004 did not prevent prices for retail space and private apartments from rising but helped keep the increase in check (OECD, 2016[28]).

Inclusive transport policies can unlock growth in cities.[5] Estimates for the UK show that strengthening public transportation running between a job-rich and a job-poor area in a given city can allow for a reduction in unemployment in job-poor areas. Manning and Petrongolo (Manning and Petrongolo, 2017[29]) assess the benefits from a reduction in transport costs between Stratford in east London (the site of the 2012 Olympic Games) and central London and find that it would trigger an increase in the probability of finding a job in Stratford since more people would start looking for a job in central London.[6] The absence of inclusive policies can also be a drag for urban growth. This is the case, for example, of Aix-Marseille, France, where the expansion of the metropolitan area is held back by a social context characterised by very high inequality, which contributes to a high crime rate and therefore reduces the attractiveness of Marseille as a destination city in spite of rising labour demand (OECD, 2013[30]).

Building intermodal and integrated transport systems

Another strategy to improve the performance of the transport system as a whole in cities is the one that focuses on increasing transport intermodality. Transport intermodality refers to the integration across the networks for different transport modes available in a city. As the size of the total network expands, transport

performance improves. An intermodal trip starts, for instance, in the commuting zone on public transport and ends, for instance, in the city centre, where the last mile to reach a destination is more comfortably done via cycling or micromobility. A crucial part of well-designed intermodal transport is a unique ticketing system. Intermodal transit hubs favouring the switch between transport modes can support the system. Another strategic choice that favours intermodality consists of ensuring that public transport vehicles can accommodate passengers travelling with their bike or scooter. Finally, intermodal trips can be encouraged by making walking and cycling more amenable transport mode choices for short journeys, for instance through policies making walking and cycling infrastructure safer and more comfortable to use.

Many large cities in developed and developing countries face the impact of high growth in the use of private cars for suburban commute and urban sprawl. In many instances, the majority of the population lives outside the central city of a metropolitan or functional urban area (FUA) with limited mobility options. Part of the cities' strategies to promote accessibility and the use of public transport is the creation of intermodal points and interchanges to allow at least two different modes of transport to be used in an integrated manner. Passenger transport is to a large extent intermodal public transport as people change from one mode to another for most of their journeys. Intermodal interchange points aim to provide a seamless journey to passengers using different modes of transport (Link, n.d.[31]). These terminals permit the different transport networks articulation that either serves to streamline intermodal mobility and to make easier connections with the high capacity modes. One of the best examples of an intermodal network is the city of Madrid whose intermodal interchange points facilitate change in transport mode for commuters living or working in the suburbs (Box 1.3). COVID-19 is creating the conditions for a higher increase in the use of private cars due to commuters' fear of contagion by using public transport. An online survey conducted in June 2020 on behalf of TransLink, the transport authority in the Metropolitan Vancouver Regional District, showed that over one-third of the population expected to increase their private vehicle use and another third expected to decrease their use of public transport.[7] In the Madrid metropolitan region, local authorities estimate that between 10% and 13% of residents will switch from public transport to private vehicles as a result of the health crisis.[8]

Box 1.3. Intermodal interchanges in Madrid

The city of Madrid has been working for the last two decades on the improvement of the interurban network's infrastructures and services. The creation of intermodal interchange points in strategic areas of the city aims to minimise the inevitable sensation of having to change from one mode of transport to another. The intermodal points are classified according to their infrastructure in three groups: interchange terminals (*intercambiadores*), intermodal areas and exchange points. The interchange stations have a critical role in access and dispersion of metropolitan journeys, while the intermodal areas and the rest of the exchange points supply journeys in the urban area. The interchange terminals act as the access gateways of Madrid's public transport system (suburban buses and suburban trains), optimising accessibility to the mainly urban transport modes. There are 12 principal metropolitan intermodal points in the city of Madrid of which 5 are interchange terminals managed by the regional transport authority. One in 2 trips in the entire region goes through 1 of these 12 nodes.

Source: CRTM (2016[32]), *Annual Report 2016*, http://www.crtm.es (accessed on 19 October 2018).

Car parking near transport hubs complements the intermodal interchange strategy. Car parks located near metro or train stations or big interchanges give drivers the opportunity to leave their car and continue travelling by public transport, at the same time avoiding traffic jams. For example, the public transport authority in Warsaw is constructing car parks for a Park and Ride (P+R) system. At the moment, there are 16 car parks with 4 654 parking places and a valid ticket is needed to be entitled to use them (ZTM, n.d.[33]).

Moreover, to develop and optimise public transport, the city of Warsaw plans to transform the Warsaw West railway station into a multimodal transport hub. The national rail reconstruction manager PKP PLK plans to reconstruct the station to provide direct connections to the trams and bus networks.[9] In Prague, the transport and development plans seek to achieve a more sustainable and multimodal system of transportation by connecting commuters in the surrounding municipalities with the existing railway system. For that, transport investment projects include a fourth metro line, new tramway lines and the construction of P+R facilities in the municipalities that surround Prague. However, research suggests that P+R schemes have a negative impact on real estate property value (Kahn, 2007[34]). Across US cities between 1970 and 2000, for example, home values near P+R stations fell by 2% with neighbourhoods experiencing increases in poverty but properties close to Walk & Ride stations generally saw their values increase more than 5% over 10 years (Kahn, 2007[34]). Access to Walk & Ride stations increases the supply of transit-oriented communities where people live, commute and shop while using their private car less frequently.

Integrated transport systems make travel easier and more affordable (World Bank, 2015[35]). The objective of an integrated public transport service is to achieve a high modal share for public transport with a seamless service by offering several alternatives to commuting that are competitive in terms of convenience and flexibility as well as costs (Veryard and Perkins, 2017[36]). Streamlining schedules, stops, fares and passenger information among underground services, buses and commuter rail allows passengers to use the system easily and for the service provider to cut down operational costs and boost operational revenue (World Bank, 2015[35]). However, seamless integration between all different forms of transport (bus, BRT, light rail, metro, trains as well as walking and cycling) is the main challenge in delivering competitive levels of service (Veryard and Perkins, 2017[36]). An integrated system involves modifying various parts of the network to avoid duplication. The public transport network of the cities of Madrid and Prague exemplify an integrated transport system (Box 1.4). Both cities are practically covered by all forms of public transport (available in the city) integrated into one system and present several common features:

- Physical integration, as the close proximity and ease of access at mode interchanges make it easy to use public transport.
- Systems, in particular bus and rail, should be integrated into a single network to complement each other.
- Fare integration, as in many cities, a single fare card for multiple services facilitates transfer between modes, also making payments convenient for passengers. Electronic fare payment systems allow passengers to be charged by distance or time, regardless of the number of transfers they make. Another advantage is that it allows different public transport operators to divide their revenues equally according to the distance travelled using a particular mode.
- Information integration to provide passengers with comprehensive, easy-to-understand information for travel planning. Passengers should have easy access to this information at home, work, school, stations, terminals, etc. Integrated schedules mean that all routes serving a particular stop or terminal are in operation at the same time to avoid leaving passengers stranded.
- Institutional integration to have a common institutional framework to be able to undertake land use planning, travel demand management and integrated public transport services. When there is no such a framework, co-operation and co-ordination among the different government agencies and public and private providers are key to ensure a seamless operation.

Box 1.4. Integrated public transport systems: The case of Madrid and Prague

Prague has a long tradition of using public transport and has one of the highest percentage shares for public transport use in the European Union (EU). Almost 70% of inhabitants in the city often use public transport as a mode of transport. One of the reasons that has arguably contributed to the high levels of public transport use is the development of the Prague Integrated Public Transport System (PID) where all means of transport are interconnected and co-ordinated. The PID is a public transport system that serves the entire area of Prague and two-thirds of the Central Bohemian Region, although there are plans to expand it to that entire region. The PID operates 3 metro lines, 31 tram lines, 248 bus lines, 26 railways, 1 funicular and 5 ferries. Travellers only need to purchase one ticket to use a combination of transport modes. The Prague Integrated Transport System has four basic principles:

- A unified regional transport system built around a rail transport (railways, metro and trams), and bus services linking-up residential areas to rail transport stations.
- P&R parking lots at train stops in the suburbs and beyond facilitate multimodal transport (car + public transport).
- Single ticket enables passengers to travel easier regardless of the selected way of transport and transport service provider.
- Competitive market conditions keep costs down, while coordination and cooperation are maintained.

The **Madrid** region (Comunidad Autónoma de Madrid, CAM) has an extensive and complex intermodal public transport system that consists of various modes of transport. Two major subsystems can be distinguished: i) the urban area of the city of Madrid with over 200 urban bus routes (EMT), 12 underground lines (Metro), one light rail line and 37 suburban train stations; and ii) the region's metropolitan area with over 100 urban bus routes, over 300 suburban lines, 5 metro lines, 3 light rail lines and 9 suburban railway lines. Both systems are connected by a series of large interchanges (*intercambiadores*) that surround the central area of the city of Madrid, channelling radial mobility between the capital and its metropolitan rings. The transport network provides services to all municipalities in the CAM. It has increased the number of bus lines across the city by 40%. The entire city considered, 66% of the population has a metro station in a radius of 600 metres (10 minutes' walk approximately). The Strategic Sustainable Mobility Plan of the Madrid region (SSMP) 2013-25 promotes the development of an integrated transport system based on four pillars:

- Administrative integration: This began with the creation of the *Consorcio Regional de Transportes de Madrid* (CRTM) as the unique public transport authority for the Madrid region and participating local governments.
- Fare integration: This was achieved with the introduction of the travel pass currently used for more than 70% of the transport journeys. The integration of the fare system at the regional level is the key characteristic of public transport in the Madrid region. There is a wide range of ticket options: among them, the multimodal and integrated travel card provides an unlimited number of trips during a month or a year.
- Modal integration: Refers to the complementarity of all of the different transport modes to achieve intermodality.
- Technological integration: Refers to the integration of data, formats, protocols and processes amongst operators, customers and authorities.

Source: For Prague: EC/UN-Habitat (2016[37]), *The State of European Cities 2016 - Cities Leading the Way to a Better Future*, http://dx.doi.org/10.2776/770065; IPR (2015[38]), *Do You Know Prague? The City in Maps, Graphs and Figures*, http://www.iprpraha.cz/uploads/assets/dokumenty/obecne/do_you_know_prague.pdf; ROPID (n.d.[39]), *Homepage*, http://stary.ropid.cz/info/we-introduce-pid__s219x903. For Madrid: CRTM (2013[40]), *Madrid, A World Reference - The Public Transport System in the Region of Madrid*, https://www.crtm.es/media/157716/wreference-2013nov-web.pdf (accessed on 22 October 2018); CRTM (2016[32]), *Annual Report 2016*, http://www.crtm.es (accessed on 19 October 2018); CRTM (2013[41]), *Plan Estratégico de Movilidad Sostenible de la Comunidad de Madrid 2013-2025*, http://www.crtm.es/plan-estrategico-movilidad-sostenible (accessed on 2 October 2018).

Transport integration requires clear regulations at the metropolitan level and, in their absence, strong co-operation and collaboration between the regional and local levels of government are necessary. As the experience of the Warsaw metropolitan area suggests (Box 1.5), an adequate metropolitan transport vision supported by the joint forces of the regional and local governments is necessary to achieve public transport integration. A transport authority operating at the metropolitan scale may facilitate the planning and co-ordination of infrastructure, fares and modal integration.

Box 1.5. Transport integration without regulations – The case of Warsaw

In Poland's capital Warsaw, the transport authority Zarząd Transportu Miejskiego (ZTM) manages the public transport system. The transport system consists of buses, trams and metro. However, the railway lines have shaped the urban form of the city and its suburbs since the 19th century. Until 2005, the national railway operator PKP managed the whole railway service and infrastructure of Warsaw. Regional trains operated by PKP were key for commuters in the metropolitan area. Even though more than 30 stations were located within the city of Warsaw, the number of passengers was very low due to the separate ticket tariffs and low-quality service and infrastructure. Moreover, for a long time, urban buses competed with the railways in the city and some suburban areas on parallel lines.

In 2002, the city of Warsaw government realised that railway lines in the city could be part of the urban transport system. The first step was to integrate tariffs but the first attempts to do so with PKP failed. In 2005, the region of Mazovia was given responsibility for regional trains, establishing the Mazovian Railways Company (KM) but there was no integration of regulations. Since the city of Warsaw wanted to have an influence on the railway service, it created the railway operator owned by the city (SKM) in 2005, with the objective of providing services to the entire Warsaw metropolitan area. City authorities had to buy new trains and build capacity in railway operations. SKM entered into competition with KM and competition did not meet passenger expectations. Negotiations between the city of Warsaw and the Mazovia region led to the gradual introduction of a common ticket. A passenger with a ZTM ticket can now travel on KM trains. Thanks to the tariff integration and the synergies between the regional and city operators, the city government was able to fully introduce an intermodal public transport system in the Warsaw metropolitan area consisting of buses, trams, metro and urban rails.

Despite progress, some challenges remain. For instance, Warsaw and the suburban communities compensate for the losses of KM, even though it is a regional authority dependent on public funding. More investment is needed to improve line capacity as the rail infrastructure is national and it is shared with national intercity and cargo operators. Transport integration has remained at the metropolitan level but has not expanded at the regional level. The train offer has led to new passengers using the train and vehicles have reached their maximum capacity level.

Source: Florczak, M. (2012[42]), "Integration without regulations", https://fsr.eui.eu/wp-content/uploads/121207_Florczak_Maciej.pdf (accessed on 9 August 2019).

Building an integrated transport system is a challenging task. Governments need to overcome a number of barriers that go from deficiencies in planning, resistance to change, the lack of a centralised transport authority, the influence of interest groups, the predominance of political priorities over technical ones and a weak implementation strategy. According to the OECD ITF, four key actions can be considered to design an effective integrated public transport system:

- Design interchange stations to provide secure, uncongested conditions for transfer via the shortest routes possible.
- Provide adequate bike parking areas at stations and stops.
- Integrate ticketing and information systems as well as the physical transport infrastructure.
- Establish integrated urban transport plans in consultation with stakeholders and the public (Veryard and Perkins, 2017[36]).

The experience of the city of Santiago, Chile, in building the Transantiago, reveals some of the hurdles authorities need to overcome to organise and implement an integrated public transport system (Box 1.6). The Transantiago is one of the most expensive and ambitious transport projects in the country's history but, despite the USD 10 billion investment since the start of the development process in 2007, citizens do not consider it delivers the service at the expected quality levels. One of the most important lessons from the implementation of the Transantiago is that when the government wants to change a transport system, it should do it gradually, phasing the scheme in several stages, allowing for adjustments as problems arise and in consultation with citizens.

Box 1.6. **Chile's capital** mobility network: Transantiago

The reorganisation of the Transantiago bus network in Chile's capital Santiago is one of the largest policy experiments ever conducted in the country and is a precedent for improving public transport provision (OECD, 2017[43]). Until 2007, Santiago, had a public transport system that covered the entire territory of the metropolitan area (2 000 km^2), which included the 36 communes, and offered service to 6 million inhabitants. However, the public transport system had some deficiencies that made it inefficient and ineffective such as: low occupancy rate of buses; very poor frequency in low demand periods, producing high congestion and pollution; an overlap of services on main avenues; frequent on-the-street competition for passengers; poor travel conditions for students; many micro-owners (owners of 1 or 2 buses) but strong owners unions; and poor working conditions for drivers with salaries commensurate with the number of tickets sold.

In 2007, Chilean authorities implemented a transport reform programme to modernise the public transport system in the metropolitan area of Santiago. The Transantiago project aimed at encouraging the use of public transport, improving the quality of service by eliminating on-the-street competition and replacing the existing bus fleet, improving air quality and reducing travel time.

The project had a trunk and feeder structure which intended to increase the use of the metro and avoid overlap of services. The number of buses was reduced from 10 000 to only 5 000 (to eliminate congestion). The project included an integrated fare system with the use of a smart card. To allow operators from the old system to continue working in the new one, bus owners were integrated into bigger companies. This made the Transantiago a privately operated system to minimise the risk of strikes and city paralysis. State-operated services had a poor reputation in the country and it was thought that a private system would provide better service and bring the experience of world-class operators.

However, as soon as the new system started operations, it faced a number of obstacles. There were design deficiencies that limited the efficiency of the new system. For instance, residents were not familiar with the trunk and feeder structure; the required bus fleet size was underestimated leading to insufficient coverage and lack of adjustment flexibility; payment to bus operators was based on referential demand and there was therefore no incentive to move buses; the design of the system was based on an outdated origin/destination survey (2002); and there was no focus on service quality. There were also implementation problems due to the rush to implement the new system even before basic conditions were met. For instance, most dedicated corridors for the buses were not built, the fleet control software was not operational, the information systems for users was not ready and the entire system was changed in a single day (big bang approach) as there was no transition period. The metro was overcrowded as it passed from 1.3 million users to 2.2 million. There was a financial deficit as the government froze fares, which had to be financed through subsidies.

In 2010-12, the government introduced changes to the system which included the possibility to modify contracts, the abandonment of the trunk and feeder structure, changes in the incentive system to operators from kilometres run to effective passenger transportation, fare increases and a new law that secures public funds.

In 2019, the government changed the Transantiago to a new system called Red Metropolitana de Movilidad (RED) seeking to increase the service standards and the modernisation of the procurement model of transport services. RED currently includes buses, metro and MetroTren services as part of the integrated transport system. Payments are made through a unique transport card. Different bus companies form part of the RED (i.e. Buses VULE; Subus Chile, Express de Santiago UNO, MetBus, RedBus Urbano, and Servicio de Transporte de Personas) which provide bus services in the Santiago

metropolitan area and, in that way, avoid the "too big to fail" problem. Currently, Transatiago's fleet is less polluting, less accident-prone and more accessible than the previous system but some challenges remain. The system seems to be rather rigid leading to higher journey times for some passengers. Plans to improve safety and adapt routes to changing patterns of demand in a growing city seem to be at an advanced stage.

Source: Prepared based on the presentation given by Chile's Ambassador to the OECD, Felipe Morandé, to the International Transport Forum on 5 September 2019 and OECD (2017[43]), *Gaps and Governance Standards of Public Infrastructure in Chile: Infrastructure Governance Review*, https://doi.org/10.1787/9789264278875-en. For further information, see http://www.red.cl/.

Encouraging active and micromobility

A successful public transport system encourages active mobility and provides a sense of safety

Promoting and facilitating active mobility is becoming part of new developments in cities around the world. Active mobility had long been neglected in cities as the focus was on facilitating car usage. However, active mobility is gaining importance, in particular over short distances in urban and suburban areas, as well as intermodal mobility. In the aftermath of COVID-19, active mobility is regarded as the response to the new mobility needs of urban residents. Indeed, in cities across the world**,** public transport usage has fallen with an increasing number of people walking or riding bicycles to avoid crowded mass transits and follow health advice for physical activity and distancing. Cities like Bogotá, Brussels, Geneva, London, Mexico City, Milan and Paris are investing in extra bike lanes, some of which are temporal to respond to the emergency but others are permanent. Investing in pedestrians and cyclists, according to the United Nations (UN), can save lives, help protect the environment and support poverty reduction.[10] London's experience shows that investing in cycling can produce economic benefits as making cycling safer and easier in business districts helps to attract and retain the employees companies need to succeed (Transport for London, 2018[44]). In Spain, the use of bicycles increased by 260% in May 2020 as a result of the pandemic.[11] In the city of Madrid, there has been an increase in the use of individual mobility devices (i.e. walking, bicycles, scooters, etc). These devices are considered adequate to cover short distances and a way to avoid contagion. The transport authority in the Madrid region has authorised private providers to expand their fleets of electric bikes to up to 4 800 units more during the summer 2020 period. If the demand is met, the offer of electric bikes could reach 9 600 units. BiciMAD, Madrid's bike-sharing system, already has 2 496 units operating and is being expanded as well. Thus, authorities expect that the total number of bicycles available to the capital residents will be three times higher than in 2019.[12] However, for public transport operators, this means a reduction in the number of possible passengers and revenue.

Active mobility has underutilised the potential of green urban transport. Active mobility does not generate motorised traffic and encourages mode shift away from private cars leading to reduced emissions and less noise. Cycling as a transport mode can be a substitute for public transport, especially over short distances. In Copenhagen, 36% of the trips to work or school are made by cycling equalling to 0 tonnes of CO_2 emissions and the city aims to be CO_2-neutral by 2025 (City of Copenhagen, 2011[45]). Thanks to their substitutability, cycling is especially appealing in cities that are reaching saturation of their local public transport network, such as the city centre of Paris. However, cycling and public transport can also be complementary. First, cycling can significantly expand the catchment area of rail stations (ITF, 2018[46]). Second, bicycle-sharing systems in the city centre of cities allow commuters to bridge the "last mile" between public transport stops and their final destinations. Incentivising cycling entails deploying the physical infrastructure needed for riders to feel comfortable using bikes, such as having dedicated bike lanes, dedicated parking lots, especially near rail stations, and bike-accessible trains.

Box 1.7. Defining active mobility and micromobility

Active mobility and micromobility are two closely related concepts that may even be used as equivalents but there are some differences. Active mobility is a generic term to identify any form of human-powered transportation such as walking, cycling, skating, kick scooters, etc. Micromobility includes the use of exclusively human-powered vehicles, such as bicycles, skates, skateboards and kick scooters (ITF, 2020[47]). It refers to personal transportation using devices and vehicles weighing up to 350 kg and whose power supply, if any, is gradually reduced and cut off at a given speed limit which is no higher than 45 km/h. Micromobility can include the model of shared usage. There is no rigid separation between micro and shared mobility: micromobility indeed often comes in the form of shared mobility, so long as the devices and vehicles are third-party-owned and accessible on demand by travellers. In recent years, the growing use of electric light vehicles such as e-bikes and e-scooter has given rise to the term electric micromobility or e-micromobility.

Source: ITF (2020[47]), *Safe Micromobility*, https://www.itf-oecd.org/sites/default/files/docs/safe-micromobility_1.pdf (accessed on 21 September 2020).

Cycling and walking are the fastest and least expensive modes for door-to-door travel for many short-distance trips. Walking and cycling are considered as the investment areas that can contribute the most to achieving cities' strategic goals such as reducing congestion and improving public and environmental health, at the lowest net cost. According to the city of Copenhagen, taking a bicycle results in a net profit for society of DKK 3.65 (USD 0.58) while taking a car results in a net loss for society of DKK 6.59 (USD 1.04) (City of Copenhagen, 2011[45]). Investment in cycling infrastructure seems also to produce value for money. The Dutch government spends EUR 30 (USD 35) per annum per person on bike infrastructure – 15 times the amount spent in England – which represents 3% of the government's transport and traffic budget. The results have been lower carbon emissions and high health levels (Hawkins Kreps, 2018[48]). Cycling is also a more inclusive way of travelling, as it is more affordable than driving. To unlock cycling's potential, cities are investing in traffic-protected bikeways that provide the safety and comfort needed. For instance, London is investing in building a cycle network with major new routes across the city and creating local routes and neighbourhood schemes. Moreover, that transport authority has put into service a new Cycling Infrastructure Database (CID) available to everyone. The CID provides services such as: tailored journey planning, cycle parking mapping, and informing TfL and borough plans (Transport for London, 2018[44]). Cycling in London has more than doubled since 2000: on average, cycling levels rose by 5.8% between 2000 and 2017 and there was an overall 24% increase between 2012 and 2017 (Transport for London, 2018[44]). London's transport strategy's central aim is for 80% of all trips in London to be made on foot, by cycle or using public transport by 2041, compared to 63% in 2015 (Greater London Authority, 2018[25]).

To encourage active mobility, cities are improving sidewalks, street crossings and other walking infrastructure. This includes removing barriers and expand walking access to transit to make more efficient and safer use of streets for short journeys. COVID-19 has created the momentum for cities to invest in walking and cycling infrastructure as part of their emergency infrastructure projects. However, it is important that cities link emergency infrastructure to long-term urban accessibility objectives by investing in building infrastructure now that they want to keep for the future (ITF, 2020[49]). Providing more and better services to make public transport the best option for longer ones is a complementary action. A shift from car use to more space-efficient means of transport is a long-term solution to congestion and contributes to properly functioning cities. According to the experience of London, a successful public transport system is one that encourages walking and cycling (Greater London Authority, 2018[25]). New developments are required to discourage the use of private cars through the provision of limited and costly car parking

services or the reduction of the "implicit" subsidies that encourage the use of private cars (e.g. lower fuel prices, support for parking and fuel from the employers). Other measures include enabling shared use services models and developing safety standards for new services entering the market and reviewing existing regulatory frameworks. New York City's strategic plan aims to allocate more street space to walking, biking and buses as they move the greatest number of people while using the least amount of street capacity. For that, the Department of Transportation is enhancing and expanding the 1 000-mile (1 600 km) bike network, increasing the bike parking opportunities and expanding the bike-sharing programme to the 5 boroughs (NYC Department of Transportation, 2016[17]).

Not all cities have the right infrastructure and urban form for encouraging cycling and walking and, like in many Eastern EU cities, their mode share is generally low. In the Romanian cities of Sibiu and Timişoara accessibility by walking is rather limited due to the low priority for pedestrians in the organisation of public spaces. The problem is worst in residential areas due to narrow or absent sidewalks or stairways, obstacles built or located on sidewalks, heavily damaged surfaces and the lack of adequate connecting ramps with walkways and pedestrian crossings. The lack of sidewalks is a major and frequently encountered problem in suburban areas of both cities. In the Metro Vancouver Regional District, some neighbourhoods of the municipalities of New Westminster and Surrey, mainly rural ones, do not have walking infrastructure. In many places in the region, poor walking connectivity to the FTN and rapid transit stations is deterring ridership and making those investments less effective than they could otherwise be. Thus, the transport authority, TransLink, is working with the different municipalities to share the costs of pedestrian facility upgrades within walking distance of frequent transit stops, stations and exchanges. In Athens, walking and cycling as mobility options are relatively underdeveloped as there are no dedicated cycling lanes in central areas and cycling is considered to be difficult and risky given the other vehicles' driving behaviour (OECD, 2015[50]).

However, some cities are making progress in the promotion of active mobility. In Mexico City, the ECOBICI programme has achieved significant success in increasing bicycle use by residents in the entire metropolitan area. In 2015, 45% of trips with ECOBICI were for commuting. Along with the ECOBICI system, other programmes have been introduced in Mexico City to encourage bicycle use such as the conversion of several streets and avenues to bicycle and pedestrian use on Sunday mornings. The programme Travel by Bike (*Muévete en Bici*), implemented in 2007 started with 10 km of road space being closed to motorised traffic every Sunday morning; by 2012, the road space was expanded to 24 km (OECD, 2015[51]).

Micromobility and e-micromobility as an alternative to public transport

Cities are using micromobility to encourage active mobility, in particular light electric devices. Micromobility has surged in recent years, particularly in the city centre of large cities. Sydney's transport strategy considers that assisted mobility devices, such as e-bikes and motorised scooters, have the potential to move people out of single-occupant cars for the first mile and last mile of trips, freeing up capacity on the roads for people who need to travel further. The advantage of these devices is that they are faster and require less physical effort than walking and cycling. Lisbon, for instance, which was awarded the title of European Green Capital in 2020, deployed a large fleet of electrical bikes to help users overcome the difficulties associated with travelling by bike in a hilly city.

In recent years, the use of electric micromobility (e-micromobility) devices has increased across the world. The number of e-bike shares systems with at least 100 e-bikes grew from 1 in 2013 to 18 in 2019, and the total of e-bikeshare bicycles passed from 2 500 in 2013 to more than 40 000 in 2019 (Yanocha, 2019[52]). In the US, in 2018, people took 84 million trips on shared micromobility, more than double the number of trips taken in 2017.[13] In fact, in 2018, e-scooters overtook bikes as the preferred vehicle for dockless vendors in the US with 85 000 e-scooters available for public use in 100 US cities. In China, the annual e-bike sales passed from just over 20 million units in 2009 to over 35 million in 2018 (Yanocha, 2019[52]).

The key advantages of micromobility are its flexibility and low cost. Micromobility devices have a lower operating cost than owning and operating private cars and are even further reduced when sharing schemes are available. According to the experience of Western Australia, the use of e-bikes has the potential to make people leave their cars at home. The use of e-bikes helped decrease commuting by car from 61% to 32% for trips as a driver or passenger (NSW Government, 2018, p. 62[53]). Electric mobility devices can also provide widespread access to nearby destinations quickly, minimise harm to the environment, promote equity and affordability, maximise resource efficiency, maintain safety and contribute to a healthy lifestyle. E-bike sharing at interchanges has the potential to increase the use of public transport as e-bikes can better connect people to the mass transit network.

Promoting electric mobility requires care. Cities need to consider a number of issues that may go wrong when making investments (Yanocha, 2019[52]). For instance, there could be a high demand for public parking and charging infrastructure that local governments will have to consider and install. The efficiency of the system could be damaged if there is an oversupply and indiscriminately parked devices clutter the streets. If the charging systems for shared devices are inefficient, it could lead to an increase of energy use. Health outcomes may be compromised if electric micromobility replaces walking and pedal cycling trips. Regarding safety, without proper infrastructure, the number of accidents and crashes may increase. There are also equity and affordability concerns as availability may be limited to higher-income neighbourhoods or only to those who possess a smartphone or credit card, and their use could be too expensive for low-income groups without fare integration with transit (shared systems). Moreover, elderly and disabled people may not be conformable or feel safe in using those devices.

How can cities promote micromobility?

With new technological developments and the introduction of new types of electric micromobility devices cities need a clearer classification. The goal is to bring clarity on what constitutes an electric micromobility device as their use and where they can be used will depend on it. Cities could classify e-bikes and scooters as non-motor vehicles and clearly define the maximum speed for low (25 km/h) and moderate (top speed 45 km/h) speed electric devices. It is also important that cities define the infrastructure that electric devices are permitted to use to improve safety and order in the streets. For instance, the city of Madrid is becoming a lab for an innovative mobility regulation. Due to the transformation of means of transport over the last five to ten years, authorities have enacted a regulation that addresses the circulation of alternative means of transport. The approach to regulate this issue has been to make a clear distinction for a different type of new vehicles:

- Vehicles for urban mobility (electric kickboards, Segways, etc.): The local regulation uses the classification of the type of motor vehicles (A, B, C0, C1 y C2) established by the national General Traffic Directorate through the Norm 16/V-124. It then establishes that this type of vehicle has to circulate either on roads (where maximum speed is 30 km/h) or bicycle lanes. It also regulates the equipment (lights, braking device, whistle, etc.) that these vehicles have to incorporate to circulate legally.
- Rollerblades and kickboards, or similar vehicles, with no motor: Will be able to circulate on sidewalks at a maximum speed of 5 km/h and on all types of bicycle lane.
- Skateboards: Follow a similar regulation to rollerblades and kickboards, but their circulation will be forbidden on sidewalks or bicycle lanes that are too steep. This is to ensure safety since this kind of device has no brakes. For sports purposes, users will have to go to the specific authorised areas.

Cities can design safe and inclusive on-street infrastructure, enforce the safe use of cycling infrastructure, and offer public safe-riding courses. To manage and monitor the functioning of the electric micromobility systems, cities need to integrate small electric modes into citywide strategies and plans, and collect data for analysis and enforcement (Yanocha, 2019[52]).

Active mobility requires political commitment and long-term investments

Active mobility infrastructure requires political support. Making cycling a priority in urban accessibility requires strong political conviction and planning. Cities like Copenhagen and London have even issued cycling strategic plans supported by their local authorities. Promoting active mobility is not just an issue for the departments of transport, it is widespread across most policy fields. Thus, broad commitment and co-ordination from various policy departments make it easier to integrate active mobility and micromobility into long-term political goals on environment, well-being and economic development.

Active mobility initiatives require a steady and reliable financial flow. Countries and cities are spending more on walking and cycling infrastructure. For example, the Netherlands plans to invest EUR 552 million on bicycle infrastructure with the aim of getting an additional 200 000 Dutch people on bicycles (Reid, 2018[54]). A well-planned and consistently financed package for infrastructure and regulation is essential to promoting active mobility. One key aspect is that active mobility infrastructure has to compete with other modes of transport budget investments priorities even if they are relatively low cost. Thus, cycling measures need to be planned holistically and at the same time as other urban improvements like housing and parks. Active mobility infrastructure investments require ongoing sustainable funding to retrofit, build, maintain, improve, promote and expand the network. However, most cities do not begin with long-term funding. Research suggests that there are four stages for funding cycling infrastructure in a more sustainable way in the long term (Box 1.8).

Box 1.8. Overcoming challenges for funding cycling infrastructure

Stage one: Demonstration projects. Cities without a cycling culture and infrastructure need to start somewhere to create momentum. Trial projects can get over the inertia and fear of change by establishing initial success. These projects are usually lower-cost and build confidence and support for the higher-price project. Funding can come from outside the private sector, for example form agencies interested in health, energy and environment benefits.

Stage two: Policy-driven funding. After the trial period, the next stage is to design a sustainable programme; this involves creating a master plan and adopting other policies to modify existing transport plans so as to make cycling part of all transport plans. Cycling infrastructure would then be built as a component of larger infrastructure projects.

Stage three: Routine funding. Timely implementation of a cycling network requires independent retrofit projects prioritised in a cycling master plan. Most cycling programmes have an annual budget amount that is supplemented by special project funds, often from regional and national programmes. Successful projects can be the basis for budget support from champions of the bicycle programme across the board. Measurable progress can also help ensure continued and increased funding. Funding from outside the transport sector also needs to be considered, for example from local development programmes.

Stage four: Accelerated success. Once the bicycle programme has been funded, the next stage is to maintain a plateau level of funding. It is sometimes vision and competition with other cities, regions and even countries that fuel big budgets. Pointing the virtues of other cities' cycling network can positively influence decision-makers.

Source: CiViTAS (2013[55]), *Enabling Cycling Cities: Ingredients for Success*, http://www.pas-port.info/cycling (accessed on 3 June 2020).

Going smart, shared, autonomous and electric

In 2017, transport, the second largest sector in terms of CO_2 emissions, accounted for 24% of total carbon emissions from fuel combustion (IEA, 2019[56]). Moreover, over the past 50 years, CO_2 emissions from the transport sector have grown faster than any other sector (OECD, 2019[57]). CO_2 emissions from the transport sector have grown at an annual rate of 2% points during 2000-17. CO_2 emissions from road passenger transport – of which urban transport made up 53% in 2015 (ITF, 2017[58]) – have grown at an annual rate of 2.4%, hence almost at a half percentage point higher rate (IEA, 2019[56]). Urban transport is undergoing a rapid and profound change that puts it at the forefront of the transition towards a climate-neutral economy.

Urban transport systems need to provide different mobility alternatives to commuters if it is to play a fundamental role in reducing air pollution. Local policymakers trying to bring down car usage in their cities and promoting alternative means of transport need to ensure that their public transport systems are sufficiently accessible. Without a sufficiently accessible public transport system, price-based instruments, such as carbon taxes or congestion charges, can exacerbate inequalities in spite of making the economy as a whole better-off. The negative distributional impact of such policies materialises when individuals being taxed do not have alternative means of transport to turn to. The negative impact can be offset, for example, by reinvesting the revenues generated from the tax into public transport improvements (Anable and Goodwin, 2018[59]). Carbon taxes can also present an efficiency-equity trade-off. Raising carbon taxes without complementary redistributive measures can in fact exacerbate the rural-urban divide since people living outside of urban areas spend far more on fuel than urban residents. The negative distributional impact can be offset by means of a redistributive policy from urban to rural areas, or avoided altogether by means of differential taxation of car usage, depending on whether it takes place in rural or urban areas.[14]

Shared mobility has boomed in recent years, especially in an urban context. A shared mobility service is characterised by an optimised shared-vehicle fleet system that provides on-demand transport and is typically enabled by an application-based digital platform (ITF, 2019[60]). Car (or motorcycle) sharing is a type of shared mobility and typically refers to the service through which private individuals can rent a vehicle owned by a third party – whether a company or another private individual – for a short duration and typically in an urban context.[15] In many cities, the car-sharing market is quite competitive and populated by a high number of companies, each owning their fleet of cars and/or motorcycles that customers can easily locate and rent through the respective applications. The proliferation of providers has led in certain countries and cities to the entry into the market of an intermediary integrating the information on various providers into a single application (e.g. Urbi). The car-sharing market keeps expanding and its definitions being redrawn. While the “car-to-go” formula is so far the most widely adopted, there are several car-sharing alternatives that are being developed. For instance, GaiaGo is an application that makes it easier for households living in the same condominium to share a car by allowing for efficient co-ordination of personal trips.

According to the projections elaborated by the ITF, shared mobility could halve the number of vehicle-kilometres travelled in urban areas if widely adopted. This could lead to a 30% decrease in CO_2 emissions from urban transport by 2050 relative to projections based on current ambitions. Shared mobility was only responsible for 1.5% of worldwide urban passenger-kilometres in 2015 but, by 2050, it is likely to cover more than one-fifth of urban trips (ITF, 2019[60]).

Electric vehicles (EVs) can also accelerate the transition towards a climate-neutral economy, especially if renewable energy is used to power them (ITF, 2018[61]). The uptake of EVs correlates very strongly with the extent of subsidies or tax breaks put in place in countries and cities to make EV prices more competitive. For instance, Norway managed to get the EV sales share to rise from 20% to 32% within just 1 year between 2017 and 2018 thanks to their effective system of subsidies and tax breaks (BMU, 2018[62]).[16]

While important, price incentives are not sufficient. McKinsey research shows that drivers who choose EVs tend to be high-income, have tertiary degrees and generally be more sensitive to environmental issues (McKinsey & Company, 2014[63]). Hence, both national and local policies need to devote greater efforts towards increasing the sensitivity to environmental issues of the general public. Moreover, the price of EVs is expected to remain higher than internal combustion engine ones well beyond 2050 (ITF, 2018[61]). Governments should therefore consider substantially scaling up their investment efforts in green technologies if the price gap is to close in a relatively short period.[17]

Local government can also incentivise the uptake of EVs by, for instance, excluding EVs from local congestion charges. A study on the London congestion charge finds that that greater proximity to the charge zone is positively associated with hybrid and EV registrations, implying that this policy has been effective at promoting the adoption of low emission vehicles (Morton, Lovelace and Anable, 2017[64]).

Local authorities can help the diffusion of EVs by ensuring the widespread presence of charging stations. The cost of a two-plug charging station is about EUR 2 000 (McKinsey & Company, 2014[63]). Since this can be a too high investment for many individuals, local authorities can intervene and provide the charging infrastructure. Alternatively, they can incentivise employers and owners of other popular destinations where car owners typically park their cars (e.g. shopping malls) to do so. Providing the incentives for the network of private charging stations to grow can effectively compensate for the limits associated with charging stations located in public parking areas. In some neighbourhoods, car owners might indeed park their cars predominantly in privately-owned spaces, such as garages, therefore limiting the utilisation of government-provided charging stations located in public parking areas.

Finally, cities must aim at minimising the CO_2 footprint of all means of transport, including shared ones. Many cities are moving towards electrification of their public transport system. For example, in London, as of 2018, any new public buses must be hybrid, electric or hydrogen, in line with the current administration goal of making London a carbon-free city by 2050 (Greater London Authority, 2018[25]).

Autonomous vehicles have the potential to enhance accessibility

The adoption of autonomous vehicles (AVs) – driverless cars – does not need to be in contrast with environmental goals. On the contrary, AVs have the potential to accelerate the transition towards a climate-neutral economy. It would be indeed more convenient for users to switch to a shared or green mobility solution if alongside it they could use the time saved on driving to do other more fulfilling tasks. Local and national policymakers need to take a more proactive stance in providing private actors the right incentives for these innovations to accelerate the transition towards a climate-neutral economy.

AVs are the next game-changer in urban mobility. They have the potential to provide citizens with more flexible travel options, greater safety and faster journeys. To enhance their effectiveness, these vehicles are designed to provide shared services to help reduce congestion and extend the catchment area of the public transport network. They will also improve the mobility of people who cannot drive today, for example because of disabilities or age. While self-driving cars have the potential to improve many aspects of daily life, they could also create a series of undesired consequences if regulation does not keep pace (OECD, 2019[65]). The benefits depend on the costs and rate of take-up, the ownership models and the number of customers. But there are risks involved as well, such as the increase in traffic volumes, an increase in vehicle-kilometres travelled and higher greenhouse gas (GHG) emissions. Therefore, governments need to explore and identify appropriate policy and regulatory mechanisms to ensure that driverless cars support their transport and accessibility strategies. For example, governments may adapt the regulatory framework to enable innovation without hindering other societal outcomes such as equity and safety. However, they do not necessarily need to regulate all outcomes as private sector actions may be guided by tools others than regulation, such as voluntary agreements. Moreover, governments do not need to regulate everything that is new but may remove existing regulation where it is no longer warranted or adapt it. Regulations should be iterative and flexible in order to account for many unknowns around the uptake of automated vehicles and other transport technologies and services (ITF/OECD, 2020[66])

Box 1.9. Smart shuttle trial – Sydney Olympic Park

The New South Wales government in partnership with HMI Technologies, IAG, NRMA and the Sydney Olympic Park Authority conducted a trial of an autonomous shuttle bus. This pilot exercise started in August 2017 and was the first, precinct-based trial of an automated shuttle in the country. The trial focused on testing automated vehicle technology and presented a unique opportunity to develop a research platform that improves citizens' mobility. The trial aimed to understand what supporting technology and infrastructures were needed to operate an automated shuttle in this environment, how it interacted with other precinct users such as pedestrians, cyclists, etc., and how it integrateed with the broader transport network. This trial provided some light regarding passengers' responses to this type of vehicle and the services it can enable, such as on-demand transport at off-peak times.

Source: NSW Government (2018[53]), *Future Transport Strategy 2056*, https://future.transport.nsw.gov.au/sites/default/files/media/documents/2018/Future_Transport_2056_Strategy.pdf.

At the time of writing this report, only cars that can drive autonomously under certain circumstances are available on the market. While the technology underlying fully automated vehicles is far from ready for commercialisation today, most experts expect AVs to become available at some point during the next decade. Fully automated vehicles will probably not become available everywhere at the same time. Most likely, cities or countries with advantageous climate conditions (e.g. no snow and little rain), orderly traffic and a favourable regulatory environment will see an earlier introduction than other places. Such a staggered introduction offers policymakers two advantages. First, the timeline for the introduction of self-driving cars becomes more predictable once a large-scale rollout begins in some countries. Second, policymakers in most countries will be able to learn from the experience of the early adopters and can adjust their policies accordingly to deal with any undesired consequences (OECD, 2019[65]).

In the absence of a more decisive policy direction, the net social benefits of automated vehicles are uncertain. The adoption of AVs entails both private benefits and social costs. On one hand, AVs improve the quality of life of commuters by allowing them to redirect their energy away from driving and towards other tasks, such as working, reading or sleeping during the commute to and from work. On the other hand, precisely because commuting becomes more pleasant, people may decide to switch from public transport to private car ridership and live much further away from cities than they do at present in order to live in larger homes or be surrounded by more green space, thus potentially leading to a resurgence of suburbanisation. Better planning at the metropolitan level is necessary to prevent uncontrolled suburbanisation (OECD, 2019[65]).

There is substantial disagreement among experts concerning the consequences of AVs on private car ridership. A survey run by the ITF asked a number of experts whether they believed that AV technology would increase car usage or not. The majority (54%) answered that it would, since: i) by reducing the time spent in traffic or looking for parking, it would make car ridership a relatively more attractive alternative and induce a switch from other transport modes; ii) it would make car ridership accessible to those that are too young or too old to drive (ITF, 2018[61]). Thirty percent replied that car usage would go down because of the savings in the estimated time required to complete a ride and thanks to the combination of AVs with car-sharing solutions. The remaining 16% agreed that AVs would not significantly affect car ridership.

To understand how AV adoption would change commuter behaviour and gauge the extent of associated benefits, it is important to consider the consequences it would have for different types of journeys. Between 1976 and 2010, average daily travel time for residents of the French île-de-France region has increased from 76 minutes per day to 92 in spite of the substantial improvements in the transport network (IAU, 2016[67]). The rise in travel time dedicated to leisure-related trips is responsible for this increase. Several

factors may be behind the rise in travel time dedicated to leisure-related journeys: the decline in hours worked, demographic change, more entertainment opportunities. Since most entertainment opportunities tend to be located in the amenities-rich city centre of cities, the increasing demand for leisure-related trips is an attraction force that pulls housing demand towards the city centre, effectively countering any tendency towards urban sprawl. It is possible that AVs may reduce user cost especially for this type of trip, since user cost for job-related trips is already fairly low thanks to public transport. In this case, some people would not mind living further out in the commuting zone since they could more easily access leisure opportunities located in the city centre. If this were the case, the social cost of AV adoption in terms of increased urban sprawl would certainly be high and might not offset the private benefit experienced by commuters.

Smart mobility projects can enhance accessibility

Smart mobility is one of the key components of smart city policies. It builds on the concept of intelligent transport systems (ITS), which focuses on intermeshing digital technologies among devices, vehicles and infrastructure for better traffic management. Smart mobility also includes communicative assets (vehicles, infrastructure and other objects), mobility data platforms and shared mobility services. All these component together have the potential to improve mobility and accessibility outcomes and reduce the negative externalities related to transport activity (ITF/OECD, 2020[66]). Indeed, mobility is increasingly technology-led. Data sharing and smartphone applications are enabling more flexible approaches to matching citizens' transport demand with transport services. Over the last decade, mobile technology is improving the customer interface by providing a single platform for trip planning, payment and travel information. Ridesharing services exemplify how technology – mainly through advances in Global Positioning System (GPS) navigation devices – smartphones and networks can co-ordinate drivers, customers and payment systems. "Smart mobility promises a virtuous cycle of technological innovation, new services, and improved outcomes for people … but it does not guarantee these" (ITF/OECD, 2020, p. 6[66]). Realising the benefits of smart mobility requires addressing some challenges such as re-bound effects that could generate additional travel, which may erode many potential benefits, and smart mobility that could improve bit also diminish equity outcomes; there are also concerns about the privacy impacts of smart mobility data, and traditional regulatory tools and processes, which may not be adapted to new technologies and services (ITF/OECD, 2020[66]).

Automated metro systems are becoming more common around the world. Users already use applications to receive information in real-time and plan their journeys. They can also use electronic ticketing via transport cards (i.e. Navigo card in Paris, Oyster card in London, Opal card in Sydney, Compass card in Vancouver, Isar card in Munich or Octopus card in Hong Kong). These cards, by providing an integrated tariff system, ensure seamless journeys across transport modes in the areas covered.

Smart mobility projects create opportunities to improve the capacity of the existing network and enhance accessibility at the same time. Their advantage is that they may lead to more cost-effective transport service delivery by making the most of the existing infrastructure. Cities need to be prepared to ensure the safe and effective adoption of ITS, ensuring they contribute to the city's overall vision of transport and accessibility. Some of the actions national and local governments may need to explore to be better prepared to adapt the new technology to meet the cities' strategic goals are: enabling new and upgraded physical infrastructure and digital assets to support new technologies; identifying road infrastructure that supports automated vehicles; and implementing intelligent traffic management methods.

Cities are experimenting Mobility as a Service (MaaS) applications that allow citizens access to mobility services in a simple, easy-to-understand way. MaaS is a service model that enables users to plan and pay for their journeys using a range of services via a single customer interface, such as a mobile application. Users can hop on any bus, train, tram, metro, bicycle, taxi, ferry, car-share, rental car, etc. for a single monthly fee, for instance, with trip routing suggestions based on users' specific, prioritised criteria

(i.e. lowest cost, shortest travel time, space for large items, wheelchair accessibility, lowest carbon footprint). MaaS relies on sharing real-time information across different transport providers to help users optimise their journeys through a single MaaS platform. Finland's capital Helsinki is currently experimenting with this service model and the first results show a 25% increase in the use of public transport (Rodriguez, 2017[68]). In the city of Turku, Finland, the implementation of a MaaS platform has led to an increase in 20% in the number of public transport users with people claiming to have sold their family's second car. Ninety-eight percent of customers considered that the introduction of the platform, known as Föli, has increased the attractiveness of public transport in their everyday life. MaaS has also reduced commuting by private car between municipalities, as 9% of customers on regional lines are completely new public transport users and 42% had the opportunity to use their car but preferred public transport instead (Taskinen et al., 2016[69]).

All technological and service developments have important implications for the government's role in the transport domain. Governments increasingly assume the role of enabler of the use of new technology. They do this through regulation, service provision and collaboration with the private sector and researchers. The future role of government will be mainly to focus on setting network and customer outcomes and ensure policy and regulatory frameworks are in place to support new service models. City governments will need to review regulations governing road, rail and bus operations to provide arrangements that can pre-empt or respond quickly to market disruptions.

Making transport and accessibility gender-sensitive

Travel by public transport is highly gendered. Nowadays, women travel widely to access employment, education, leisure, etc. However, transport today is neither planned nor designed to be gender-sensitive (Allen, 2019[70]). It is usually women who have to take care of domestic chores, children, the elderly and sick, while they also participate in productive activities; this dictates their travel patterns and behaviours, and they tend to travel more if they have a family. The time lost in travelling is therefore far more penalising for women. There are significant differences between men and women regarding the mode of transport they use. In Europe, fewer women than men own or use a car. For example, in Sweden, 70% of the cars are owned by men. In France, 60% of men living outside the Paris region travel by car (Duchène, 2011[71]). In the city of Gothenburg, only 34% of women travel by car (City of Gothenburg, 2014[72]). In Mexico City, men conduct 26% of their trips by car while women only 18% (SEMOVI, 2019[73]). However, the situation is beginning to change. In the US, the number of women with driving licenses is overtaking that of men; 2.6 million more women are licenced to drive than men.[18] Canada is close to having more women with a driving license (49.95%) (Singh, 2014[74]). In the UK, the number of driving licence applications is increasing by 2.5% more for women than for men (Singh, 2014[74]).

Women tend to make more of their trips on foot than men. In Mexico City, women make 33% of the trips on foot whereas men only 19.5% (SEMOVI, 2019[73]). In Malmö, women conduct 17% of their trips by walking whereas men only 12% (City of Malmö, 2016[24]). In African countries, walking is the most commonly used mode of transport by women (57% in Bamako, 69% in Niamey, and 73% in Dakar) and the problem is particularly acute in rural areas, where the poor state of roads prevents women from using intermediate modes of transport (ex. rickshaws and bicycles) and forces them to travel on foot (Duchène, 2011[71]). This could be problematic for women because they tend to have programmes of activities that are more complex than those of men due to their double working day.

In developing countries, women have a perception of insecurity in public transport, which limits their mobility options and possibilities to access opportunities. It is not enough that opportunities are available for them if women do not perceive to be safe by using public transport they will simply not travel. For example, in Asunción and Lima, 75% and 80% of women respectively have a perception of insecurity while travelling in public transport, particularly at night (Jaitman, 2020[75]). This perception is higher among women who do not use public transport and belong to higher-income groups. In Asunción (24%) and Lima

(78%), women have witnessed or have been victims of crime while using public transport (Galiani and Jaitman, 2016[76]). In Mexico City, in 2018, a study showed that 88.5% of women who used public transport had been victims of at least one type of sexual harassment act and the perception of insecurity in public transport limits women's mobility options (SEMOVI, 2019[73]). To improve security for women and enhance accessibility, some cities reserve vehicles for women. In Brazil, Egypt, India, Japan, Mexico and the Philippines, some train coaches and areas on buses are for women only, in view of combating sexual harassment. In Dubai, India, Iran, Mexico and Russia, there are taxis reserved for women.

To enhance sustainable inclusive urbanisation, accessibility needs to be planned and fostered through a gender lens. For this purpose, there should be an understanding of the differences in how men and women interpret specific aspects of accessibility. For women, transport behaviour is more deeply shaped by socio-economic and life-stage factors than for men, thus the way women and men interpret accessibility in physical, cognitive, financial and emotional terms varies greatly and defines how they use transport (ITF, 2019[77]). Improving women's safety in public transport is essential to closing the gender gap in access to opportunities. Other aspects that would make a difference in enhancing accessibility from gender and inclusive perspective are: encouraging and funding the collection of disaggregated data to build a better evidence base for gender-sensitive planning; integrating gender into transport projects and funding with gender budgeting; and linking women's issues with transport, education and employment (Allen, 2019[70]; ITF, 2019[77])

The design, function and use of the transport system and urban environments should be planned considering the needs of all travellers equally to give everyone access to their city. It cannot be assumed that any transport investment and improvement will benefit everyone equally. Accessibility contributes to broader government objectives of well-being, sustainability and social inclusion by facilitating people's access to opportunities regardless of their age, abilities or disabilities, gender and socio-economic background. It has the potential to improve quality of life and helps lift people out of poverty. For that, cities need to improve their understanding of the links between accessibility, inclusiveness and well-being and of the travel patterns of women, the elderly, children, etc. This can only be achieved if the potential synergies between improving the access to goods, services and information, and goals such as environmental protection and limiting social exclusion are considered from the outset. Research has shown that women tend to use more bus services as it is easier to access opportunities at shorter distances than by train but if bus services are not designed and planned based on this logic and safety is not improved, this imposes a strong barrier in women's accessibility possibilities (Allen, 2019[70]).

Planning and designing smart mobility projects should go beyond technological considerations to ensure well-being, inclusiveness and accessibility. One way of doing so is by engaging the local community in the development of the smart mobility initiative or project as well as in its implementation. Local authorities are using smart city strategies to make cities safer, accessible and sustainable. For smart mobility projects to be inclusive, they also need to reduce the physical barriers to transport access for the elderly, disabled people, children, etc. Cities are implementing different projects to redesign stations and vehicles to facilitate physical access to transport for persons with reduced mobility regardless of gender and age. For example:

- Paris is ensuring the installation of sensors in metro stations to provide important sound information to sight-impaired users.[19]
- Madrid is using technological solutions via a contactless travel card for people with limited mobility to use public transport and parking areas.[20]
- London seeks to enhance streets and the public transport network to enable disabled and older people to travel more easily spontaneously and independently, making the transport system navigable and accessible to all and reducing the additional journey time that disabled and older users can experience.[21] TfL has already set ambitious aims to improve step-free access and is

working to make 40% of the tube network step-free by 2022 (a significant increase from the current 26%) (Greater London Authority, 2018[25]).

Promoting gender-inclusive urbanisation and transport requires the participation of a wider range of stakeholders, including women and disadvantaged groups (i.e. the elderly and minorities) in the transport sector. Women make up only 22% of the transport workforce in Europe (EC, 2017[78]). Taking affirmative action to promote gender equality in the transport sector may be a way to have more women involved in the transport sector. Mexico City's Strategic Plan of Gender and Mobility aims to reduce sexual harassment of women, strengthen gender parity in the transport sector and satisfy the specific mobility needs of women. It includes targets for the participation of women in the transport sector. By 2024, the plan aims to have at least 5% more women in positions at the Director-General level and in areas where women make up less than 30% of the workforce (SEMOVI, 2019[73]).

Cities need to harness the knowledge of citizens by providing win-win opportunities to gain their active participation in city transformation. The amount and variety of outreach carried out by cities and their transport authorities varies but there is a clear recognition across cities of the importance of community engagement. Cities and transport authorities view public engagement and customer service as core components of their transport and accessibility strategies. Citizens have different needs, preferences and opportunities to access various activities depending on several factors such as the stage in life, gender, income and perceptions on what is valuable.

Improving the quality of life through urban form

It is widely acknowledged that cities are not just centres of economic growth but need to consider concerns over quality of life such as equity, access to open space, services and goods, and environmental issues. However, it is becoming increasingly difficult to manage the interdependence of issues that cities must address. Although sectoral policies can help enhance quality of life, a focus on integrated policies is vital to tackle urban challenges. Focusing on urban form is a way of enhancing coherence across economic, social and environmental policies with an impact on quality of life and therefore accessibility.

Research suggests that well-designed urban form can be an effective tool to increase a sense of place and physical activity, improve air quality and accessibility, increase social cohesion and promote well-being among residents in urban areas (OECD, 2014[79]). The urban form is important because it contains four key interdependent metrics that contribute to high ridership and lower GHG emissions from public and private transport: density, land use mix, connectivity and a balanced transport offer (IPCC, 2014[14]). Cities' experience shows that investing in mass transit may help reduce congestion and GHG emissions, as well as contribute to well-being and competitiveness. However, public transit alone cannot increase ridership without significant geographic expansion and improved service levels (DeRobertis, 2010[80]). Ridership is more likely to increase when transport and the urban form are planned in parallel.

Urban density – Promoting sustainable development

Density refers to how intensively urban land is utilised and proximity particularly concerns the location of urban agglomerations in a metropolitan area (OECD, 2012[3]).[22] Cities with high levels of population density can more effectively serve their residents with rapid transit as fewer kilometres of infrastructure are needed to serve the same population (Marks, Mason and Oliveira, 2016[6]). High density (population, housing, jobs) levels are commonly associated with "compact city" strategies. Among several types of urban forms, the compact city has been presented as a way of encouraging urban sustainability as it promotes walkable, eco-friendly urban forms. Globally, cities are becoming denser; this densification accounts for 50% to 60% of the global city population growth (OECD/European Commission, 2020[2]). This increase in density requires more investments to provide housing, jobs and services such as transport.

The COVID-19 pandemic has reinforced the value of proximity by enhancing accessibility through urban design and planning (OECD, 2020[4]). With COVID-19, debates have started to emerge on the vulnerability of densely populated urban areas. They are regarded as places where the risk of contagion is higher than in low-density places. However, research has found that density is not significantly associated with COVID-19 infection rates, in fact, areas with high density tend to have lower death rates.[23] OECD research has concluded that "…it is not density alone that make cities vulnerable to COVID-19, but the structural economic and social conditions of cities make them more or less able to implement effective policy responses" (OECD, 2020, p. 15[4]).

Density levels vary depending on the income level of every country. Cities in low-income countries are 4 times denser than those in high-income countries; the population density in cities in North America is less than 2 000 inhabitants per km², whereas in South Asia and Sub-Saharan Africa, it is around 8 000 inhabitants per km² (OECD/European Commission, 2020[2]). Moreover, in Europe, cities with similar levels of population have very different densities, reflecting their differences in urbanisation patterns. For example, cities like Milan (73 people/hectare [ha]), Munich (44 people/ha), Prague (25 people/ha), Vienna (41 people/ha) and Warsaw (33 people/ha) with similar population levels differ in their levels of density (IPR, 2015[38]).

In most metropolitan areas, the majority of the residents live outside the city core and these people are in general not able to access opportunities by public transport nearly as well as residents in central areas (Marks, Mason and Oliveira (2016[6]). The problem is that urban growth tends to happen outside city centres where there is limited public transport service. Indeed, according to the European Commission and the OECD (2020[2]), the further away from the city centre, the lower the densities are, and the larger the city, the more distance is needed for densities to drop. In the Czech Republic, for instance, the build-up areas of cities have increased in recent years leading to urban sprawl and a process of suburbanisation as more people live in the suburbs than in the core areas. Suburbanisation is one of the causes of high levels of car ownership and in consequence heavy road traffic and air pollution as public transport options are limited in suburban areas (OECD, 2018[81]). Greater efforts are needed to allow for and encourage densification, in particular easing density restrictions in low-density areas close to city centres and along public transport corridors; this is key but gradual densification should also be permitted in most parts of an urban area (OECD, 2017[20]).

Many cities across the world are promoting policies towards more compact urban developments. In a compact city, urban land is intensively used, urban agglomerations are contiguous and there is a clear difference between rural and urban land (Table 1.2). Moreover, urban areas are linked by public transport systems that determine how effectively urban land is utilised (OECD, 2012[3]). Another characteristic of compact cities is that it facilitates access to local jobs and services. For that, land use is mixed and most residents have access to services and goods either by foot or by public transport. Research suggests that higher population densities, especially when combined with high employment densities, are strongly correlated with easier access to goods, services and information (IPCC, 2014[14]; OECD, 2012[3]). A lack of opportunities in the vicinity where people live cannot be overcome by greater transport efficiency. Conversely, in cities with low densities of employment, commerce and housing, there is generally an increase in the average travel distances for accessing opportunities. These longer travel distances also contribute to higher GHG emissions.

Table 1.2. Key characteristics of a compact city

Dense and proximate development patterns	Urban areas linked by public transport systems	Accessibility to local jobs and services
Urban land is intensively utilised Urban agglomerations are contiguous or close together Distinct border between urban and rural land use Public spaces are secured	Effective use of land Public transport systems facilitate mobility in urban areas	Land use is mixed Most residents have access to local services either on foot or by public transport

Source: Based on OECD (2012[3]), *Compact City Policies: A Comparative Assessment*, https://dx.doi.org/10.1787/9789264167865-en.

The effective management of density is key to promoting compact, well-planned cities. "Densification is perceived as a fundamental strategy for creating sustainable accessibility" (Gil Solá, Vilhelmson and Larsson, 2018[7]). The creation of high-density, mixed-use places requires transport investment to be fully aligned with the city's growth strategy. At a minimum, densification may be possible by easing land use restrictions such as restrictive zoning regulations and planning decisions that prevent it. Explicit restrictions such as floor-to-floor area rations or implicit restrictions such as minimum lot-size requirements and limitations on multifamily homes are just some practices that prevent densification (OECD, 2017[20]). Policies that promote compact cities tend to incentivise the development of brownfield over greenfield land. Higher density makes it easier for cities to promote mass transit, as it needs high density to pay off investments. Hence, density and mass transit must be planned jointly (DeRobertis, 2010[80]). Allowing high densities where there is no mass transit or allowing mass transit where there is low density is not likely to lead to better accessibility. The central goal is to promote high density in city centres where services and goods could be accessed by walking. The strategies may include the establishment of new residential areas or buildings. Some instruments to promote compact city development include: minimum density standards, mixed-use regulation and a density bonus for developers (Rode et al., 2014[5]).

Cities reach a level where increasing density is no longer desired. The aim is to reach a level of sufficient density and not maximising or increasing density as this could have negative effects, such as reducing well-being levels. In Paris, for example, increasing density levels could lead to higher demands on public services, insufficient water availability, poor air quality and waste disposal problems.

Cities tend to promote compact city development with a hierarchy of higher density and mixed-use clusters around public transport nodes. These strategies normally involve the redevelopment of areas in proximity to major transit stations. They intend to maximise access to transit through land use planning and community development policies. Examples can be found in cities such as London, Milan, Stuttgart and the Île-de-France region around Paris (Box 1.10). This is because the most significant influence on transit seems to be proximity to public transport. The neighbourhood around the stations is an essential part of the life of the city as the station is the link between public transport and the city. When a new public transport service (mostly rail transport) is provided in a neighbourhood, it has an impact on its functioning and planning. Cities such as London consider that land around stations provides opportunities to create high-density, mixed-use places that are well connected to local amenities, and jobs and locations further afield. This is a way to make the most of past public transport investment and the benefits of any future investment by providing new homes and jobs nearby. In the Île-de-France region, France, the development of the Grand Paris project places the *gare* (station) at the centre of urban development. Other examples include Denmark's Planning Act which requires new offices over 1 500 m^2 to be located within 600 metres of a rail station contributing to Copenhagen's compact urban form. Korean cities have also explored the integration of land use policy and transport policies to build more compact cities and make better use of available land, particularly as cities face critical urban challenges such as demographic change and access to affordable housing (Box 1.11).

Box 1.10. Accessibility in redeveloped urban areas – The cases of Île-de-France, London, Milan and Stuttgart

The old fairgrounds in **Milan**, Italy, occupied a large site (approximately 0.6 km^2) in a central location less than 3.5 km from the central station and the city centre. Due to its prime location, local authorities decided the site was better suited for mixed-use development. The project was called City Life. To build it, Milan amended its zoning plan to change the use from fairground to mixed-use, under the premise that the redeveloped area would be denser than the surrounding areas but with more parks and open spaces. This density/open space combination was achieved by concentrating residential uses in three 27-story towers. Roads were not extended through the project site, pedestrian and bicycle pathways were given priority making it the largest car-free area in Milan. All parking was built underground. Non-residential buildings, including museums, shops and offices were determined through public meetings and negotiations between local authorities and developers. Coincidentally, a new metro line had been sited near the project and city planners realigned the metro to include a new station underneath the project City Life. Moreover, city planners re-analysed the project's traffic and parking requirements and concluded that parking could be reduced to 1 000 from the 4 000 spaces originally planned.

The Möhringen station in **Stuttgart**, Germany, was historically a freight station and rail yard. As the city built its tramlines, the station became the core area linking the former village of Möhringen to the city centre. Eventually, the rail yard became obsolete and, in 1995, local authorities planned for its redevelopment. Stuttgart amended its 1990 general plan and selected densities consistent with other city areas with the same characteristics, even though Möhringen was much denser than the adjacent neighbourhood. In the zoning amendment, the city rezoned the abutting low-density housing to this same higher density. Planners considered locating it and the services required (supermarkets, kindergartens, senior residences, etc.) near a light rail station. The redeveloped area includes five buildings of four stories each for mixed use. Planners decided that all parking had to be underground, only public parking for visitors and shoppers is available in the street. Since the local authorities give priority to housing construction, there are no fees for residential projects.

In the UK's capital city **London**, the Mayor's Transport Strategy promotes exploring opportunities for development around the nearly 600 rail and tube stations to create high-density and mixed-use areas. Some of the measures include converting land use from low-density uses (retail parks, storage, parking, etc) to high-density, mixed-use development. It is expected that such change could act as a catalyst for the regeneration of town centres and neighbourhoods and play a role in revitalising high streets. Development around stations could provide opportunities for rental housing, as affordable housing is a key challenge for the city. Locating high-density housing within walking distance of stations means that residents will not only be well connected by rail or tube to employment opportunities but also to schools, hospitals and shops by public transport, walking or cycling. A key advantage is that land around stations is often owned by the transport authority (Transport for London, TfL), Network Rail and other public sector owners. This is seen as a good opportunity to increase housing delivery by making better use of underused land. The Transport Strategy suggests using buses and cycle links to encourage high-density development further from stations and, in that way, increase the catchment area of a station.

In France, the **Île-de-France** (IDF) region, in which Paris is located, has 437 stations, 399 of which are outside Paris (not including metro stations). Approximately 35% of inhabitants in the region live within a radius of 800 metres from a station and 83% within less than 2 000 metres. In the coming years, the IDF region plans to increase the service of public transport, using the attraction power of the stations to build new housing, bring new jobs and meet environmental objectives. The strategy is to increase density and the land use mix around stations. The urban mobility plans of the region call for better local

planning of the urban public space around the stations and promote the use of public transport instead of the private car. One of the key actions is to build 68 new stations in areas that currently lack the service by 2030. These new stations are expected to increase the attractiveness of the neighbourhoods and contribute to their economic development. The Société du Grand Paris (SGP) (head of the transport project) launches a call for innovative projects on services or the planning of public spaces around stations every year. Regional and transport authorities promote a more coherent development around public transport infrastructure projects to achieve a more transversal development of the neighbourhoods around the stations. It is expected that this approach will be implemented in the extension of metro line 11 to the east of Paris and the extension of the RER E (suburban train) to the west (Mantes-la-Jolie). The different actors in charge of the suburban train extension have implemented an observatory of the territory to improve their knowledge of the urban development challenges and use it as a basis for discussions and decision-making. Similar projects around existing stations are in place.

Source: DeRobertis, M. (2010[80]), "Land development and transportation policies for transit-oriented development in Germany and Italy: Five case studies", http://www.gmfus.org/publications/land-development-and-transportation-policies-transit-oriented-development-germany-and (accessed on 9 July 2019); City Life Development (2017[82]), *City Life Project*, https://europe.uli.org/wp-content/uploads/sites/127/ULI-Documents/CityLife-Project.pdf; Successful policies on land use density, auto parking and assessment of transportation impacts, accessed at: Comparative Domestic Policy Fellowship German Marshall Fund (n.d.[83]), "Comparative Domestic Policy Fellowship", https://cittastadt.files.wordpress.com/2009/12/presentation-vta-dec09pdfreduced1.pdf; Greater London Authority (2018[25]), *Mayor's Transport Strategy*, http://www.london.gov.uk (accessed on 15 July 2019). For Île-de-France: Laurent, S. (2018[84]), *La gare au coeur du développement urbain*, https://www.iau-idf.fr/fileadmin/NewEtudes/Etude_1596/C175_web.pdf (accessed on 5 August 2019).

Urban redevelopment strategies are essential for the promotion of densification. It is commonly accepted that certain levels of density could contribute to economic growth due to increased agglomeration. Deteriorated buildings or areas could be repurposed for housing or other cultural or leisure activities boosting the economic activity of the area. But accessibility considerations should be part of the initiatives to make them effective. Public transport is a key component of policies intended to revitalise, regenerate and support growth in deprived areas (UITP, 2018[85]). People living in deprived areas most of the time rely on walking or public transport, when provided, for accessing jobs, goods and services. If public spaces and transport are undeveloped, they will have limited access to socio-economic opportunities. Co-ordinating investment in public transport and redevelopment projects has the potential of increasing access to opportunities and contribute to well-being.

Box 1.11. Enhancing sustainability through compact city policies – The experience of Korean cities

Korean cities face increasing challenges due to rapid urbanisation. The share of the urban population doubled from 40.7% in 1975 to 81.9% in 2009. Korea is one of the densest and most urbanised countries in the world. Korea's population is increasingly concentrated in urban areas. While the percentage of the global population residing in urban areas increased from 31% to 51% between 1960 and 2010, Korea's share of urban residents jumped from nearly 28% to 83% during the same period. The country's economic model and rapid growth underpinned by highly urbanised spatial form have led to increased resource consumption and put pressure on the environment. Today, Korean cities are characterised by smaller and ageing households. For instance, the ratio of single-person households increased from 5% in 1980 to 24% in 2010. Korea based its urban development largely on road-oriented transport (ROT), which increases energy consumption, air pollution and commuting distance.

For example, in Seoul Metropolitan Area (SMA), the average commuting distance increased from 9.7 km in 1996 to 13 km in 2010. Road construction doubled from 1990 to 2012, by which roadways accounted for approximately 10% of total urban area. In consequence, traffic congestion cost increased by 32% between 2003 and 2007 and accounted for 2.4% of the national GDP in 2010. Unequal public transport accessibility (in Seoul, 91.2% of people live within a 5-minute walk from public transport but only 68% in Daejeon), unequal job density (85.96% in Seoul, 58.95% in Incheon) and unbalanced matching index in local service accessibility (0.04 in Jung-gu/Seoul, 0.069 in Gangnam-gu/Seoul) show the need to change the urban form model. This requires the integration of public transport with urban form planning.

To face these challenges, Korean urban policy has evolved over time to promote urban compact city policies. The Korean government's Second Revision of the Fourth National Comprehensive Plan and other documents have acknowledged the need to make urban areas more compact by promoting high-density development and building affordable housing near railway stations. Mixed land use and integrating land use policy with transport policy through transport-oriented development strategies are alternatives that Korean cities are exploring to achieve sustainable urban development goals.

Source: OECD (2012[86]), *OECD Urban Policy Reviews, Korea 2012*, https://dx.doi.org/10.1787/9789264174153-en; OECD (2014[79]), *Compact City Policies: Korea: Towards Sustainable and Inclusive Growth*, https://dx.doi.org/10.1787/9789264225503-en.

Research suggests that excessive densification could reduce proximity and increase travel (Gil Solá, Vilhelmson and Larsson, 2018[7]). The problem is that building more housing may increase economic returns for land use but it may also crowd out less intensive land uses such as public meeting places, recreational areas, schools, etc. The need for new housing and related densification may threaten the quality of public spaces such as urban parks, green areas and playgrounds. Moreover, as has happened in some cities such as Prague and Vancouver, a side effect of densification is that it may exclude economically vulnerable groups. The reason is that a new high standard of housing may be relatively expensive to buy or rent for low-income households, which could be forced to move to peripheral areas with cheaper housing. In this case, these groups may not have the same access to goods and services as those living in central areas. The renovation of older housing near central areas well served by public transport may also create gentrification and exclude some low-income residents.

Research has found an overarching trend in the decline of population and built-up densities in cities across the world (IPCC, 2014[14]). According to OECD studies, "[d]espite growing populations and pressures on the housing market of many cities, little densification has occurred in recent decades in most urban areas in the OECD" (OECD, 2017, p. 23[20]). However, this decline varies across income groups, city sizes and regions.

A common misconception about density is that it requires high-rise buildings configured in close proximity to each other. This is the case in many Asian cities, particularly in the People's Republic of China (China hereafter), that rely on the vertical expansion of built-up areas. Multiple land use configurations can lead to the same levels of density. High population density does not necessarily mean high-rise buildings. One key point of consideration is that accessibility should focus on making everyday life easier for residents. Therefore, since most new buildings are inserted into already defined land uses, to make everyday life simpler would entail adding complementary activities that add value (Gil Solá, Vilhelmson and Larsson, 2018[7]). The challenge here is to focus on residents needs rather than only on the availability of land to build and promote activities that may not be in line with residents' priorities.

Integrating land use and transport policies

How land is used has a strong effect on the length of commutes, environmental sustainability and climate adaptation and mitigation efforts. Cities have an important role to play in land use planning, as this is mostly the purview of local governments across the OECD. Land use planning is place-based by definition and highly context-specific and thus requires a high level of information on local conditions, which higher levels of government often do not have (OECD, 2017[20]). Land use mix refers to the diversity and integration of land uses (i.e. parks, residential, commercial, industrial). The land use mix can be measured in several ways: i) the ratio of jobs to residents; ii) the variety and mixture of amenities and activities; and iii) the proportion of retail and housing (IPCC, 2014[14]). Therefore, diverse and mixed land uses can reduce travel distances and enable walking and other active modes of transport to access goods and services (Kockelman, 1997[87]; OECD, 2017[20]). However, some research suggests that the politics of land use and transportation decisions rarely favours accessibility as an important policy outcome (Duranton and Guerra, 2016[16]).

Land use policy and transport policy are normally integrated through transit-oriented development (TOD) strategies. TOD planning should cover diverse scales, not only small land plots around stations. TOD planning on a large scale is a way to ensure a sufficient number of public transit customers and to justify the investment in public transport (OECD, 2014[79]; DeRobertis, 2010[80]). For example, in 2004, the Hammarby Sjöstad neighbourhood in southern Stockholm set itself the goal of increasing public transport ridership, bicycle use or walking by 80% by 2010. By 2008, ridership had already increased to 79% due to increases in the number of residents (OECD, 2014[79]). Its tram line was built as the main commuting traffic mode and the first tram line ever to serve as a connection between the southern neighbourhoods of Stockholm. Other features of the local transport system include its pedestrian and bicycle network, its large carpooling system and the ferry system (Perth and Berg, 2014[88]).[24] In Metro Vancouver, municipalities and regional authorities use the concept of Frequent Transit Network (FTN) to identify corridors linking urban centres and other key activity areas with high-frequency, high-quality service. Whether served by bus, rail or ferry, FTN corridors – and especially the nodes where these corridors intersect – are important places for the region to direct growth and development. The FTN has become an important organising framework in Metro Vancouver for co-ordinating land use and transport policies.

One key lesson from the experience of Metro Vancouver is that, to improve accessibility, it is necessary to rethink transport. To deliver the Regional Transport Strategy of the metro area, the transport authority, TransLink, needs to invest strategically to maintain and expand the transport system. For that, investment decisions are made in tandem with decisions on land use and demand management. The key issue is to ensure that new projects enhance goods movement and travel time reliability without increasing general purpose traffic; therefore, understanding what land uses are in place and current and future demand is essential. Where basic networks are incomplete or supply is insufficient to meet demand, decisions on the expansion are made in a way that promotes regional goals as cost-effectively as possible. TransLink has noticed that infrastructure alone cannot resolve transportation problems, especially if new infrastructure acts to encourage people to travel farther or more frequently.

The provision of strategic infrastructure is a critical element that determines the character of a city at any stage of development. Public transport and services determine urban mobility patterns including modal choice. That is why infrastructure developments should be directly linked to strategic planning policy, which in turn informs local planning and regulation (Rode et al., 2014[5]). This is, however, not always easy, as linking transport to land use and strategic planning depends on the level of maturity and capacity of the institutional planning framework of the region or city. That is probably one of the reasons why cities in less developed countries focus exclusively on trying to satisfy transport demand and the provision of infrastructure without necessary considering other urban development issues.

One of the best-known examples of urban containment land use regulations and TOD is the Finger Plan of Copenhagen's Capital Region (Box 1.12). The Finger Plan is a national planning directive that sets the

overall principles for municipal planning in the Greater Copenhagen area. It requires that municipal planning be carried out based on an assessment of development in the area as a whole and must ensure that the main principles of the overall "finger city" structure are continued. The main lesson from this plan is the importance of co-ordinating urban development with the expansion of infrastructure such as transport. Thus, under this plan, the principle of accessibility is a key element of controlling sprawl and maintaining a compact urban form. For instance, the plan provides that large office workplaces should generally be located within 600 metres of the closest public transport stations (Danish Ministry of the Environment, 2015[89]).

Box 1.12. **Ensuring an overall regional planning strategy: Copenhagen's Finger Plan**

In 1947, the Danish Regional Planning Office created Copenhagen's Finger Plan. Since its adoption, the plan has been the backbone of regional planning for the Greater Copenhagen area even though different bodies have carried out the planning and with different legal effects. Through the Finger Plan, planners have sought to establish urban growth on the basis of an overall structure where urban development is concentrated along city fingers linked to the railway system and radial road networks, and the city fingers are separated by green "wedges" which are protected from urban development. Currently, the area covered by overall planning for the Greater Copenhagen area includes 34 municipalities.

The Finger Plan is a national planning directive issued pursuant to the Planning Act. According to the plan, urban development of regional significance must be co-ordinated with the expansion of overall infrastructure within the Greater Copenhagen area with special consideration for public transport services. The municipal planning in the Greater Copenhagen area must ensure that:

- Urban development and urban regeneration in the core urban region take place within the existing urban zone and with consideration for the opportunities to strengthen public transport services.
- Urban development and new urban functions in the peripheral urban region (the "finger city") must be located with consideration for existing and approved infrastructure and the opportunities to strengthen public transport.
- The green "wedges" are not converted into urban zones or used as recreational facilities.
- Urban development in the rest of the Greater Copenhagen area is local in nature and takes place in connection with municipal centres.

The plan also ensures that overall areas significant for the development of the metropolitan area as a whole are reserved for future transport infrastructure, technical installations, noise impact areas, etc.

Source: Danish Ministry of the Environment (2015[89]), *The Finger Plan - A Strategy for the Development of the Greater Copenhagen Area*, http://www.naturstyrelsen.dk (accessed on 19 July 2019).

For cities with less mixed land use, such as those in Asia and North America, large residential developments are separated from jobs and retail centres by long distances. In cities with more space dedicated to single-use areas, residents tend to travel overall longer distances and carry out a larger share of their travel in private vehicles than residents who live in areas with more land in mixed use. Low levels of mixed land use increase commuting distances and have a negative impact on social cohesion and city productivity levels. This is the case of several cities in Latin America, where the pattern of land use has led to the hollowing out of city centres and moved population to the suburbs away from jobs and services. In

Mexico, for instance, urbanisation does not translate into economic development because cities fail to provide an environment that connects inhabitants to economic opportunities and to social and urban infrastructure, and prevents firms from reaping agglomeration benefits (Box 1.13). In this case, as in many other developing cities, institutions governing land use may only mature enough over time to effectively regulate land markets and manage land conversions.

Box 1.13. Poor land use planning limits access to jobs and services: The case of Mexican cities

Urban expansion in Mexican metropolitan areas has been inefficient and costly, hollowing out city centres and contributing to social segregation. In the last decades, urban development occurred at ever greater distances from the centre city and became increasingly spatially dispersed rather than clustered. Moreover, roughly 90% of the housing stock consists of individual homes rather than denser and multi-family residences, and individual homes continue to make up the majority of all new development. Other factors have played a role: rising income levels and lower transport costs; a fiscal and regulatory bias towards single-family, owner-occupied homes; the prevalence of irregular settlements; weak municipal capacity and local land use controls for urban development; and a high level of municipal fragmentation within metropolitan areas, making co-ordinated land use and transport planning across neighbouring jurisdictions a challenge.

Urban sprawl has had significant consequences for mobility. It has contributed to rising rates of car ownership and making the provision of efficient, quality public transport alternatives more challenging and costly. Mexico's motorisation rate doubled over the past decade, reaching 20 vehicles per 100 people and, in 2011, over 70% of the country's 22.4 million cars were registered in metropolitan zones. Public transport service, consisting primarily of buses, can be unreliable, expensive and time-consuming, and the fleet is often of poor quality. The development of bus rapid transit (BRT) networks in some cities is promising, yet too often remains divorced from broader urban planning efforts.

Source: OECD (2015[90]), *OECD Urban Policy Reviews: Mexico 2015: Transforming Urban Policy and Housing Finance*, https://dx.doi.org/10.1787/9789264227293-en.

The experience of Germany and the US suggests that linking national urban transport funds to integrated urban planning has proven useful to increase co-ordination of urban transport and land use planning (Aguilar Jaber and Glocker, 2015[91]). In the US New Starts programme, project sponsor agencies are required by the Federal Transit Administration (FTA) to submit information of existing land use, transit-supportive plans and policies, performance and impacts of policies. In Germany, planning procedures involving interest groups and the public are part of the requirements to access national funds for urban transport projects. Developing an environmental impact assessment and a cost-benefit analysis are part of these requirements (Aguilar Jaber and Glocker, 2015[91]). Linking national urban transport funds to integrated urban planning can also pay off in emerging economies. In India, for example, this has been facilitated by national funds made available for urban transport projects as part of a larger urban development project and funded by the Ministry of Urban Development. In order to be eligible for funding, transport projects have to be part of a comprehensive city development plan (Aguilar Jaber and Glocker, 2015[91]).

The effectiveness of land use policy towards higher densities and mixed use depends on the willingness of residents to accept high levels of density by changing from using private cars to public transport and non-motorised modes of transportation (Inturri et al., 2017[12]). Certainly, the level of service is also a determinant on changing people's behaviour towards using transport. Traffic congestion, little diffusion of cycling and walking for systematic trips, the inefficiency of parking management and the absence of city

logistics measures are some of the factors that may affect people's transport behaviour and perception. Another problem is that, in general, when land uses are planned without co-ordination across policy sectors, the distance between origin and destination tend to be longer (IPCC, 2014[14]).

Connectivity – Building pedestrian-friendly cities

Many modern cities have to contend with two legacies from earlier planning: the distribution of single-use land zones and the promotion of car dependency. Planners today wish to correct those errors by increasing densities, promoting mixed land use and increasing connectivity. Connectivity refers to street density and design and can be measured by block size, or intersections per road kilometre (IPCC, 2014[14]). A high level of street connectivity is characterised by finer grain systems with smaller blocks that allow frequent changes in direction. It has a positive correlation with the convenience of walking and lower GHG emissions. Low street connectivity has certainly the opposite effect. The human-scale street design includes smaller block sizes, higher building densities and mixed-use to facilitate micro-accessibility, last-mile connectivity, walkability and social interaction (Rode et al., 2014[5]). In China, for instance, cities have low levels of density and Chinese planners are well aware of (and often advocate) multifunctional zoning but a clear separation of functions prevails. The OECD (2015[92]) concluded that if China is to build denser, more liveable cities it should work more on connectivity.

Box 1.14. Building more liveable urban areas: The case of Chinese cities

Improving the quality of urbanisation in Chinese cities requires promoting more pedestrian-friendly cities. Chinese cities are characterised by the existence of superblocks that discourage walking and community life. Chinese authorities need to do more than simply pursuing increased densities, which might in any case overload infrastructure systems and have other undesired consequences. Some of the actions that Chinese cities could do to improve the quality of city life are:

- Chinese cities need to improve internal connectivity by developing finer-grained road networks. The number of road intersections per square kilometre in Chinese cities is drastically lower than in Western cities and the distance between intersections is anywhere from three to ten times greater. Breaking up the superblocks would create more competition among small developers and also facilitate the formation of denser, more vibrant urban communities. This requires more flexible zoning to allow for more mixed-use development. The problem is that, currently, the massive grid of roads 50 to 60 metres wide (more similar to motorways than city streets) segments the urban space, while large square blocks with just 1 or 2 entrances further reduces internal connectivity.
- Density could be managed at smaller scales than the superblock, allowing gradual densification to be co-ordinated with infrastructure development, for instance by allowing higher densities closer to metro stations and other public transport interchanges, in line with the principles of TOD.

Source: OECD (2015[92]), *OECD Urban Policy Reviews: China 2015*, https://dx.doi.org/10.1787/9789264230040-en.

Improving on low levels of connectivity in cities is complex and expensive. As infrastructure already exists, increasing connectivity requires investment either to redevelop the site or a retrofit to facilitate walking and cycling. Street patterns may need to be redesigned for smaller blocks with high connectivity. Retrofitting often involves widening sidewalks, constructing medians and adding bike lanes, as well as reducing traffic speeds, improving traffic signals and providing parking for bicycles (IPCC, 2014[14]). Improving connectivity levels also has a political cost, which could be bigger than the economic one. Decision-makers need to

balance the preferences of those who lobby for a more pedestrian-friendly city with active mobility options and those who depend on the private car to commute and have a need for parking spaces. This is a difficult balance to achieve; thus decision-makers would need to be willing to pay the political cost of any decision in either direction.

Actions to correct past planning errors must be based on the unique historic, cultural, geographic and climate variables of every city and account for how people choose to live. In Australia and Mexico for instance, people generally prefer living in single housing units. Thus, retrofitting existing cities with high-density activity centres, and corridors and transit-oriented developments may not be workable ideas in all contexts. For instance, in Perth, Australia, isolated apartment enclaves, apartments lining highways, crammed unit developments and high-rise developments in low-rise town centres are emerging across the city and less than 10% of people living within walking distance of a train station actually use it for travelling (Lutton, 2017[93]). The lesson from the Australian experience in city retrofitting is that higher densities and public transport of themselves do not improve quality of life but their planning must respect the unique and physical context of a city through meaningful local community participation (Lutton, 2017[93]). In Mexico, people largely prefer living in a single-family home rather than in flats but the convenience of proximity to services in central areas is leading to a change in preference among younger generations who would prefer living in a flat in central areas.

Changing the balance between modes of transport

Accessibility requires offering different mobility alternatives (transport solutions). Accessibility planning requires a balance between various transport modes by promoting public transit, walking and cycling, while car use should be deemphasised or even reduced in some areas. Most city planners appear to be in favour of promoting public transit, cycling and walking, mainly by changing land use and urban structures. However, this does not mean that the use of cars is to be abolished or reduced by planning. The question is more about changing the balance between different modes of transport, a change that might even lead to better conditions for certain car users, such as less congestion. Changes in land use and the transportation system could result in changes in the accessibility conditions (Straatemeier, 2008[8]).

Research suggests that given the strong interrelationship between urban form and transport, the integration of land use and transport represents a unique opportunity to enhance accessibility and more sustainable planning outcomes (Rode et al., 2014[5]). The concept of accessibility provides a basis for making trade-offs between land use and transport policies that has been sorely lacking. Accessibility gives planners the opportunity to assess the impact changes in transport and land use system has on the potential for interaction offered by different places in the urban network (Straatemeier, 2008[8]). Research suggests that in cities where motorisation is already mature, changing accessibility no longer influences car-dependent lifestyles and travel behaviours. This means that regions at the early stages of urbanisation have a unique opportunity to influence accessibility, in particular in cases where income levels, infrastructure and motorisation trends are changing rapidly (IPCC, 2014[14]).

Enhancing accessibility requires a planning approach with a broader perspective on planning than just transport. This means it should include other instruments of planning and areas of urban development. For planners in the Metro Vancouver Regional District, the best transport plan is a good land use plan; but based on the case studies elaborated for this report and the evidence gathered through research, it is possible to argue that a good accessibility policy is a good regional/metropolitan integrated development strategy. The reason is that accessibility is an objective that can only be achieved by the inclusion of different policy instruments: mobility (transport), land use, housing, etc. For that, cities need to identify how best to sequence, co-ordinate and integrate various transport infrastructure investments with land use development. This planning approach also provides an opportunity to improve social inclusion by prioritising housing and infrastructure provision for lower-income households (Rode et al., 2014[5]).

Box 1.15. The case of accessibility in the Netherlands

In the Netherlands, following the hypothesis that increased access to opportunities favours new economic development, one could wonder if the expansion of road and rail capacity between Almere and Amsterdam is the best solution. Notwithstanding the positive effects of cutting down congestion levels, expanding existing infrastructure will not significantly increase the potential accessibility of Almere. Investing in new infrastructure connecting Almere to other neighbouring regions, to which it is currently not well connected, could have a much greater effect on the total number of available opportunities.

It is important to understand that accessibility works both ways, as Amsterdam would also benefit from improving accessibility between the two cities. A better solution could be to increase the network position of Almere by building new infrastructure connection to other parts of the region rather than just to Amsterdam and thus improving both its absolute and relative accessibility.

The interventions would not aim at increasing network efficiency but are aimed at increasing the number of opportunities available within a certain time budget. This results in two types of strategies. First, interventions in the transport system aimed at creating the right accessibility conditions in locations where particular spatial development is favoured. Second, signalling opportunities for spatial development at places in the urban network that already provide favourable accessibility conditions. This implies that planning for accessibility does not only refer to planning for shorter travel distances, as is often interpreted within transportation planning, but also to planning for social and economic interaction.

Source: Straatemeier, T. (2008[8]), "How to plan for regional accessibility?", http://dx.doi.org/10.1016/j.tranpol.2007.10.002.

There are examples of how transport can be linked to other urban development objectives. For example, in Paris, the *Grand Paris* project includes a transport component that places emphasis on improving the quality of mobility in the metropolitan area. It seeks to provide users with a wide range of transport solutions so that they can personalise their routes based on their location and information they receive. Although this mobility plan focuses on the infrastructure and the quality of the transport service, other plans and projects complement it by focusing on the revitalisation of the areas around the stations. In Metro Vancouver, the metropolitan transport authority, TransLink and the Regional Planning Authority have worked in co-ordination to develop the Regional Growth Strategy which underpins the regional transport plan (Box 1.16). This has allowed local authorities to develop the concept of "complete communities", understood as walkable, mixed-use, transit-oriented communities.

Box 1.16. Developing complete communities – Vancouver

In the Metro Vancouver Regional District, the development of "complete communities" is one of the strategic goals of both the Regional Growth Strategy (RGS) and Regional Transportation Strategy (RTS). Complete communities are understood as walkable, mixed-use, transit-oriented communities where people can work, access services, live and enjoy social, cultural, educational and recreational pursuits. Providing diverse and affordable housing choices to meet current and future demand is central to the idea of complete communities. Access to a wide range of services and amenities close to home and a strong sense of regional and community identity and connection are also considered important to promote health and well-being. An important strategy in the setting of complete communities is to design neighbourhoods within urban areas, urban centres and local centres that are accessible for

people of all ages and physical ability, promote transit, cycling and walking. However, the implementation of the initiative is perhaps its weakest point as local councils need to do this individually, but still require support provided by Metro Vancouver.

In Metro Vancouver, residents have an increasing amount of choice in how to get around. More than 90% of the places where people live and work can be reached by public transport at higher levels than cities of comparable size in North America. Based on its compact model, it is estimated that the most affordable and efficient way of achieving liveability, environmental and economic goals is to ensure that, by 2045, half of all trips in the region are made by walking, cycling and transit as they are the lowest-cost and lowest-impact forms of transport. In Metro Vancouver, sustainable urban development is being shaped around the transit-oriented development (TOD) approach. TOD is considered an effective way of concentrating growth on brownfield sites while generating and attracting transit ridership to shift mode share.

Source: TransLink (2013[94]). (2013), *Regional Transportation Strategy: Strategic Framework, TransLink, Vancouver*, https://www.translink.ca/-/media/Documents/plans_and_projects/regional_transportation_strategy/ (accessed on 29 March 2018).

References

Aguilar Jaber, A. and D. Glocker (2015), "Shifting towards Low Carbon Mobility Systems", *International Transport Forum Discussion Papers*, No. 2015/17, OECD Publishing, Paris, https://doi.org/10.1787/5jrvzrjggnhh-en (accessed on 27 August 2019). [91]

Allen, H. (2019), "Women's mobility is defined by transport connectivity and accessibility", in *Transport Connectivity: A Gender Perspective*, OECD Publishing, Paris, https://www.itf-oecd.org/sites/default/files/docs/transport-connectivity-gender-perspective.pdf. [70]

Anable, J. and P. Goodwin (2018), "Assessing the Net Overall Distributive Effect of a Congestion Charge", *International Transport Forum Discussion Papers*, No. 2018/13, OECD Publishing, Paris, https://doi.org/10.1787/7f4c51f2-en. [59]

BEA (2020), *GDP & Personal Income [Database]*, https://apps.bea.gov/iTable/index_nipa.cfm. [26]

BMU (2018), *Incentives for Electric Vehicles in Norway*, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. [62]

Carbon Pricing Leadership Coalition (2016), *What Are the Options for Using Carbon Pricing Revenues?*. [96]

City Life Development (2017), *City Life Project*, https://europe.uli.org/wp-content/uploads/sites/127/ULI-Documents/CityLife-Project.pdf. [82]

City of Copenhagen (2011), *The City of Copenhagen's Bicycle Strategy 2011-2025*, http://www.kk.dk/cityofcyclists (accessed on 27 July 2020). [45]

City of Gothenburg (2014), *Gothenburg 2035 - Transport Strategy for a Close-Knit City*, Urban Transport Committee, City of Gothenburg, https://goteborg.se/wps/wcm/connect/6c603463-f0b8-4fc9-9cd4-c1e934b41969/Trafikstrategi_eng_140821_web.pdf?MOD=AJPERES (accessed on 16 July 2019). [72]

City of Malmö (2016), *Sustainable Urban Mobility Plan: Creating a More Sustainable Malmö*, City Council of Malmö, https://malmo.se/download/18.16ac037b154961d0287384d/1491301288704/Sustainable+urban+mobility+plan%28TROMP%29_ENG.pdf (accessed on 16 July 2019). [24]

CiViTAS (2013), *Enabling Cycling Cities: Ingredients for Success*, CiViTAS MIMOSA, http://www.pas-port.info/cycling (accessed on 3 June 2020). [55]

Coppola, P. and E. Papa (2013), "Accessibility planning tools for sustainable and integrated land use/transport (LUT) development: An application to Rome", *Procedia - Social and Behavioral Sciences*, Vol. 87, pp. 133-146, http://dx.doi.org/10.1016/j.sbspro.2013.10.599. [9]

CRTM (2016), *Annual Report 2016*, Consorcio Regional de Transportes de Madrid, Madrid, http://www.crtm.es (accessed on 19 October 2018). [32]

CRTM (2013), *Madrid, A World Reference - The Public Transport System in the Region of Madrid*, Consorcio Regional de Transportes de Madrid, Madrid, https://www.crtm.es/media/157716/wreference-2013nov-web.pdf (accessed on 22 October 2018). [40]

CRTM (2013), *Plan Estratégico de Movilidad Sostenible de la Comunidad de Madrid 2013-2025*, Consorcio Regional de Transportes de Madrid, Madrid, http://www.crtm.es/plan-estrategico-movilidad-sostenible (accessed on 2 October 2018). [41]

Curtis, C. (2008), "Planning for sustainable accessibility: The implementation challenge", *Transport Policy*, Vol. 15/2, pp. 104-112, http://dx.doi.org/10.1016/J.TRANPOL.2007.10.003. [11]

Danish Ministry of the Environment (2015), *The Finger Plan - A Strategy for the Development of the Greater Copenhagen Area*, http://www.naturstyrelsen.dk (accessed on 19 July 2019). [89]

DeRobertis, M. (2010), "Land development and transportation policies for transit-oriented development in Germany and Italy: Five case studies", German Marshall Fund of the United States, http://www.gmfus.org/publications/land-development-and-transportation-policies-transit-oriented-development-germany-and (accessed on 9 July 2019). [80]

Dewita, Y., M. Burke and B. Yen (2019), "The relationship between transport, housing and urban form: Affordability of transport and housing in Indonesia", *Case Studies on Transport Policy*, pp. 1-11, http://dx.doi.org/10.1016/j.cstp.2019.01.004. [23]

Diamond, R. (2016), "The determinants and welfare implications of US Workers' diverging location choices by skill: 1980-2000"*, American Economic Review*, American Economic Association, http://dx.doi.org/10.1257/aer.20131706. [97]

Duchène, C. (2011), *Gender and Transport*, OECD Publishing, Paris, https://doi.org/10.1787/5kg9mq47w59w-en (accessed on 4 March 2020). [71]

Duranton, G. and E. Guerra (2016), "Urban accessibility: Balancing land use and transportation", University of Pennsylvania, https://faculty.wharton.upenn.edu/wp-content/uploads/2017/05/Urban-accessibility-Balancing-land-use-and-transportation-Gilles.pdf (accessed on 3 April 2018). [16]

EC (2017), *2017 Report on Equality between Women and Men in the EU*, European Commission, http://dx.doi.org/10.2838/258611. [78]

EC/UN-Habitat (2016), *The State of European Cities 2016 - Cities Leading the Way to a Better Future*, European Commission, http://dx.doi.org/10.2776/770065. [37]

Florczak, M. (2012), "Integration without regulations", https://fsr.eui.eu/wp-content/uploads/121207_Florczak_Maciej.pdf (accessed on 9 August 2019). [42]

Galiani, S. and L. Jaitman (2016), "El transporte público desde una perspectiva de género: Percepción de inseguridad y victimización en Asunción y Lima", BIB, https://publications.iadb.org/publications/spanish/document/El-transporte-p%C3%BAblico-desde-una-perspectiva-de-g%C3%A9nero-Percepci%C3%B3n-de-inseguridad-y-victimizaci%C3%B3n-en-Asunci%C3%B3n-y-Lima.pdf (accessed on 4 March 2020). [76]

German Marshall Fund (n.d.), "Comparative Domestic Policy Fellowship", https://cittastadt.files.wordpress.com/2009/12/presentation-vta-dec09pdfreduced1.pdf. [83]

Gil Solá, A., B. Vilhelmson and A. Larsson (2018), "Understanding sustainable accessibility in urban planning: Themes of consensus, themes of tension", *Journal of Transport Geography*, Vol. 70, pp. 1-10, http://dx.doi.org/10.1016/j.jtrangeo.2018.05.010. [7]

Greater London Authority (2018), *Mayor's Transport Strategy*, http://www.london.gov.uk (accessed on 15 July 2019). [25]

Hawkins Kreps, B. (2018), "A modest investment with major dividends: Cycling culture in the Netherlands", Resilience, https://www.resilience.org/stories/2018-11-08/a-modest-investment-with-major-dividends-cycling-culture-in-the-netherlands/ (accessed on 27 July 2020). [48]

IAU (2016), "L'évolution des modes de vie accroît le temps passé à se déplacer", *Note Rapide d'Institut d'Aménagement et d'Urbanisme*, Vol. 714. [67]

IEA (2019), *CO2 Emissions from Fuel Combustion 2019 - Highlights*, IEA, Paris, https://doi.org/10.1787/2a701673-en. [56]

Inturri, G. et al. (2017), "Influence of accessibility, land use and transport policies on the transport energy dependence of a city", *Transportation Research Procedia*, Vol. 25, pp. 3273-3285, http://dx.doi.org/10.1016/J.TRPRO.2017.05.165. [12]

IPCC (2014), *2014: Human settlements, infrastructure and spatial planning*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter12.pdf (accessed on 17 July 2019). [14]

IPR (2015), *Do You Know Prague? The City in Maps, Graphs and Figures*, IPR, http://www.iprpraha.cz/uploads/assets/dokumenty/obecne/do_you_know_prague.pdf. [38]

ITF (2020), *COVID-19 Transport Brief: Re-spacing Our Cities For Resilience*, International Transport Forum, https://www.itf-oecd.org/sites/default/files/respacing-cities-resilience-covid-19.pdf (accessed on 25 November 2020). [49]

ITF (2020), *Safe Micromobility*, ITF, Paris, https://www.itf-oecd.org/sites/default/files/docs/safe-micromobility_1.pdf (accessed on 21 September 2020). [47]

ITF (2019), "Benchmarking Accessibility in Cities: Measuring the Impact of Proximity and Transport Performance", *International Transport Forum Policy Papers*, No. 68, OECD Publishing, Paris, https://doi.org/10.1787/4b1f722b-en. [18]

ITF (2019), "Improving Transport Planning and Investment through the use of Accessibility Indicators", *International Transport Forum Policy Papers*, No. 66, OECD Publishing, Paris, https://doi.org/10.1787/46ddbcae-en (accessed on 16 July 2019). [10]

ITF (2019), *ITF Transport Outlook 2019*, OECD Publishing, Paris, https://dx.doi.org/10.1787/transp_outlook-en-2019-en. [60]

ITF (2019), *Transport Connectivity A Gender Perspective*, OECD Publishing, Paris, https://www.itf-oecd.org/sites/default/files/docs/transport-connectivity-gender-perspective.pdf (accessed on 28 July 2020). [77]

ITF (2018), *Integrating Urban Public Transport Systems and Cycling*, ITF Roundtable Reports, OECD Publishing, Paris, https://doi.org/10.1787/bd177112-en (accessed on 21 September 2020). [46]

ITF (2018), *Policy Priorities for Decarbonising Urban Passenger Transport*, ITF, Paris. [61]

ITF (2017), *ITF Transport Outlook 2017*, OECD Publishing, Paris, https://doi.org/10.1787/9789282108000-en. [58]

ITF (2017), "Linking People and Places: New ways of understanding spatial access in cities", *International Transport Forum Policy Papers*, No. 35, OECD Publishing, Paris, https://doi.org/10.1787/996cc49e-en. [19]

ITF/OECD (2020), "Leveraging digital technology and data for human-centric smart cities: The case of smart mobility", OECD, Paris. [66]

Jaitman, L. (2020), "Public transport from a gender perspective: Insecurity and victimization in Latin America. The case of Lima and Asuncion metropolitan areas", *Journal of Economics, Race, and Policy*, Vol. 3/1, pp. 24-40, http://dx.doi.org/10.1007/s41996-019-00040-2. [75]

Kahn, M. (2007), "Gentrification trends in new transit-oriented communities: Evidence from 14 cities that expanded and built rail transit systems", *Real Estate Economics*, Vol. 35/2, pp. 155-182, http://dx.doi.org/10.1111/j.1540-6229.2007.00186.x. [34]

Kockelman, K. (1997), "Travel behavior as function of accessibility, land use mixing, and land use Balance: Evidence from San Francisco Bay Area", *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 1607/1, pp. 116-125, http://dx.doi.org/10.3141/1607-16. [87]

Laurent, S. (2018), *La gare au coeur du développement urbain*, pp. 30-33, https://www.iau-idf.fr/fileadmin/NewEtudes/Etude_1596/C175_web.pdf (accessed on 5 August 2019). [84]

Link (n.d.), *Intermodal Passenger Transport in Europe: Passenger Intermodality from A to Z*, European Forum on Intermodal Passenger Travel, http://www.rupprecht-consult.eu/uploads/tx_rupprecht/LINK_Guidance_Brochure.pdf. [31]

Lutton, L. (2017), "Retrofitted cities are forcing residents to live with planning failures – We're due for a rethink", The Conversation, http://theconversation.com/retrofitted-cities-are-forcing-residents-to-live-with-planning-failures-were-due-for-a-rethink-83216 (accessed on 10 September 2019). [93]

Manning, A. and B. Petrongolo (2017), "How local are labor markets? Evidence from a spatial job search model", *American Economic Review*, Vol. 107/10, pp. 2877-2907. [29]

Marks, M., J. Mason and G. Oliveira (2016), *People Near Transit: Improving Accessibility and Rapid Transit Coverage in Large Cities*, ITDP, https://3gozaa3xxbpb499ejp30lxc8-wpengine.netdna-ssl.com/wp-content/uploads/2016/10/People-Near-Transit.pdf (accessed on 12 March 2018). [6]

McKinsey & Company (2014), *Electric Vehicles in Europe: Gearing Up for a New Phase?*. [63]

Metro Vancouver (2017), *Transit-oriented Affordable Housing Study 2017-2019*, http://www.metrovancouver.org/services/regional-planning/housing-affordability/transit-oriented/Pages/default.aspx (accessed on 25 June 2018). [27]

Metro Vancouver (2015), *The Metro Vancouver Housing and Transportation Cost Burden Study - A New Way of Looking at Affordability*, Metro Vancouver, Vancouver, http://www.metrovancouver.org/services/regional-planning/PlanningPublications/HousingAndTransportCostBurdenReport2015.pdf (accessed on 29 June 2018). [22]

Mexico City Government (2014), *Ley de Movilidad del Distrito Federal*, Asamblea Legislativa del Distrito Federal, http://www.paot.org.mx/centro/leyes/df/pdf/2018/LEY_MOVILIDAD_DISTRITO_FEDERAL_02_04_2018.pdf (accessed on 9 September 2019). [15]

Moretti, E. (2012), *The New Geography of Jobs*, Houghton Mifflin Harcourt. [98]

Morton, C., R. Lovelace and J. Anable (2017), "Exploring the effect of local transport policies on the adoption of low emission vehicles: Evidence from the London congestion charge and hybrid electric vehicles", *Transport Policy*, Vol. 60, pp. 34-46. [64]

NSW Government (2018), *Future Transport Strategy 2056*, Transport for NSW, Sydney, https://future.transport.nsw.gov.au/sites/default/files/media/documents/2018/Future_Transport_2056_Strategy.pdf. [53]

NYC Department of Transportation (2016), *New York City Strategic Plan 2016*, Department of Transportation, New York, https://www.nycdotplan.nyc/PDF/Strategic-plan-2016.pdf (accessed on 6 August 2019). [17]

OECD (2020), "City policy responses", *Tackling Coronavirus (COVID-19): Contributing to a Global Effort*, OECD, Paris, https://read.oecd-ilibrary.org/view/?ref=126_126769-yen45847kf&title=Coronavirus-COVID-19-Cities-Policy-Responses. [4]

OECD (2019), *Accelerating Climate Action: Refocusing Policies Through a Well-Being Lens - Highlights*, OECD, Paris. [57]

OECD (2019), *OECD Regional Outlook 2019: Leveraging Megatrends for Cities and Rural Areas*, OECD Publishing, Paris, https://doi.org/10.1787/9789264312838-en. [65]

OECD (2018), *OECD Environmental Performance Reviews: Czech Republic 2018*, OECD Environmental Performance Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264300958-en. [81]

OECD (2017), *Gaps and Governance Standards of Public Infrastructure in Chile: Infrastructure Governance Review*, OECD Publishing, Paris, https://doi.org/10.1787/9789264278875-en. [43]

OECD (2017), *The Governance of Land Use in OECD Countries: Policy Analysis and Recommendations*, OECD Publishing, Paris, https://doi.org/10.1787/9789264268609-en. [20]

OECD (2016), *Making Cities Work for All: Data and Actions for Inclusive Growth*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264263260-en. [95]

OECD (2016), *Road Infrastructure, Inclusive Development and Traffic Safety in Korea*, OECD Publishing, Paris, https://doi.org/10.1787/9789264255517-en. [28]

OECD (2015), *Ageing in Cities*, OECD Publishing, Paris, https://doi.org/10.1787/9789264231160-en. [21]

OECD (2015), *Governing the City*, OECD Publishing, Paris, https://doi.org/10.1787/9789264226500-en (accessed on 9 August 2017). [50]

OECD (2015), *OECD Territorial Reviews: Valle de México, Mexico*, OECD Territorial Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264245174-en. [51]

OECD (2015), *OECD Urban Policy Reviews: China 2015*, OECD Urban Policy Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264230040-en. [92]

OECD (2015), *OECD Urban Policy Reviews: Mexico 2015: Transforming Urban Policy and Housing Finance*, OECD Urban Policy Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264227293-en. [90]

OECD (2015), *The Metropolitan Century: Understanding Urbanisation and its Consequences*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264228733-en. [1]

OECD (2014), *Compact City Policies: Korea: Towards Sustainable and Inclusive Growth*, OECD Green Growth Studies, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264225503-en. [79]

OECD (2013), “Vers une croissance plus inclusive de la métropole Aix-Marseille : Une perspective internationale”, OECD, Paris. [30]

OECD (2012), *Compact City Policies: A Comparative Assessment*, OECD Green Growth Studies, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264167865-en. [3]

OECD (2012), *OECD Urban Policy Reviews, Korea 2012*, OECD Urban Policy Reviews, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264174153-en. [86]

OECD/European Commission (2020), *Cities in the World: A New Perspective on Urbanisation*, OECD Urban Studies, OECD Publishing, Paris, https://dx.doi.org/10.1787/d0efcbda-en. [2]

Perth, M. and P. Berg (2014), *Hammarby Sjöstad — A New Generation of Sustainable Urban Eco-Districts*, The Nature of Cities, https://www.thenatureofcities.com/2014/02/12/hammarby-sjostad-a-new-generation-of-sustainable-urban-eco-districts/ (accessed on 19 July 2019). [88]

Reid, C. (2018), "Netherlands invests extra €552m to get even more people on bicycles", Forbes, https://www.forbes.com/sites/carltonreid/2018/11/26/dutch-government-invests-extra-e345m-to-get-even-more-people-on-bicycles/#14b8ee123bc6 (accessed on 27 July 2020). [54]

Rode, P. et al. (2014), "Accessibility in cities: Transport and urban form", *NCE Cities Paper 03*, LSE Cities, London School of Economics and Political Science, http://www.lsecities.net (accessed on 9 July 2019). [5]

Rode, P. et al. (2019), *National Transport Policy and Cities: Key Policy Interventions to Drive Compact and Connected Urban Growth*, Coalition for Urban Transitions, London and Washington, http://www.coalitionforurbantransitions.org (accessed on 2 October 2020). [13]

Rodriguez, M. (2017), "Mobility as a Service (#MaaS). How to "plug in". Finland case", Moviliblog, https://blogs.iadb.org/transporte/en/mobility-as-a-service-maas-how-to-plug-in-finland-case/ (accessed on 9 August 2019). [68]

ROPID (n.d.), *Homepage*, http://stary.ropid.cz/info/we-introduce-pid__s219x903. [39]

SEMOVI (2019), *Plan estratégico de género y movilidad 2019*, Secretaría de Movilidad, Mexico City. [73]

Singh, S. (2014), "Women in cars: Overtaking men on the fast lane", Forbes, https://www.forbes.com/sites/sarwantsingh/2014/05/23/women-in-cars-overtaking-men-on-the-fast-lane/#1a72bbaf68d2 (accessed on 4 March 2020). [74]

Straatemeier, T. (2008), "How to plan for regional accessibility?", *Transport Policy*, Vol. 15, pp. 127-137, http://dx.doi.org/10.1016/j.tranpol.2007.10.002. [8]

Taskinen, J. et al. (2016), "City of Turku leads the way towards digitalisation and MaaS in Finland", Intelligent Transport, https://www.intelligenttransport.com/transport-articles/73424/city-turku-transport-digitalisation/ (accessed on 9 August 2019). [69]

TransLink (2013), *Regional Transportation Strategy: Strategic Framework*, TransLink, Vancouver, https://www.translink.ca/-/media/Documents/plans_and_projects/regional_transportation_strategy/rts_strategic_framework_07_31_2013.pdf?la=en&hash=0A459174FB44A8870D00EFCE54124A01078D0698 (accessed on 29 March 2018). [94]

Transport for London (2018), *Cycling Action Plan: Making London the World's Best Big City for Cycling*, Transport for London, London, http://content.tfl.gov.uk/cycling-action-plan.pdf (accessed on 3 September 2019). [44]

UITP (2018), "Public transport as an instrument for urban regeneration", UITP, Brussels, https://www.uitp.org/sites/default/files/cck-focus-papers-files/Policy%20Brief%20-%20PT%20and%20Urban%20Regeneration-BAT-WEB-300DPI.pdf (accessed on 24 April 2019). [85]

Veryard, D. and S. Perkins (2017), "Integrating Urban Public Transport Systems and Cycling: Summary and Conclusions of the ITF Roundtable on Integrated and Sustainable Urban Transport 24-25 April 2017, Tokyo", ITF, Paris, http://www.itf-oecd.org (accessed on 29 July 2020). [36]

World Bank (2015), "Integrated public transport systems make travel easier and more affordable", World Bank, Washington, DC, https://www.worldbank.org/en/news/press-release/2015/04/07/integrated-public-transport-systems-make-travel-easier-and-more-affordable (accessed on 6 August 2019). [35]

Yanocha, D. (2019), "The electric assist: Leveraging e-bikes and e-scooters for more liveable cities", TIDP. [52]

ZTM (n.d.), *About ZTM - Information*, Zarząd Transportu Miejskiego, https://www.ztm.waw.pl/?c=138&l=2 (accessed on 10 September 2019). [33]

Notes

[1] High-income households during 1980-2000 in the United States have demonstrated higher sensitivity to the supply of local amenities: cities where the supply of local amenities grew the most are also cities where the share of highly educated individuals rose fastest (Diamond, 2016[97]).

[2] Moretti (2012[98]) provides a personal example: "Take the Mission District, the neighbourhood of San Francisco where I live. It is one of the areas of the city that has been most affected by the influx of college educated high-tech professionals. Since it is close to the freeway, many workers in Silicon Valley who prefer an urban lifestyle end up here. Remarkably, the people who are benefiting most from this influx of high-tech workers are the largely Latino home owners who have been selling their property to the newcomers – people like the Mexican American couple who owned a nice two-story Victorian near my house that had been in the family for decades. They decided to sell it for $950,000 and move to the suburbs, where they could buy a similar sized house for half the price and live off the balance."

[3] Land value capture can be a means to achieve a more equitable distribution of the gains associated with transport infrastructure improvements. By allowing public authorities to recoup part of the investment costs by partially shifting the burden on private subjects benefitting from transport infrastructure improvements through the increase in land values (i.e. landowners and private developers), land value capture creates the spending capacity to subsidise affordable housing in the proximity of the new infrastructure (see Chapter 2).

[4] Rapid transit may be understood as the high-quality transport service that delivers fast, comfortable and cost-effective services. The service could be provided by Bus-Rapid Transit Systems (BRT), a system of railways (metro, trams, suburban trains) used for local transit in a metropolitan area. The characteristic is that they use a rapid transit line underground (metro), at street level or even above the ground.

[5] Growth strategies aimed at reducing unemployment in cities are a clear example of how inclusiveness and growth objectives can be successfully combined (OECD, 2016[95]).

[6] They also calculate a negative spill-over on the job-finding rate in central London, where job seekers would suffer from increased competition from Stratford.

[7] For further information, see Mustel Group, https://mustelgroup.com/covid-19-the-future-of-transit-in-metro-vancouver-uncertain/.

[8] For further information, see Diario ABC Madrid, https://www.abc.es/espana/madrid/abci-10-por-ciento-madrilenos-dejara-transporte-publico-para-pasarse-coche-privado-crisis-covid-19-202006031305_noticia.html.

[9] For further information, see https://www.railwaypro.com/wp/warsaw-makes-progress-public-transport-development/.

[10] For further information, see UNEP, https://www.unenvironment.org/resources/annual-report/share-road-programme-annual-report-2018.

[11] For further information, see https://www.eleconomista.es/nacional/noticias/10582841/06/20/La-demanda-de-bicicletas-aumenta-un-260-durante-mayo-con-vistas-a-cambiar-el-modelo-de-transporte-en-Espana.html.

[12] For further information, see BiciMAD, https://www.bicimad.com/

[13] For further information, see Shared Micromobility in the US 2018, https://nacto.org/shared-micromobility-2018/.

[14] The government of British Columbia accompanied the introduction of carbon taxation with the commitment by the state government to redistribute the carbon tax proceeds in the form of business tax cuts and tax credits, personal income tax cuts (targeted at lower-income categories), low-income tax credits, reductions in property taxes and even a Climate Action Tax Credit for every citizen (Carbon Pricing Leadership Coalition, 2016[96]).

[15] Despite the similarities, car sharing therefore differs from services through which private individuals rent their cars or motorcycles to other private individuals, including for long durations (e.g. Drivy, SocialCar, etc.). It also differs from carpooling, through which a rider and car owner offers the possibility to others of joining him/her on a given trip in exchange for the reimbursement of trip-related expenses exclusively, thus without the intention of profiting from it.

[16] Among the measures implemented are the elimination of registration fee, value added tax (VAT) and road tolls on newly sold EVs.

[17] Recent asymmetric technological advancements put the price gap between electric and internal combustion engine vehicles at the risk of opening even further, as happened, for instance, when more cost-effective shale gas extraction methods started becoming available in the most recent years.

[18] Data refers to 2018 and is available at https://www.fhwa.dot.gov/policyinformation/statistics/2018/dl220.cfm (accessed 17 March 2020).

[19] For further information, see “Sensorial accessibility”, https://www.ratp.fr/en/accessibility/sensorial-accessibility.

[20] For further information, see https://www.metromadrid.es/en/travel-in-the-metro/card-types.

[21] For further information, see https://tfl.gov.uk/corporate/about-tfl/corporate-and-social-responsibility/equality-and-inclusion.

[22] Urban density is the measure of an urban unit of interest (e.g. population, employment and housing) per area unit (e.g. block, neighbourhood, city, metropolitan area and nation). The three most common measures of density are population (i.e. population per unit area), built-up area (i.e. buildings or urban land cover per unit area) and employment density (i.e. jobs per unit area) (IPCC, 2014, p. 952[14]).

[23] For further information, see https://www.jhsph.edu/news/news-releases/2020/urban-density-not-linked-to-higher-coronavirus-infection-rates-and-is-linked-to-lower-covid-19-death-rates.html.

[24] For further information, see www.thenatureofcities.com/2014/02/12/hammarby-sjostad-a-new-generation-of-sustainable-urban-eco-districts/.