1. Viewing the built environment through a well-being lens: What it means for definitions and measurement

This chapter discusses the definition and measurement of the built environment, as seen through the lens of the OECD Well-being Framework. Interactions between well-being and the built environment span material, social, relational and environmental aspects of people's lives. The OECD Well-being Framework, which monitors current well-being as well as resources for the future, can thus be helpful in systematically assessing the impact of the built environment both on people's well-being in the present and on sustainability. This chapter examines a wide spectrum of definitions of the built environment, from both governments and academia, and identifies the key components of the built environment (i.e. housing, transport, urban design/land use and technical infrastructure) that have particular relevance for people's well-being. The chapter then introduces 25 indicators, selected to help assess the quantity and the quality of the built environment and highlight its inter-relationships with people's well-being.

1.1. How is the built environment defined, and what are its key components?

1.1.1. Introduction

The built environment shapes living conditions and quality of life for individuals, families and communities. In distinction to the natural environment, the built environment refers to human-made structures, which includes housing, parks, workplaces, transport facilities and digital infrastructure. It plays an important role in driving the well-being of people and communities, affecting their health, learning, mobility, their social interactions and their participation in public life. Because of their long-term impact, public policies and private decisions that contribute to shaping the built environment have implications for the sustainability of human activities and people's future quality of life.

Recent economic, social and environmental developments further highlight the critical role of the built environment. Digital technologies, in particular, have radically changed the way people work, consume and communicate (OECD, 2019[1]), and this transformation has only reinforced the need for a new approach to the built environment. Trends like teleworking will impact people's preferences in regard to housing and urban environment in the long term. The built environment can act as an important lever to improve people's well-being when its planning, construction and operation are adapted to the digital age. The COVID-19 pandemic has further highlighted how the built environment affects people's well-being, through its influence on people's life satisfaction, social connections, physical and mental health and environmental quality. During lockdown periods, people in overcrowded housing or living alone faced greater risks to mental health – both of these situations are shaped by public policies and private practices bearing on the built environment (OECD, 2021[2]).

In this context, this report explores how the built environment interacts with people's lives and affects their well-being and sustainability. It draws primarily on the OECD's Well-Being Framework – which provides a holistic and people-centred view of societies' conditions – to highlight the many inter-relationships between the built environment and both material and non-material aspects of people's lives. It will explore the inter-relationship between the built environment and some key dimensions of the well-being framework (e.g. health, safety and social connections). It will also examine how the built environment shapes the risk and resilience factors that influence sustainability (e.g. vulnerability to extreme weather events, learning opportunities, the creation of a dynamic and inclusive economic system). The built environment influences economic, social and environmental sustainability through both its inherent qualities and its externalities such as the construction sector's impact on climate change.

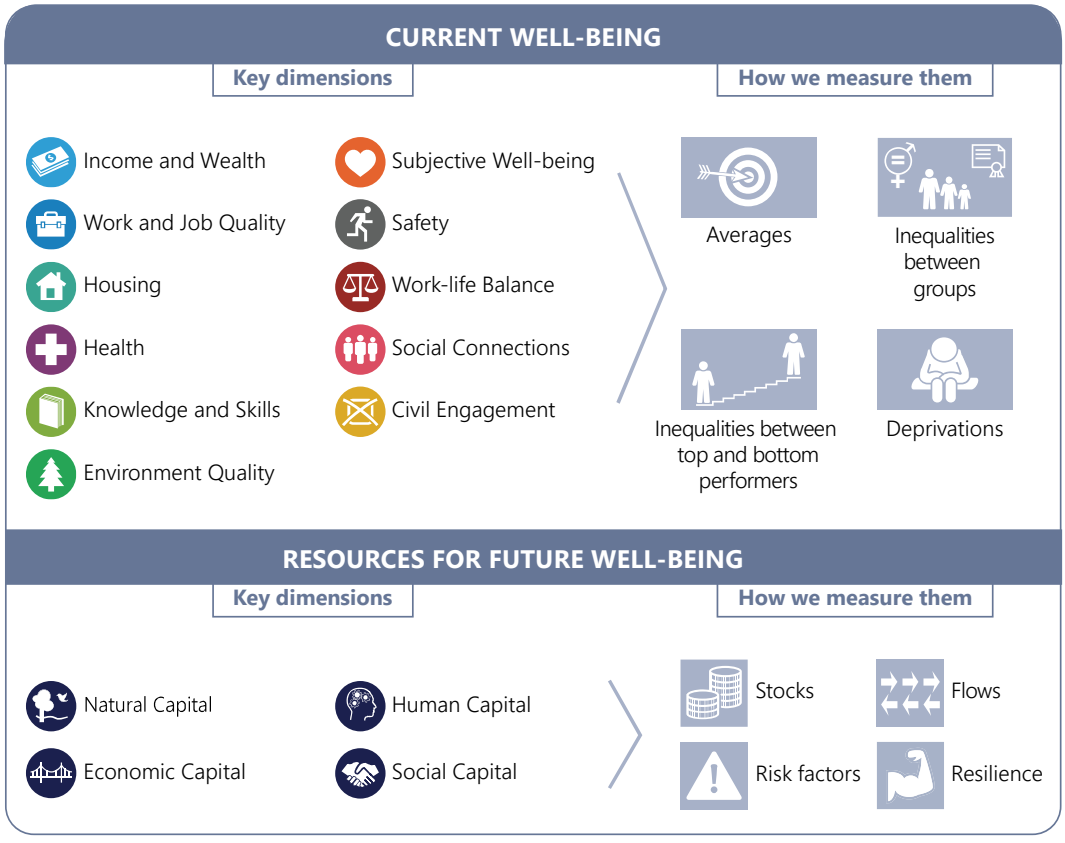
This report aims to provide both evidence on the importance of the built environment for people's well-being and society's sustainability by leveraging available data from official sources. While the built environment is a fundamental component of countries' economic capital, the inherent quality of its stock is not accounted for adequately by existing measures. This report will fill this gap and help accelerate awareness in the wider society and broaden the policy paths to include more indicators related to the built environment's relationship to well-being and sustainability. In particular, this report will adopt a well-being lens to examine the quality and availability of internationally comparable data from official sources on various dimensions of the built environment in OECD countries. It will establish how holistic well-being approaches can serve as a tool for more integrated policy solutions. And it will help shine a light on dimensions of well-being where more work is needed to build on policy synergies with the built environment. It will also draw on recent OECD-wide work on different components of the built environment, including work on housing, territorial development, urban sprawl and infrastructure, so as to systemically assess how the built environment affects various aspects of people's lives and sustainability.

This chapter lays the foundations for an in-depth analysis of the relationship between the built environment and well-being and sustainability by first covering the wide spectrum of definitions and aspects of the built environment. It then explores the internationally comparable data available from national statistical sources that can help assess the quality of the built environment and highlights the factors shaping its future evolution.

1.1.2. The OECD Well-being Framework: Why this holistic approach matters for the built environment

The analysis of this report is based on the OECD well-being framework. The OECD Well-being Framework (herewith "the Framework") (Figure 1.1), based on the recommendations made in 2009 by the Stiglitz, Sen and Fitoussi-led Commission on the Measurement of Economic Performance and Social Progress and various national initiatives in the field, guides the OECD's work on monitoring trends in people's diverse experiences and living conditions, as well as in the sustainability of well-being across member and partner countries. It underpins the *How's Life?* report series, published regularly since 2011, which is operationalised with a dashboard including more than 80 indicators. The Framework includes both material (e.g. income, wealth, jobs, housing) and non-material (e.g. environment, education, safety) dimensions, as well as more relational aspects of well-being (e.g. social connections).

Figure 1.1. The OECD Well-being Framework



Source: OECD (2020), *How's Life? 2020: Measuring Well-Being*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9870c393-en.

The holistic approach of the OECD well-being framework is helpful in systemically assessing various impacts the built environment has on people's well-being and sustainability. Each of the four key components of the built environment may shape material well-being dimensions, such as income and wealth, and work and job quality. Beyond these economic dimensions, however, the built environment also matters for well-being dimensions such as health, safety, environmental quality and social connections. In this report, the relationship between the built environment and people's well-being is analysed through three broad clusters: material conditions, grouped with economic capital; quality of life factors, examined with natural and human capital; and community relations, explored alongside social capital. Furthermore, beyond national averages, which often mask large inequalities between population groups, the distribution of current well-being is also examined by looking at three types of inequality: 1) gaps between population groups (i.e. horizontal inequalities); 2) gaps between those at the top and those at the bottom of the achievement scale in each dimension (i.e. vertical inequalities); and 3) deprivations.

1.1.3. How is the built environment defined?

The issue of scope in defining the built environment

The built environment, as opposed to the natural environment, is the human-made environment that has been built to serve human purposes. In other words, the built environment generally refers to "the man-made surroundings that provide the setting for human activity, ranging from the large-scale civic surroundings to the personal places" (Moffatt and Kohler, 2008[3]). The built environment provides essential services on which societies rely to satisfy primary needs (e.g. shelter, mobility, energy production and transmission and water distribution) and improve social and economic conditions (e.g. communication network, waste collection and facilities for education, work, health care, or entertainment) (Lanau et al., 2019[4]). In higher education, it refers to "a range of practice-oriented subjects concerned with the design, development and management of buildings, spaces and places" (Griffiths, 2004[5]).

The challenge of defining the built environment comes from the fact that the socio-economic perceptions and cultural contexts of the built environment keep changing over time. Over a longer historical horizon, the 18th century industrial revolution (by focusing on resource constraints and energy and material flows), as well as the 19th century romantic movement (by reflecting the new perspective on the relation between society and nature) all impacted people's perspectives on the built environment (Moffatt and Kohler, 2008[6]). The industrial era, with its increased use of concrete, steel and glass, changed the fundamental structure and functionality of the urban environment and its buildings (Kamei, Mastrucci and van Ruijven, 2021[7]). More recently, 20th century modernism called for methods of production to be "reconceived in the light of scientific reasoning" (Rabeneck, 2008[8]). Sennett (2018[9]) presented how the 19th century city-makers tried to connect the built ("*ville*") with the lived ("*cité*"), but the 20th century saw the separation of the two, with urban planning focusing more on the "built", with less consideration for the people living inside.

The complexity and ambiguity of the built environment (Cairns, 2008[10]) **make defining and scoping the built environment challenging**. Components of the built environment can be as diverse as everything that surrounds us that is human-made, which can include not just rooms, buildings, cities and transport systems, but also material products that have been produced artificially, such as furniture, as well as intangible infrastructure like the Internet. Architects, urban planners, transport engineers, economists, policy makers as well as professions such as health-care workers, psychologists and sociologists among many others, will all have different takes on how the built environment can be defined. Thus, the approach undertaken in this report provides a framework for understanding the built environment in the OECD countries by listing a number of scalable components of the built environment to highlight their inter-relationships with people's lives and society's sustainability. This builds on the identification of the major streams of literature that analyse the built environment from a number of distinct perspectives.

Academic approaches to the built environment

One approach to defining the built environment focuses on its individual elements, such as buildings (Anderson, Wulfhorst and Lang, 2015[11])**.** Oftentimes, the word "building" is used interchangeably with the term "built environment". Some studies focus on individual buildings and the experiences of the building's users. A user-centred theory of the built environment focuses on the fact that "the building user's experience incorporates the interactive effects of both how occupants are affected and how they act on and respond to the environment" (Vischer, 2008[12]). With this approach, the inter-relationship between the built environment and people's lives can be examined on a more measurable human-scale. For example, focusing on key physical factors (e.g. light, temperature, sound and air quality) of indoor environmental quality that strongly influence occupants' perception of built spaces could possibly lead to better monitoring of the occupants' comfort and the well-being outcomes of building practices and standards (Altomonte et al., 2020[13]). This view also facilitates an environmental assessment of the built environment, focusing on energy use in buildings, the "sick building syndrome" (i.e. occupants feeling sick or discomfort when spending time in a building), the indoor climate and building materials containing hazardous substances (Forsberg and von Malmborg, 2004[14]), and also on forecasting the fulfilment of climate targets by the built environment sector (Francart, Malmqvist and Hagbert, 2018[15]). The Center for the Built Environment (CBE) at the University of California, Berkeley, for example, has been able to document people's levels of comfort, workplace efficiency and environmental satisfaction by conducting occupant surveys of building systems (Graham, Parkinson and Schiavon, 2021[16]).

An alternative approach to defining the built environment takes a broader scope, focusing on its interaction with nature and society as a whole. A number of published research papers look at the built environment as a system of interactions between individual components of the built environment and nature, as well as society. This approach often warns against separating the built environment from the wider urban and natural environment, including the risk of separation between building design, construction and use (Rabeneck, 2008[8]). Instead, this approach calls for attention on the entire systems within the built environment rather than on individual elements such as buildings (Anderson, Wulfhorst and Lang, 2015[11]; Moffatt and Kohler, 2008[6]). Some analysts also argue that the identity of the built environment should not be defined in terms of particular professions, which would undermine its interdisciplinary characteristics (Haigh and Amaratunga, 2010[17]). The built environment should be able to describe "in one holistic and integrated concept the creative (and not so creative) results of human activities throughout history" (McClure and Bartuska, 2011[18]).

The field of urban planning has also used a variety of terms to refer to the built environment. Handy et al. (2002[19]) define the built environment as comprising urban design, land use and the transportation system, and lists dimensions of the built environment at the neighbourhood scale, such as density and intensity, land use mix, street connectivity, street scale, aesthetic qualities and regional structure. Their importance is stressed in distinguishing the terms "urban design", which usually refers to "the design of the city and the physical elements within it including both their arrangement and their appearance", and "land use", which typically refers to "the distribution of activities across space, including the location and density of different activities", such as residential, commercial, office, industrial and other activities (ibid.). Along this line, Hürlimann et al. (2022[20]) undertook a review of literature for climate change preparedness across sectors of the built environment, using search terms such as "urban planning", "property", "construction", "design (architecture, urban design and landscape architecture)" and the "built environment" as a whole. This list of key components of the built environment paints a multi-dimensional view of the economic, social and environmental aspects of the built environment. Lanau et al. (2019[4]) categorised the built environment into mobile stock (e.g. consumer durables) and nonmobile stock, with the latter including residential and non-residential buildings as well as infrastructure such as transportation infrastructure and technical infrastructure (e.g. for energy supply, telecommunication, water distribution and waste collection networks). Butt et al. (2015[21]) also point out that individual commodities that are used in the buildings and structures,

industries and their associated manufacturing and processing plants, technologies, inventories and stock, and supply chains could fall under the phrase “built environment”.

This report embraces both these approaches to the built environment, looking into individual buildings as well as the broader environment that constitutes the built environment. For example, characteristics of individual buildings such as housing conditions are studied, but also the housing sector’s role in the overall financial security of households, the overall impact on the economy, and the contribution to climate change (i.e. impact on environment and sustainability). Advocating for an ambivalent approach to theorising the built environment, Cairns (2008[10]) argued that conceptualising the built environment does not necessarily have to make exclusive either/or choices between different theories and modes. This may prove to be beneficial in ensuring that different stakeholders may be able to participate in the decision-making process over the life-cycle of the built environment. An inclusive manner will also help bridge the knowledge gap between the building scale and urban scale in the built environment (Anderson, Wulfhorst and Lang, 2015[11]).

Governments’ definitions of the built environment

Governments are undertaking various measures to ensure that the built environment is built and maintained to uphold people’s quality of life. A preliminary stocktaking of the OECD countries’ definitions or inventories of components of the built environment, mostly from a review of relevant websites on the national level, has been instrumental in categorising governments’ different approaches to the built environment. As was the case for the academic community, this report finds that interpretations of the built environment vary widely amongst countries, and also among different Ministries or agencies within a single country. Some focused on the built environment with specific policy tools, such as building codes or building standards, while others were more interested in the broader-scale built environment, such as land use planning and infrastructure investment. However, in general, governments often approach the built environment in a more holistic way, in the process of planning, implementing or revising their national plans, policy assessments and legal systems for the built environment. There is also the tendency to interpret the definition of the built environment in the broader sense, when dealing with policy issues such as the environment, energy, health and culture.

- **The Australian Department of the Environment and Energy** published the report, **”Australia state of the environment 2016: built environment”** (Coleman, 2017[22]), which carried out an assessment of Australia’s built environment by looking at various aspects of the built environment, including land use, housing, transport, air and water quality, as well as the natural environment within urban areas. The built environment is defined here as “the human-made surroundings that provide the setting for people to live, work and recreate. It encompasses physical buildings and parks, and their supporting infrastructure such as transport, water and energy networks.”
- **The European Commission** committed itself in 2020 to put forward a sustainable built environment strategy and has stated that the built environment “corresponds to everything people live in and around, such as housing, transport infrastructure, services networks or public spaces” (European Parliament, 2023[23]).
- **In Finland, the “Land Use and Building Act”** has a chapter (Chapter 22) that deals with the care of the built environment. It states that buildings and their surroundings should be kept in “a condition that meets standards of health, safety and fitness for use at all times and does not cause environmental harm or damage the beauty of the environment”. This act also states that the built environment must be kept in good condition, and that an authority should ensure that “traffic ways, streets, market places and squares, and parks and areas intended for the enjoyment of residents meet the standards of a satisfactory townscape and of pleasantness and comfort” (Ministry of the Environment, n.d.[24]). **Finland’s Ministry of the Environment** and **Business Finland** also run the **“Low-Carbon Built Environment Programme”**, offering funding to support climate work

related to the built environment by boosting "the development and dissemination of products, technologies, services and practices for the built environment that mitigate climate change and promote decarbonisation". Although the programme has assisted many projects that support the transition to a low-carbon construction sector, its scope covers not just buildings and their low-carbon properties but extends to the built environment in the broader sense (Ministry of the Environment, n.d.[25]).

- **Ireland's 2022 Analysis of Well-being ("Understanding Life in Ireland: The Well-being Framework")** includes "Housing and the Built Environment" as one of the key dimensions of its well-being framework. This dimension is elaborated as "the physical infrastructure that shapes the ability of an individual to meet basic needs such as shelter, security and social belonging" and "the local built environment that determines access to infrastructure and broader services, for example safe, sustainable and accessible transport choices" (Government of Ireland, 2022[26]). It is noteworthy that the title of one of the dimensions was changed in 2022 to explicitly refer to the built environment. They explain that the purpose of the change was to allow "infrastructure (including public transport) to be more visible" and also to allow "issues such as recreation areas and accessibility to be more clearly included" (Government of Ireland, 2022[26]).
- **In the Netherlands**, **"the Environment and Planning Act"** was recently introduced (Netherlands Enterprise Agency, n.d.[27]), which incorporates 26 existing acts around the built environment, housing, infrastructure, environment, nature and water, in order to focus on "a healthy physical environment that meets the needs of society" (IPLO, n.d.[28]). Although the aim of this revision is to make it easier to start projects such as the construction of housing on former business parks, or the building of wind farms (Government of the Netherlands, n.d.[29]), this newly revised act combines existing laws on the broader built environment, including land use, residential areas, infrastructure and the built environment's interactions with the natural environment.
- **New Zealand's Ministry of Health** describes the built environment as "urban areas, the form, shape and accessibility of homes, work and play", which all have a direct influence on the quality of lives. It stresses the importance of "easy and efficient access to everyday facilities such as grocery stores, medical centres, pharmacies, workplaces, schools, living areas and recreational areas" (Ministry of Health, n.d.[30]).
- **Sweden's Ministry of Culture** has published "Policy for Designed Living Environment" (Ministry of Culture, 2019[31]), in which a holistic view of shaping the physical environment is taken, incorporating not just architecture and design but also art, historical contexts and social values. It calls for "an awareness of the importance of architecture and design issues" in areas of community planning, housing, culture and public art, the environment, social issues, education, research, transport, trade, and accessibility and consumer policy".
- **The United States Environmental Protection Agency (EPA)**'s **"Sustainable Materials Management (SMM) Strategic Plan"** states that "the built environment touches all aspects of our lives, encompassing the buildings we live in, the distribution systems that provide us with water and electricity, and the roads, bridges and transportation systems we use to get from place to place" and defines the built environment as "the man-made or modified structures that provide people living, working and recreational spaces" (EPA, n.d.[32]).

Governments or public agencies may also view the built environment as individual buildings independent of the external environment, or more generally as the construction or infrastructure sectors, depending on the relevant policy context.

- In the **UK, the Green Construction Board**, which was established in 2011 as a consultative forum for government and the UK design, construction, property and infrastructure industry, has developed the *Low Carbon Routemap for the Built Environment* (The Green Construction Board,

2013[33]), which gives a breakdown of the built environment in order to show the amount of its carbon emissions. Here, the scope of the built environment includes domestic buildings, non-domestic buildings and infrastructure but excludes emissions from the use of transport infrastructure (e.g. use of cars).

- In **Canada**, the **"Canada Green Buildings Strategy"** (Government of Canada, n.d.[34]), focuses on buildings, including building materials and construction sector supply chains, and uses the word "built environment" synonymously with "buildings". The Canadian Standards Association has published "Accessible design for the built environment" (CSA Group, n.d.[35]), which aims to "make buildings and the exterior built environment accessible and safely usable by persons with physical, sensory, or cognitive disabilities". Hence, the scope of the built environment discussed here is narrower, as in the building codes, and more detailed in describing both internal and exterior circulation, spaces and amenities.
- Similarly, **the International Organization for Standardization (ISO)** has published the standard document, "Building construction - Accessibility and usability of the built environment" (ISO, n.d.[36]), which specifies a range of requirements and recommendations for the elements of construction, assemblies, components and fittings that comprise the built environment. This document does not deal with the external environment, such as public open spaces, which is unrelated to the use of one specific building.

1.1.4. Key components of the built environment with relevance to people's well-being

The definition and scope of the built environment need to be fit for the purpose of analysing people's well-being. The definitions and scope of the built environment vary extensively among academics, governments and businesses, ranging from personal shelters, buildings, streets and neighbourhoods to cities and national-level infrastructures. Although evidence is abundant that whatever the definition of the built environment, it closely interacts with people's lives, it is important to carefully consider the most appropriate definition and the spatial scale/extent for the particular aim (Mavoa et al., 2019[37]). For the purpose of analysing the impact of the built environment in terms of people's well-being and sustainability, this report provides a framework for understanding the built environment in OECD countries by listing a number of components to highlight their inter-relationships with people's lives and well-being and society's sustainability.

In this context, the components of the built environment examined are: 1) Housing (i.e. residential buildings); 2) Urban Design/Land Use; 3) Transport; and 4) Technical infrastructure (i.e. water, energy, waste management and digital infrastructure). The rationale for selecting each of these elements of the built environment is given below, by providing a glimpse of each element's main interactions with people's lives and well-being. A more detailed description of the inter-relations of the built environment and its key components with people's well-being and sustainability will be presented in Chapter 2.

Housing (residential buildings)

The first layer of the built environment to be examined is housing, or residential buildings. Buildings are usually categorised into residential and non-residential buildings, with the latter being mainly comprised of commercial and industrial buildings as well as public buildings such as educational and health facilities. The building sector, in general, has a greater climate change impact than any other sector (Andrić, Koc and Al-Ghamdi, 2019[38]), and therefore has a large role in making the green transition to net zero. For example, buildings and construction account for almost 40% of global energy-related CO_2 emissions, so decarbonising buildings is a major driver for the low-carbon transition (OECD, 2022[39]). Housing accounts

for more than a quarter of CO_2 emissions in the OECD, and the burning of fossil fuels in homes will need to make way for carbon-free energy sources in order to meet agreed net-zero emission targets by 2050 (OECD, 2023[40]). In addition to their environmental impact, buildings come with financial and economic impacts, as they are closely related to the construction industry and real estate/property market. Policies and regulations concerning buildings, in particular building codes, influence urban design in general, and have implications in terms of safety, health, aesthetic design, culture and even socio-economic opportunities. Commercial and industrial buildings affect people's well-being, most profoundly in terms of workers' productivity (Esfandiari et al., 2017[41]; Miller et al., 2009[42]), but this report will focus foremost on residential buildings (i.e. housing) which have multifaceted impact on people's lives .

Housing provides space for socialising, studying, caring and working. It impacts people's wealth, as high housing costs undermine household income. Poor housing conditions also threaten physical and mental health. Housing is the most widely owned asset in households' wealth (OECD, 2021[43]), while property debt is the largest liability in households' portfolios (Causa, Woloszko and Leite, 2019[44]). *Where people live* has a foundational role in their quality of life, impacting the availability of jobs, health and education services, through to access to clean air, green space and recreational facilities (OECD, 2014[45]). And since housing expenditure is such a significant outlay, it has a dramatic impact both on the goods and services that households can afford to support their well-being today and on their ability to build savings to help guard against future income shocks. Housing could also be examined from the perspective of the construction and maintenance of buildings, which influence real estate and financial markets. More recently, the COVID-19 pandemic reshaped the way people distinguish between housing and the workplace, increasing the importance of housing from a new angle. The pandemic broke the cultural and technological barriers that prevented widespread remote work in the past, setting in motion a structural shift in where work takes place (Lund et al., 2020[46]). This trend also impacted the real estate market. For example, one study in the US showed that the shift to remote work may explain over one-half of the 23.8 percent national house price increase since late 2019 (Mondragon and Wieland, 2022[47]).

Urban Design/Land Use

The physical setting in neighbourhoods, streets and cities, and especially how they are designed and arranged, influences people's lives. It is hard to define the boundaries of the urban environment, and its scope is often fuzzy. This requires a multi-dimensional and integrative approach, as was the case when defining the built environment. In the context of this report, urban design and land use is investigated with the aim of understanding how the physical setting and its arrangement shape people's lives in terms of well-being. It is difficult to list all the dimensions of well-being that are interlaced with urban design/land use, but a few examples are given here to highlight the intangible impacts of urban design/land use on people's lives. It influences both physical and mental health. Urban design/land use that promotes walking and cycling will help create active, healthier and more liveable communities (Papas et al., 2007[48]; Handy et al., 2002[19]). It is also an important factor affecting the health of the elderly (Yan, Shi and Wang, 2022[49]; Tuckett et al., 2018[50]) and mental health outcomes, such as suicide rates (Jiang et al., 2021[51]). Urban design may also promote or hinder opportunities for social interactions and increased life satisfaction. Measures that promote walkability and conviviality in neighbourhoods may lead to potentially more opportunities for stronger personal relationships (Mouratidis, 2018[52]), whereas extremely dense areas with high-rise buildings are thought to contribute to loneliness, fear of crime and lower community spirit (Gifford, 2007[53]). The nexus between urban design/land use and environmental quality is complex and intertwined. For example, in terms of air pollution, fragmented urban areas experience higher concentrations of NO_2 and PM10 (i.e. pollutants driven by road transportation), but densely populated urban areas suffer from higher SO_2 concentrations (from fuel combustion in power stations and domestic heating systems) (Cárdenas Rodríguez, Dupont-Courtade and Oueslati, 2015[54]).

Transport

Transport is another important component of the built environment that is inextricably linked to individual and collective well-being (ITF, 2021[55]). Transport impacts people's well-being through providing access to job opportunities as well as life-enhancing activities. An equitable transport system will allow everyone to satisfy their needs, but inequalities in transport accessibility, in particular lack of access to education or employment, will be detrimental to society (ITF, 2021[55]). People in disadvantaged communities often have a less well-maintained infrastructure – notably roads, less access to reliable public transport services, and lower ownership of private cars (OECD, 2018[56]). Lack of public transport connections between disadvantaged neighbourhoods and places of employment hinders job opportunities for residents of these neighbourhoods (OECD, 2018[57]). In addition to work and job quality, transport can alleviate or aggravate traffic safety problems (Asadi et al., 2022[58]; Saha, Dumbaugh and Merlin, 2020[59]). Inadequate and unsafe transport infrastructure has a greater negative impact on the economic opportunities and well-being of women than on those of men (OECD, 2021[60]). The recent global energy crisis and the ensuing rise of transport costs have also posed grave threats for vulnerable populations, further highlighting the necessity of exploring the transport sector in terms of people's well-being. Higher fuel prices for vehicles have a disproportionate effect on certain communities, households and individuals (OECD, 2021[61]), and tackling the accessibility challenges that people in remote areas face will also become more urgent as energy prices rise (ITF, 2021[62]).

Technical Infrastructure (Energy, water, waste management and digital infrastructure)

The fourth component of the built environment examined in this study is the technical infrastructure, with a focus on energy, water, waste management and digital infrastructure.

Energy has long been regarded as a prerequisite to people's well-being. Coleman (2017[22]) lists energy use in the context of the built environment as including "energy use by households, manufacturing and commercial and service industries, including construction and transport". Household energy use (i.e. lighting, heating and cooling) and energy use in mobility are important drivers of people's well-being. Energy use is driven by both economic and non-economic factors, such as behaviour, lifestyle, culture, religion and the desire for improved well-being. Different lifestyles influence levels of energy consumption (Roy et al., 2012[63]; Rao and Wilson, 2022[64]), which rely on the relevant energy infrastructure. Energy use and infrastructure are also closely related to environmental quality and natural capital. In addition to the energy infrastructure related to conventional fuel, cross-cutting energy infrastructure related to clean energy, such as carbon capture, utilisation and storage (CCUS), district heating and data centres, and data transmission networks, are increasingly gaining attention for their role in enabling decarbonisation (IEA, 2022[65]).

Water security and access to the Internet also have significant implications for well-being. Water infrastructure is essential in providing access to clean water, and almost all the OECD population enjoy access to drinkable water. Recently, however, the OECD has underscored the importance of water security investment and called for continued attention to water-related investment, including infrastructure that contributes to the delivery of water and sanitation services, the management of water resources, and water-related risks. Examples include dams, reservoirs, pipelines, water supply networks and waste-water infrastructure (OECD, 2022[66]). Also, the digital infrastructure that provides stable access to Internet at home increasingly underpins people's well-being. Over the years, the digitalisation of human activities has progressively increased, making digital access indispensable for working, studying and accessing basic services.

1.2. How can the built environment be measured and assessed? What are the factors that shape its future evolution?

1.2.1. Which national statistical sources deal with the built environment?

Information to describe the built environment is available from a variety of statistical sources. Data available from national statistical sources (National Accounts, general social surveys, population and household surveys, geospatial data) are of particular interest, because they are usually of better quality (accuracy, credibility, timeliness and punctuality), which allows sound measuring and monitoring over time.[1] Table 1.1 summarises the information on the built environment available in national statistical sources.

Table 1.1. National statistical sources providing information on the built environment

National Statistical Sources	Information type
National Accounts (core and satellite accounts)	• Value of stocks and investment in various components of the built environment • Household expenditure on housing and transport • Estimates of selected air pollutants emissions by economic activities related to the built environment
General social surveys and household surveys	• Affordability (e.g. housing cost overburden) • Quality of housing (e.g. overcrowding, availability of toilets) • Characteristics of the neighbourhood (e.g. noise, pollution)
Population and household censuses	• Access to basic services (e.g. improved drinking water, electricity)
Geospatial data combined with other data sources and/or modelling (e.g. administrative data)	• Description of the geographical surface: changes in land use • Accessibility and proximity to services or amenities (e.g. access to green spaces in urban areas) • Average building height
International surveys or calculations conducted by international organisations (e.g. OECD, ITF, IEA, UNFCCC, World Bank), also leveraging national sources (such as data collected by Ministries)	• Characteristics of technical infrastructure (energy, waste, etc.) and transport (e.g. volume in millions of passengers per km) • Environmental (e.g. contribution to CO_2 emissions) and social impact (e.g. road fatalities) of some elements of the built environment • Perceptions of social protection (e.g. people's perceptions of the social and economic risks they face)

National Accounts provide internationally comparable information on the value of stocks and the volume of investment in components of the built environment (European Commission et al., 2009[67]). The values also account for the reduction in the original value of the asset due to physical deterioration, normal obsolescence or normal accidental damage. Information is available disaggregated by the following components of the built environment:

1. **Dwellings** (residential buildings);
2. **Non-residential buildings** (industrial, commercial, educational, health care, public, religious, amusement, sport, recreational and community, non-residential farm buildings, etc.);
3. **Civil engineering works** (such as highways, streets, roads, railways and airfield runways; bridges, elevated highways, tunnels and subways; waterways, harbours, dams and other waterworks; long-distance pipelines, communication and power lines; local pipelines and cables, ancillary works; constructions for mining and manufacture; and constructions for sport and recreation);
4. **Transport equipment** (equipment for moving people and objects, such as motor vehicles, trailers and semi-trailers; ships; railway and tramway locomotives and rolling stock; aircraft and spacecraft; and motorcycles, bicycles, etc.).

National Accounts also provide internationally comparable information on household expenditure on housing and transport services, which is useful for capturing the quality of housing from the household perspective. Data are disaggregated as follows:

1. **Housing, water, electricity, gas and other fuels**: i) actual rentals for housing; ii) imputed rentals for housing; iii) water supply and miscellaneous services relating to the dwelling; and iv) electricity, gas and other fuels;
2. **Furnishings, household equipment and routine maintenance of the house:** i) furniture and furnishings, carpets and other floor coverings; ii) household textiles; iii) household appliances; iv) glassware, tableware and household utensils; v) tools and equipment for house and garden; and vi) goods and services for routine household maintenance;
3. **Transport services** (including public and private transportation services).

***The System of Environmental and Economic Accounts (SEEA)* has recently been added in the National Account to include estimates of emissions for a number of selected air pollutants[2] by economic activities related to the built environment**. Estimates are available on air pollutants emissions by economic activities such as 1) construction; 2) electricity, gas, steam and air conditioning supply; 3) water supply; 4) sewerage, waste management and remediation activities; 5) transport; 6) real estate activities; and 7) information and communication. SEEA also include estimates of selected air pollutants emitted by households via transport or other activities classified under the National Accounts category "housing, water, electricity, gas and other fuels", as described above, which mainly relate to heating or cooling (Eurostat, 2015[68]).

General social surveys and household surveys collect information on housing affordability and quality and on the characteristics of the neighbourhood. Information on mortgages and rent costs, as well as their burden on household income, is available. Quality features of housing include data on the space available to members of the household, the availability of facilities such as toilets or bathrooms, the conditions of the roof, ceiling, floor, walls and windows, and the presence of issues such as leaks or damp. Information on the neighbourhood includes the presence of 1) noise from neighbours or from the street; 2) pollution grime or other environmental problems; and 3) crime, violence or vandalism in the area. Population and household censuses are also valuable sources of information on access to (basic) services. They include information on access to improved drinking water, sanitation and electricity. Access to the Internet can be collected through population and household censuses, general social surveys or household surveys.

Geospatial data can help examine the urban environment more accurately, in terms of both current land use and the changes in wider geographical spaces. Geospatial data inform us about the changes in natural and semi-natural land, as well as in artificial surfaces, defined as continuous and discontinuous urban fabric (housing areas), industrial, commercial and transport units, road and rail networks, dump sites and extraction sites, and also green urban areas (United Nations et al., 2021[69]). Combining geospatial data with administrative or household surveys data enables estimation of the accessibility and proximity to services or amenities, as well as average building height. Indicators include access to green spaces in urban areas, access to public transport and selected services (hospitals, schools, recreation, food shops, restaurants) and average building height.

There is still room to develop information based on geospatial data. From the production side, greater accessibility to geospatial data (some are available for free, e.g. OpenStreetMap) and technological, computational and methodological advances (such as the use of machine learning) have created the ideal technical conditions for generating more data on the overall status of the built environment. For example, the OECD used satellite imagery and deep learning to map and analyse built-up areas in residential and business-related use for 687 European metropolitan areas (Banquet et al., 2022[70]). The demand for data has also surged in the midst of growing international awareness that the built environment contributes to

economic growth as well as to well-being and sustainability. This awareness has been widely reflected in the United Nations Sustainable Development Goals (UN SDGs) 6, 7, 9 and 11.[3] The European Commission's Global Human Settlement Layer (GHSL), which aims to produce and analyse global built-up surface, population density and human settlement thematic maps (European Commission, n.d.[71]), is used by international organisations, including the OECD, to monitor various SDG 11 indicators related to land consumption (e.g. land use per capita). The OECD Laboratory for Geospatial Analysis (The Geospatial Lab), which is an interdisciplinary and diverse network of researchers and policy makers, aims to better integrate geospatial information, statistical data and spatial modelling (OECD, n.d.[72]).

International surveys being conducted by various international organisations also provide detailed information on the built environment. The International Energy Agency (IEA), the International Transport Forum (ITF), the OECD, the United Nations Framework Convention on Climate Change (UNFCCC) and the World Bank, among many others, collect detailed information on the characteristics of technical infrastructure and transport, as well as on the environmental and social impact of individual elements of the built environment**.** These data cover energy consumption, transport and infrastructure volumes (e.g. millions of kilometres travelled by passengers (millions of passenger-km), millions of kilometres covered transporting freight tonnes (millions of tonne-km)), infrastructure investment and maintenance spending, water and waste management (e.g. annual freshwater abstractions, share of municipal waste that is recycled), contribution to air pollution (greenhouse gasses, PM2.5) by the residential and transport sector, as well as road fatalities and casualties. There are also surveys that monitor people's perceptions about social protection (e.g. OECD's *Risks that Matter* survey) that can be useful in tracking subjective indicators related to the built environment.

Finally, while national data are essential in measuring and assessing the built environment, it should also be noted that national data may mask important territorial disparities. For example, the determinants of school dropout rates can vary between rural and urban locations, between cities and even between neighbourhoods in the same city (OECD, 2014[45]). The quality of the built environment is largely determined by place-specific assets, and local performances and territorial disparities can in turn impact national well-being outcomes and broader societal challenges (OECD, 2014[45]).

1.2.2. How is the built environment assessed?

Quantity and quality are two fundamental dimensions to consider in order to assess and measure the built environment. The *amount* of built environment can be quantified in different ways: in terms of volume (e.g. millions of passenger-km, tonne-km) or value (e.g. the stock value, as available in the National Accounts). However, it cannot be determined from a single perspective whether more or less quantity of the built environment is desirable, as quantity may be interpreted differently in different contexts. For example, expanding road infrastructure in rural areas may improve the well-being of the remote population, but building more roads could also generate more traffic and pollution.

As for quality, while there is no single definition of *quality* of the built environment, some features such as accessibility, safety and sustainability are recurrent across the definitions. One primary feature of the built environment's quality is accessibility, which can be decomposed into accessibility to basic services and accessibility to destinations of interest to people. Another important quality feature is safety, as how the built environment is constructed and designed would determine the safety of the setting for people to live, work and recreate. In addition to accessibility and safety, sustainability is a crucial quality criterion for the built environment. As the built environment is conceptualised and constructed for long-term use, it is related to the concept of sustainability on two levels: both the sustainability of the built environment itself as a stock (e.g. resilience to earthquakes or to other natural hazards, whose frequency is increasing due to climate change) and its impact on the sustainability of human activity and its development. In this context, a useful reference is the UN SDGs, with a number of the goals and targets specifically referring to different components of the built environment. Analysing how the built environment is defined and

measured in the UN SDGs helps us understand the key features that have been internationally agreed to be essential in improving and sustaining people's living conditions. The UN SDGs are also the bedrock of the UN *New Urban Agenda (NUA)* (UN Habitat, 2017[73]), which was adopted at the Habitat III Conference in 2016 to promote sustainable development, with a focus on sustainable urban development. Annex Table 1.A.1 gives more detailed illustrations of how the components of the built environment are included in the UN SDGs. The importance of accessibility and safety as quality features of the built environment is highlighted in the SDGs, which also expand the quality boundaries to affordability, equity, inclusiveness, sustainability and resilience.

1.2.3. Which indicators are both important and relevant?

Given that the built environment (and its quality features) is strongly interlinked with people's well-being, the quality criteria used to select and populate the OECD Well-being dashboard can help guide the selection of the most suitable indicators to describe the built environment. These quality criteria are adapted from the OECD Statistical Quality Framework (OECD, 2012[74]) to the well-being context. Below are the quality criteria (relevance, credibility and comparability, timeliness and frequency, interpretability and working constraints) that have been prioritised for this report.

- **Relevance**: the indicator has policy relevance, and its value has to be clear. When describing the quality of a component of the built environment, it has to pertain to either households or individuals.
- **Interpretability**: the meaning of the indicator has to be obvious, and a change in the indicator must be unambiguously good or bad.
- **Timeliness and frequency**: wherever possible, data should be based on recurrent data collections, and data with no more than a five-year lag in data publication have been prioritised. Whilst ideally time series should be available to assess changes over time, some indicators have only been developed with no available time series yet. As highly relevant, they have been included.
- **Credibility and comparability**: data are sourced from national statistical sources as identified earlier in this chapter, based on internationally comparable definitions.
- **Working constraints**: indicators with data coverage for at least more than half of the OECD countries have been prioritised, preferably not referring to only one geographical area.

Some criteria have been relaxed to allow the coverage of a wider range of quality features of components of the built environment. For example, highly relevant indicators that are part of a one-off data collection (but referring to the last five years) or with a coverage limited to EU countries or cities have been included. Indicators not strictly internationally comparable or with very limited country coverage have been excluded. For example, information on transport infrastructure capital value, investment and maintenance spending is annually collected by the International Transport Forum (ITF), but country coverage is limited, and data are not strictly comparable across countries, due to differences in definitions and practices. Therefore, these indicators have been excluded from this report. On the other hand, this report features some descriptive indicators to "quantify" the built environment, its components and the typology of urban designs or lands (e.g. surface of built-up areas, height of buildings) whose interpretability is sometimes not unambiguous (e.g. higher is not necessarily better for people's well-being). These indicators have been included as necessary to picturing and understanding the overall built environment.

As the built environment is part of a country's economic capital, its quantity can be assessed in terms of volume or value. In the OECD Well-being Framework, economic capital is measured in terms of stock (value) and flows (i.e. investment) on the basis of data available in the National Accounts. Given the heterogeneous nature of the built environment (dwellings, transport, energy and water infrastructure), assessing it in terms of value allows having a common metric to quantify it.

While it is possible to broadly quantify the built environment as a whole, its quality can be assessed only individually for each of its key components on the basis of available data. Components of the built environment share common quality features (accessibility, affordability, safety, equity, inclusiveness, sustainability and resilience) that have been assessed separately. Measuring quality at the component level is definitively the first step in understanding the built environment, as it is easier than measuring the quality of the more complex *entire* built environment. In order to better target well-being interventions, it is also necessary to disentangle information and evidence on the built environment. Components of the built environment are often measured, monitored and analysed separately, and responsibility for components of the built environment falls to different actors at the governmental level (e.g. housing conditions and infrastructure or transport are not always supervised by the same Ministry), as well as at the business and private level (e.g. architects and urban planners have different roles, responsibilities and focuses that sometimes overlap and often complement each other).

Table 1.2 illustrates the indicators available to assess quantity and quality features of the built environment by component on the basis of the selection criteria presented above. More details on their data quality features are available in Annex 1.B. Annex 1.B provides information on the frequency and regularity of the indicators and some interesting breakdowns are available. When deprivation measures (i.e. focusing on the bottom part of the distribution of the indicator) and horizontal inequalities (i.e. looking at differences between population groups) can be assessed, these are also specified.

Table 1.2. Indicators (featured in this report) to assess the quantity and quality of the built environment

Component	Indicator	Measurement	Source
Overall built environment	Built environment (buildings (residential and non-residential) and civil engineering works) stock value *Quantity*	USD at 2015 PPPs, per capita	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 9B. Balance sheets for non-financial assets, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B
	Investment in the built environment (buildings - residential and non-residential - and civil engineering works) *Quantity*	Growth rate and as a percentage of GDP	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 1. Gross domestic product, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE1
Housing	Housing (residential buildings) stock value *Quantity*	USD at 2015 PPPs, per capita	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 9B. Balance sheets for non-financial assets, http://stats.oecd.org/Index.aspx?DataSetCode='SNA_TABLE9B
	Investment in housing (residential buildings) *Quantity*	Growth rate and as a percentage of GDP	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 1. Gross domestic product, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE1
	Housing affordability (current expenditures) *Quality*	Percentage of household gross adjusted disposable income that is available to the household after deducting housing current expenditures	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 5. Final consumption expenditure of households, http://stats.oecd.org/Index.aspx?DataSetCode='SNA_TABLE5' and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
	Housing cost (rents and mortgage) overburden *Quality*	Percentage of households in the bottom 40% of the income distribution spending more than 40% of their disposable income on housing cost (i.e. mortgage and rent)	*General Social Surveys or Household surveys*: as available in the OECD *Affordable Housing* database: http://oecd.org/social/affordable-housing-database and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL

Component	Indicator	Measurement	Source
	Overcrowding rate *Quality*	Percentage of households living in overcrowded conditions (Eurostat definition)	*General Social Surveys or Household surveys* as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
	Poor household lacking access to basic sanitary facilities (toilets) *Quality*	Percentage of households below 50% of median equivalised disposable household income without indoor flushing toilet for the sole use of their household	*General Social Surveys or Household surveys* as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
	Housing distress *Quality*	Percentage of respondents reporting being either "somewhat concerned" or "very concerned" by not being able to find/maintain adequate housing	OECD *Risks That Matter* survey, https://www.oecd.org/social/risks-that-matter.htm as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database
Infrastructure (including transport & technical infrastructure)	Infrastructure (civil engineering works) stock value *Quantity*	USD at 2015 PPPs, per capita	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 9B. Balance sheets for non-financial assets, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B
Transport	Convenient access to public transport (all transport modes) *Quality*	Percentage of population that has convenient access to public transport	*Geospatial data*, as available in the UN *Global SDG Indicator* database, indicator 11.2.1, https://unstats.un.org/sdgs/dataportal
	Access to various public transport modes *Quality*	Percentage of the population having access to a bus/metro/ tram public transport stop within 10 minutes walking distance	*Geospatial data*, as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?DataSetCode=FUA_CITY
	Transport effectiveness in providing access to destinations *Quality*	Ratio	*Geospatial data*, as available in the OECD ITF Urban access framework, https://stats.oecd.org/Index.aspx?DataSetCode=ITF_ACCESS
Technical Infrastructure	Access to improved drinking water sources *Quality*	Percentage of the population with access to improved drinking water sources	*Population and household censuses and surveys*, as available in the UN *Global SDG Indicator* database, Indicator 6.1.1, https://unstats.un.org/sdgs/dataportal and in the OECD *Green Growth indicators* database, https://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH
	Connection to public sewerage (primary, secondary, tertiary, or other treatment) *Quality*	Percentage of the population connected to public sewerage	*International data collections*, as available in the OECD *Green Growth indicators* database, https://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH
	Access to electricity *Quality*	Percentage of the population with access to electricity	*Population and household censuses and surveys*, as available in the UN *Global SDG Indicator* database, indicator 7.1.1, https://unstats.un.org/sdgs/dataportal
	Ability to keep the dwelling warm (energy poverty) *Quality*	Percentage of households who cannot afford to keep their home adequately warm	*General Social Surveys or Household surveys* (EU-SILC countries only), as available in the *European Survey on Income and Living Conditions* (EU-SILC), https://ec.europa.eu/eurostat/web/income-and-living-conditions/data/database
Urban design/land use	Artificial surfaces *Quantity*	As a percentage of total land	*Geospatial data*, as available in the OECD *Land cover change in countries and regions* database, https://stats.oecd.org/Index.aspx?DataSetCode=LAND_COVER_CHANGE

Component	Indicator	Measurement	Source
	Change in artificial surfaces (to and from) *Quantity*	Percentage change (2004-2019)	*Geospatial data*, as available in the OECD *Land cover change in countries and regions* database, https://stats.oecd.org/Index.aspx?DataSetCode=LAND_COVER_CHANGE
	Urban built-up areas *Quantity*	Sqm per capita	*Geospatial data*, as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?DataSetCode=FUA_CITY
	Average urban building height *Quantity*	Metres	*Geospatial data*, as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?DataSetCode=FUA_CITY
	Urban green areas *Quantity*	As a percentage of the functional urban area and in sqm per capita	*Geospatial data*, as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?DataSetCode=FUA_CITY
	Open space for public use *Quantity*	Percentage of area of cities that is open space for public use	*Geospatial data and ground assessments*, as available in the UN *Global SDG Indicator* database, indicator 11.7.1, https://unstats.un.org/sdgs/dataportal
	Access to recreational green space in urban areas *Quality*	Percentage of the urban population with access to recreational green space within 5 minutes walking distance from their home	*Geospatial data*, as available in the OECD *How's Life? Well-Being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
	Proximity to services *Quality*	Number of services by type (hospitals, schools, recreation, food shops, restaurants, green areas) within a given distance or time	*Geospatial data*, as available in the OECD ITF Urban access framework, https://stats.oecd.org/Index.aspx?DataSetCode=ITF_ACCESS

Note: The transport effectiveness ratio is computed as the ratio between the absolute accessibility (the number of destinations reachable within a fixed amount of time) for a given transport mode and proximity to potential destinations (the number of destinations within a certain distance). A ratio of one or more means the transport mode performs well, as the number of accessible destinations through the transport mode is higher than those in proximity. A ratio close to zero means that the mode performs poorly, even in providing access to nearby destinations. In the case of public transport, transport effectiveness captures the frequency of services, the in-vehicle speed, the number of transfers, and the distance to the nearest bus stop or station, as its effective performance is compared to a theoretical reference. Proximity to services is assessed for functional urban areas and components (core centre and commuting area), by mode of transport (driving, walking, cycling and public transport), by destination (hospitals, schools, recreation, food shops, restaurants, green areas), and by time intervals or distance thresholds (15 minutes/4km (1km walking); 30 minutes and 45 minutes). Functional urban areas (FUAs), as defined by the OECD and the EU, are composed of a city and its commuting zone. This definition overcomes the purely administrative perimeter to encompass the economic and functional extent of cities based on people's daily movements (OECD, 2012[75]).

Internationally comparable, detailed information on the stocks and flows of all the components of the built environment is currently not available. This report, therefore, will present stock and investment/flows for an overall measure of the built environment (covering buildings – residential and non-residential – and civic engineering works) and the two main broad components (housing – residential buildings) and infrastructure (grouping together transport and technical infrastructure: water, energy, waste management, information and communication technology), mirroring data availability in the National Accounts. Transport equipment, as available from the National Accounts, does not allow separation of public and private equipment (which have different impacts on people's well-being and sustainability, for example when concerning environmental matters), and its interpretation is relatively ambiguous (i.e. a higher stock or investment is not unambiguously instrumental in improving or preserving well-being), and therefore was not included in this report. Finally, as it is not possible using the OECD National Accounts to distinguish information on investment in infrastructure from that in non-residential buildings, only investment on housing and the overall built environment will be considered. Urban design/land use is treated differently from other elements of the built environment, because it refers to the organisation of the space, rather than to specific assets. Here it is described using indicators that allow to understand how the

space is organised in terms of some main categories, such as artificial surface, urban green areas and built-up areas.

Internationally comparable information on quality features is relatively more abundant for housing than for other components of the built environment. This may be due to the fact that housing has long been at the core of national social policies, and it has already been closely associated with welfare and well-being also at the international level (e.g. OECD Well-being Framework, OECD *Affordable Housing* and OECD Housing project). Existing indicators, however, do not fully capture trade-offs and tensions between different policy options to improve the quality of housing OECD's report, *Brick by Brick*, tried to identify both limitations and advantages of different housing policies (OECD, 2023[40]). As for transport, more information is in the process of development for transport accessibility, as the call to shift from "mobility" to "accessibility" has been relatively recent. Information on transport and urban design/land use is often available for metropolitan or functional urban area level, as their administration primarily pertains to local authorities, and an overall national measure would not allow to grasp the wide local diversity.

Subjective measures of housing distress are also available, but they are not collected on a regular basis. Most recent measures developed in response to the COVID-19 pandemic (e.g. by Eurofound) include indicators such as "inability to pay the rent or mortgage as scheduled at some time in the last 3 months" or "likelihood to leave the accommodation within the next 3 months as can no longer afford it". The OECD also collects a subjective measure of housing distress (i.e. "Concern by not being able to find/maintain adequate housing") via the *Risks That Matter* survey. This survey has been conducted three times since 2018, drawing on 25 000 responses from 25 OECD countries. The question on housing distress has been included from the 2020 wave, and results from the 2022 wave were not available when preparing this report. Additional subjective indicators related to the built environment are available from non-official sources (e.g. the Gallup World Poll). As the objective of this chapter is to present information based on national statistical sources, non-official sources have not been included. Complementary indicators from non-official sources will be introduced and discussed in Chapter 2 to present the built environment through a well-being and sustainability lens.

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Annex 1.A. The built environment in the Sustainable Development Goals (SDGs)

Annex Table 1.A.1. The built environment in the Sustainable Development Goals (SDGs)

SDGs goals and targets	SDGs indicators	Built environment and quality features
Goal 1. End poverty in all its forms everywhere		**Water infrastructure**
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.1 Proportion of population living in households with access to basic services (drinking water services and sanitation services)	Equitable, accessible
Goal 6. Ensure availability and sustainable management of water and sanitation for all		**Water infrastructure**
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services	Universal, equitable access, affordable and safe
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water	Safe and accessible
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of domestic and industrial wastewater flows safely treated	Safe and accessible
	6.3.2 Proportion of bodies of water with good ambient water quality	Safe and accessible
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time	Sustainable water management
	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	Sustainable water management
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all		**Energy infrastructure**
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Proportion of population with access to electricity	Universal, equitable and affordable access
	7.1.2 Proportion of population with primary reliance on clean fuels and technology	Sustainable (use of clean fuels and technology)
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption	Sustainable (use of renewable energy)
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation		**Transport**
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure,	9.1.1 Proportion of the rural population who live within 2 km of an all-season road	Accessible, reliable, sustainable, resilient transport infrastructure

SDGs goals and targets	SDGs indicators	Built environment and quality features
to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.2 Passenger and freight volumes, by mode of transport	
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO_2 emission per unit of value added	Sustainable (CO_2 emissions)
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable		**Housing, transport, urban design and land use**
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing	Adequate, safe and affordable housing and basic services
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities	Equitable, accessible, safe, affordable transport system
11.3 By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate	Sustainable land use
	11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically	Inclusive urban planning and management
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional and local/municipal)	Sustainability of the world's cultural and natural heritage
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100 000 population	Sustainable (reduce deaths and casualties caused by natural climate-related hazards)
	11.5.3 (a) Damage to critical infrastructure and (b) number of disruptions to basic services, attributed to disasters	Sustainable (reduce deaths and casualties caused by natural climate-related hazards)
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities	Sustainable (waste management)
	11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population-weighted)	Sustainable (air quality)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	Universally accessible, inclusive green and public spaces
	11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in	Safe public space

SDGs goals and targets	SDGs indicators	Built environment and quality features
	the previous 12 months	
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilising local materials	*No suitable replacement indicator was proposed. The global statistical community is encouraged to work to develop an indicator that could be proposed for the 2025 comprehensive review. See E/CN.3/2020/2, paragraph 23.*	Sustainable and resilient buildings with local materials (circular economy)

Source*:* Adapted from the UN Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development, https://unstats.un.org/sdgs/indicators/indicators-list/.

Annex 1.B. Data quality description of selected indicators to describe the built environment and its components

Annex Table 1.B.1. Selected indicators to describe the overall built environment

Indicator	Measurement	Breakdowns	Frequency and regularity	Source
Built environment (buildings – residential and non-residential – and civil engineering work)	USD at 2015 PPPs, per capita	By institutional sector	Annual (with possible infra-annual updates)	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 9B. Balance sheets for non-financial assets, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B
Built environment (buildings – (residential and non-residential – and civil engineering works)	Growth rate and as a percentage of GDP	n.a.	Annual (with possible infra-annual updates)	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 1. Gross domestic product, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE1

Note: If data can be broken down by socio-economic characteristics of the population ("Horizontal inequality") or are available for a subset of the population falling under a specific poverty threshold ("Deprivation"), it is specified under the column "Breakdowns". n.a. stands for "not available". The value of land underlying buildings is available only for a very limited number of countries in the National Accounts, therefore it is not included so as to ensure cross-country comparability.

Annex Table 1.B.2. Selected indicators to describe housing (residential buildings)

Indicator	Measurement	Breakdowns	Frequency and regularity	Source
Housing (residential buildings)	USD at 2015 PPPs, per capita	From the *OECD Wealth Distribution database*: By household principal residence and other real estate properties HORIZONTAL INEQUALITY: By gender, age, education of the head of the household From the *OECD Affordable Housing Database*: HORIZONTAL INEQUALITY: By urban/rural area	For *National Accounts*: Annual (with possible infra-annual updates) *For General Social Surveys or Household surveys:* Annual or every 2-5 years (depending on the country)	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 9B. Balance sheets for non-financial assets, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B *Household surveys*, as available in the OECD Wealth Distribution database, https://stats.oecd.org/Index.aspx?DataSetCode=WEALTH *General Social Surveys* or *Household surveys,* as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database
Housing (residential buildings)	Growth rate and as a percentage of GDP	n.a.	Annual (with possible infra-annual updates)	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 1. Gross domestic product, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE1
Housing affordability	Percentage of household gross adjusted	n.a. (see Housing cost overburden)	Annual (with possible infra-annual updates)	*National Accounts*, as available in the OECD *National Accounts Statistics* database: "5. Final consumption

Indicator	Measurement	Breakdowns	Frequency and regularity	Source
(current expenditures)	disposable income that is available to the household after deducting housing costs			expenditure of households", http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE5 and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
Housing cost (rent and mortgage) overburden	Percentage of households in the bottom 40% of the income distribution spending more than 40% of their disposable income on housing cost (i.e. mortgage and rent)	DEPRIVATION: it is a deprivation measure HORIZONTAL INEQUALITY: by disposable income quintile; by tenure (Own outright, Owner with mortgage, Rent (private), Rent (subsidised)) and by disability status	Annual or every 2-5 years (depending on the country)	*General Social Surveys or Household surveys*: as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
Overcrowding rate	Percentage of households living in overcrowded conditions (Eurostat definition)	DEPRIVATION: It is a deprivation measure HORIZONTAL INEQUALITY: by (disposable) income quintile; by tenure (Own outright, Owner with mortgage, Rent (private), Rent (subsidised)); by age group for bottom household income quintile and by disability status	Annual or every 2-5 years (depending on the country)	*General Social Surveys* or *Household surveys* as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
Poor households without access to basic sanitary facilities	Share of households below 50% of median equivalised disposable household income without indoor flushing toilet for the sole use of their household	DEPRIVATION: It is a deprivation measure HORIZONTAL INEQUALITY: relative income poor/not poor; by tenure (Own with or without mortgage, Rent (private or subsidised))	Annual or every 2-5 years (depending on the country)	*General Social Surveys* or *Household surveys* as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database and in the OECD *How's Life? Well-being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
Housing distress	Percentage of respondents reporting being either "somewhat concerned" or "very concerned" by not being able to find/maintain adequate housing	Question asked referring to the short term (next year or two) and also to the long term (beyond 10 years) HORIZONTAL INEQUALITY: for young people (short-term)	Available years: 2020 (2022 forthcoming)	*OECD Risks That Matter* survey, *https://www.oecd.org/social/risks-that-matter.htm* as available in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database

Note: If data can be broken down by socio-economic characteristics of the population ("Horizontal inequality") or are available for a subset of the population falling under a specific poverty threshold ("Deprivation"), it is specified under the column "Breakdowns". n.a. stands for "not available". The value of land underlying buildings is available only for a very limited number of countries in the National Accounts; therefore it is not included so as to ensure cross-country comparability.

Annex Table 1.B.3. Selected indicators to describe transport and technical infrastructure (water, energy, waste management and digital infrastructure)

Indicator	Measurement	Breakdowns	Frequency and regularity	Source
Infrastructures				
Infrastructure (Civil engineering works)	USD at 2015 PPPs, per capita	n.a.	Annual (with possible infra-annual updates)	*National Accounts*, as available in the OECD *National Accounts Statistics* database: 9B. Balance sheets for non-financial assets, http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B
Transport				
Please refer to "Infrastructures", as a specific measure of stock for transport infrastructure is not available				
Access to public transport	Percentage of the population having access to a public transport stop within 10 minutes walking distance	Information is available for OECD largest metropolitan areas	Available year: 2022	*Geospatial data,* as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?datasetcode=FUA_CITY
Convenient access to public transport	Percentage of population that has convenient access to public transport	Information is available for largest metropolitan areas	Available year: 2020 or latest available year (update of the indicator every three years for each country)	*Geospatial data,* as available in the UN *Global SDG Indicator* Database, indicator 11.2.1, https://unstats.un.org/sdgs/dataportal
Transport effectiveness in providing access to destinations	Ratio	Information is available for European functional urban areas (FUA) only. HORIZONTAL INEQUALITY: By functional urban area (FUA) and components (core centre and commuting area), by mode of transport (driving, walking, cycling and public transport), by destination (hospitals, schools, recreation, food shops, restaurants, green areas) and by time intervals or distance thresholds (15 minutes/4km (1km walking); 30 minutes and 45 minutes)	Available year: 2018	*Geospatial data,* as available in the OECD ITF Urban access framework, https://stats.oecd.org/Index.aspx?DataSetCode=ITF_ACCESS
Technical infrastructure				
Please refer to "Infrastructures", as a specific measure of stock for technical infrastructure is not available				
Access to improved drinking water sources	Percentage of the population with access to improved drinking water sources	HORIZONTAL INEQUALITY: By urban/rural area	Annual	*Population and household censuses and surveys,* as available in the UN *Global SDG Indicator* Database, indicator 6.1.1, https://unstats.un.org/sdgs/dataportal and in the OECD *Green Growth indicators* database, https://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH
Connection to public sewerage (primary, secondary,	Percentage of the population connected to public sewerage	n.a	Annual or every 2-5 years (depending on the country)	*International data collections,* as available in the OECD *Green Growth indicators* database, https://stats.oecd.org/Index.aspx?DataS

Indicator	Measurement	Breakdowns	Frequency and regularity	Source
tertiary or other treatment)				etCode=GREEN_GROWTH
Access to electricity	Percentage of the population with access to electricity	HORIZONAL INEQUALITY: By urban/ rural area	Annual	*Population and household censuses and surveys*, as available in the UN *Global SDG Indicator* database, indicator 7.1.1, https://unstats.un.org/sdgs/dataportal
Ability to keep the dwelling warm (energy poverty)	Percentage of households who cannot afford to keep their home adequately warm	Comparable information available for EU-SILC countries only. DEPRIVATION: It is a deprivation measure. HORIZONTAL INEQUALITY: by disposable income quintile; by tenure (Own outright, Owner with mortgage, Rent (private), Rent (subsidised))	Annual	*General Social Surveys or Household surveys* (EU-SILC countries only), as available in the *European Survey on Income and Living Conditions* (EU-SILC), *https://ec.europa.eu/eurostat/web/income-and-living-conditions/data/database* And in the OECD *Affordable Housing* database, http://oecd.org/social/affordable-housing-database

Note: If data can be broken down by socio-economic characteristics of the population ("Horizontal inequality") or are available for a subset of the population falling under a specific poverty threshold ("Deprivation"), it is specified under the column "Breakdowns". n.a. stands for "not available". The transport effectiveness ratio is computed as the ratio between the absolute accessibility (the number of destinations reachable within a fixed amount of time) for a given transport mode and proximity to potential destinations (the number of destinations within a certain distance). A ratio of one or more means the transport mode performs well, as the number of accessible destinations through the transport mode is higher than those in proximity. A ratio close to zero means that the mode performs poorly, even in providing access to nearby destinations.

Annex Table 1.B.4. Selected indicators to describe urban design/land use

Indicator	Measurement	Breakdowns	Frequency and regularity	Source
Artificial surfaces	As a percentage of total land	HORIZONTAL INEQUALITY: By large and small subnational region	Available years: 2004, 2015, 2018, 2019 (as part of a regular data collection)	*Geospatial data*, as available in the OECD *Land cover in countries and regions* database, https://stats.oecd.org/Index.aspx?DataSetCode=LAND_COVER_CHANGE
Change in artificial surfaces (to and from)	Percentage change (2004-2019)	HORIZONTAL INEQUALITY: By large and small subnational region	Periods: 2004-2019 and 1992-2019 (as part of a regular data collection)	*Geospatial data*, as available in the OECD Land cover change in countries and regions database, https://stats.oecd.org/Index.aspx?DataSetCode=LAND_COVER_CHANGE
Urban built-up areas	Sqm per capita	Information available for Functional urban areas (FUA). HORIZONTAL INEQUALITY: By large and small subnational region, by functional urban area (FUA) and components (core centre and commuting area) and by main purpose (residential, commercial)	Available year: 2021	*Geospatial data,* as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?datasetcode=FUA_CITY
Average urban building height	Metres	Information available for Functional urban areas (FUA). HORIZONTAL INEQUALITY: By large and small subnational	Available year: 2020 (annual update)	*Geospatial data,* as available in the OECD *Regions and Cities, City statistics* database,

		region, by functional urban area (FUA) and components (core centre and commuting area)		https://stats.oecd.org/Index.aspx?datasetcode=FUA_CITY
Urban green areas	As a percentage of the core centre of the functional urban area and in sqm per capita	Information available for Functional urban areas (FUA). HORIZONTAL INEQUALITY: By large and small subnational region	Available year: 2020	*Geospatial data,* as available in the OECD *Regions and Cities, City statistics* database, https://stats.oecd.org/Index.aspx?datasetcode=FUA_CITY
Open space for public use	Percentage of built-up area of cities that is open space for public use for all	n.a.	Available year: 2020 or latest available year (update of the indicator every three years for each country)	*Geospatial data and ground assessments,* as available in the UN *Global SDG Indicator* database, indicator 11.7.1, https://unstats.un.org/sdgs/dataportal
Access to recreational green space in urban areas	Percentage of the urban population with access to recreational green space within 5 minutes walking distance from their home	Information available for European urban areas only	Available year: 2012 and 2018	*Geospatial data,* as available in the OECD *How's Life? Well-Being* database, https://stats.oecd.org/Index.aspx?DataSetCode=HSL
Proximity to services	Total number of services within a given distance or time	Information available for European functional urban areas (FUA) only. HORIZONTAL INEQUALITY: By FUA and components (core centre and commuting area), by mode of transport (driving, walking, cycling and public transport), by destination (hospitals, schools, recreation, food shops, restaurants, green areas) and by time intervals or distance thresholds (15 minutes/4km (1km walking); 30 minutes and 45 minutes)	Available year: 2018	*Geospatial data,* as available in the OECD ITF Urban access framework, https://stats.oecd.org/Index.aspx?DataSetCode=ITF_ACCESS

Note: If data can be broken down by socio-economic characteristics of the population ("Horizontal inequality") or are available for a subset of the population falling under a specific poverty threshold ("Deprivation"), it is specified under the column "Breakdowns". n.a. stands for "not available". Proximity to services is assessed for functional urban areas and components (core centre and commuting area), by mode of transport (driving, walking, cycling and public transport), by destination (hospitals, schools, recreation, food shops, restaurants, green areas) and by time intervals or distance thresholds (15 minutes/4km (1km walking); 30 minutes and 45 minutes). Functional urban areas (FUAs), as defined by the OECD and the EU, are composed of a city and its commuting zone. This definition overcomes the purely administrative perimeter to encompass the economic and functional extent of cities based on people's daily movements (OECD, 2012[75]).

Notes

[1] Information collected and produced by National and International Statistical Institutes abide by international data quality standards, such as the UN Fundamental Principles of Official Statistics (https://unstats.un.org/unsd/dnss/gp/fundprinciples.aspx) and more subject-specific international standards and classifications.

[2] The selected air pollutants are CO_2, CH_4 (methane), N_2O (nitrous oxide), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), (SF_6 +NF3) (sulphur hexafluoride and nitrogen trifluoride), SO_x (sulphur oxides, NO_x (nitrogen oxides), CO (carbon monoxide), NMVOC (non-methane volatile organic compounds), PM2.5 (particulates less than 2.5 μm), PM10 (particulates less than 10 μm) and NH3 (ammonia).

[3] The Sustainable Development Goals that refer to components of the built environment are Goal 6 ("Ensure availability and sustainable management of water and sanitation for all"), Goal 7 ("Ensure access to affordable, reliable, sustainable and modern energy for all"), Goal 9 ("Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation") and Goal 11 ("Make cities and human settlements inclusive, safe, resilient and sustainable).