

# Walkable Cities

Subjects: Regional & Urban Planning

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Reductions in walking trips have coincided with unprecedented levels of car trips, that caused several harmful environmental and health impacts. Walking is a simple, healthy and sustainable mode of transport that can be used for short urban trips or in combination with public transport for longer distances. The promotion of walkable cities encourages pedestrian activity, provides access to services and other businesses and satisfies daily needs without requiring to use a car.

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## 1. Why walking?

Walking is the oldest and simplest form of human mobility. Everyone is a pedestrian, and walking is usually the first and last mode used in a trip. Walking is often considered the greenest, cheapest, and easiest mode of transport. Walking reduces the negative environmental impacts caused by motorized traffic in terms of CO<sub>2</sub>, air pollutants, and noise. Walking is also an active mode of transport and the most widely available form of physical activity that helps to prevent various physiological and mental diseases associated with sedentary lifestyles, such as obesity, diabetes, and depression. Walking is also the most socially inclusive mode of transport: it is free, promotes social interaction, and does not require special equipment. For these benefits, extensive research has been carried out to understand the attributes that are conducive to walking and how to create more walkable and liveable cities.

## 2. Walkable cities and pedestrian networks

Developing walkable cities is a way to create affordable and equitable transport systems for the entire urban community. A walkable city is a city that prioritises pedestrians and enables more journeys on foot. The extent to which the built environment is pedestrian-friendly and enables walking has been defined as walkability. As shown by Fonseca et al. <sup>[1]</sup>, walkability is a composite measure of a changeable number of attributes that rank urban spaces as more or less walkable. These attributes have been assessed by using different methods at different scales, ranging from the meso-scale (land use, accessibility, connectivity) to the micro-scale at the level of pedestrian infrastructure. While meso-scale attributes have been often included in walkability studies, pedestrian infrastructure attributes have been much less used due to the lack of this type of micro data. However, pedestrian infrastructure is considered the primary means of access to public spaces and the most complex transport network as it joins together all transport modes <sup>[2]</sup>.

A pedestrian network consists of all interconnected path segments of the pedestrian infrastructure that can be mainly or exclusively used for people travelling on foot <sup>[3]</sup>. This includes not only sidewalks, but also all formal and informal paths that pedestrians have legal access to, such as pedestrian-only zones and streets, shared streets, crossings, pedestrian bridges and tunnels, stairs and ramps, short-cuts, and trails in parks and open spaces, among others <sup>[4]</sup>. Previous research has shown that a suitable pedestrian infrastructure improves the comfort and safety of walking and encourages people to walk <sup>[5]</sup>.

Pedestrian networks have been mainly represented as topological maps that contain the geometric relationships between all path segments <sup>[6]</sup>. Topological maps can provide some important clues about the level of street integration, and the directness and availability of alternative routes between destinations, which have a widely recognised influence on pedestrian accessibility and on travel behaviour <sup>[7]</sup>.

However, the overall experience of walking is not only influenced by the characteristics of the pedestrian infrastructure, but also by many other built environment and streetscape attributes. Pedestrians are very sensitive to overall walking environment features, which define the extent to which walking is a convenient mode of transport and the pedestrian routes are comfortable, safe, connected, and attractive to walk <sup>[4]</sup>. A connectivity/accessibility analysis of the pedestrian

infrastructure can only give a partial view of the several factors that shape the decision and satisfaction of walking. Thus, other neighbourhood and micro scale street attributes should be considered when studying pedestrian networks and walkable cities.

### **3. Factors and attributes used to describe pedestrian networks**

In recent years, solid contributions have been made to categorise the influence of built environmental attributes on walkability. The most relevant include: (i) survey tools such as the NEWS (Neighbourhood Environment Walkability Survey) <sup>[8]</sup>, which covers pedestrian infrastructure data as well as residential density, land use mix, land use mix access, street connectivity, traffic safety, security from crime, and aesthetics data; (ii) the GIS walkability index developed by Frank et al. <sup>[9]</sup>, which has been highly replicated and adapted as a composite measure of land use mix, street connectivity, and residential density; (iii) the 5D layout of Ewing and Cervero <sup>[10]</sup>, which includes density, diversity, design, destination accessibility, and distance to public transport as critical drivers of travel behaviour; and (iv) the 5C layout developed by the Greater London Authority, which defines connectivity, convenience, comfortability, conviviality, and conspicuousness as critical dimensions to allow pedestrians to walk with high-quality levels <sup>[11]</sup>. Based on these referential works, it can be argued that a pedestrian network should be convenient, comfortable, connected, safe, and attractive.

#### **3.1. Convenience**

To be convenient, a pedestrian network should enable walking as an alternative mode of transport to access daily goods and services <sup>[11]</sup>. This dimension comprises attributes related to land use diversity and density. Having compact urban structures with mixed land uses (residential, services, retail, recreational) typically reduces the distances need to travel, making trips on foot more convenient <sup>[1]</sup>. Proximity to diverse facilities such as public transport, schools, retail, and parks is critical for pedestrians. As a rule of thumb, compact urban environments where destinations are within 10 and up to 20 min walking distance are more convenient <sup>[12]</sup>. Previous research has consistently shown that areas with diverse land uses and short distances to destinations are more conducive for walking <sup>[13][14]</sup>. Areas with high residential densities are usually characterised by more pedestrian activity <sup>[1]</sup>. They usually attract services and retail, which helps to reduce the walking distances to these destinations.

#### **3.2. Comfort**

To be comfortable, a pedestrian network should make the walking experience pleasant and suitable <sup>[11]</sup>. Comfort is related to pedestrians' emotional reactions, and this dimension is mostly influenced by pedestrian infrastructure attributes. This includes variables such as the characteristics and condition of sidewalks and remaining pedestrian infrastructure, the presence of obstacles on sidewalks, street trees, street furniture, and slopes, among others. These attributes have been insufficiently included in walkability indexes due to the lack of this type of micro data <sup>[15]</sup>. Nonetheless, research has shown that well designed and maintained pedestrian infrastructure is critical for pedestrians. For example, the presence of wide, well-maintained, and clean sidewalks has been reported as enabling comfortable walking experiences <sup>[16]</sup>. Similarly, sidewalks without physical obstacles, such as parked cars, and with street furniture, are also more comfortable for pedestrians. Sidewalks with street trees providing shade are also described as being more thermally comfortable <sup>[17]</sup>.

#### **3.3. Connectivity**

To be connected, a pedestrian network should link key origins, such as residential areas, to key destinations, such as transport hubs and city centres. This means that origins and destinations should be connected by continuous pedestrian infrastructure without interruptions and obstructions <sup>[4]</sup>. In addition, more interconnected streets provide more alternative routes, which reduces distances and makes walking more convenient <sup>[18]</sup>. Connectivity has been mostly analysed as a meso urban design variable, by using a multitude of attributes associated with the street layout. From these, the most used have been intersection and street density due to the availability of such data in GIS format <sup>[1]</sup>. Other authors have examined the topological distance, i.e., the number of turns that are needed to reach one location from another in a network. Previous studies showed that pedestrians prefer routes with few directional changes <sup>[19]</sup>. Areas providing high street connectivity have been correlated with more walking and physical activity <sup>[9]</sup>.

#### **3.4. Safety**

To be safe, a pedestrian network should provide traffic protection, as pedestrians are vulnerable road users in the case of collisions, as well as personal security, so that pedestrians can walk without being afraid of incivilities and crime. This dimension has been analysed by considering different street level attributes. In the case of traffic safety, these include traffic volume, traffic speed, traffic lanes, risk of accidents, and traffic calming devices, among others. In the case of public

security, these attributes include graffiti on buildings and structures, vacant buildings, deteriorating buildings, street lighting, homicide rates, police stations, and pedestrian activity, among others <sup>[1]</sup>. In general, a lack of traffic safety and public security has been reported as a main barrier deterring people to walk <sup>[15]</sup>. In the case of traffic safety, there is some consistency with the fact that pedestrians prefer quiet streets with low traffic speeds and volumes and streets with few lanes to cross <sup>[4]</sup>. The influence of security on walking is more evident in cities characterised by urban violence. In these cases, street lighting, surveillance systems, and police stations are known to enhance the perception of security <sup>[20]</sup>.

### 3.5 Attractiveness

Finally, to be attractive, pedestrian networks should provide inviting and pleasant conditions for pedestrians. Several street-level qualities define the extent to which walking routes and public spaces are attractive for pedestrians <sup>[21]</sup>. This includes features such as: complexity, indicating the visual richness of a place in terms of building shapes, styles, colours, and furniture; human scale, reflecting how buildings and spaces are scaled to human size and needs; level of enclosure, showing how enclosed by vertical elements the spaces are; and visual transparency, showing the degree to which people can see or perceive human activity through windows and doors. Aesthetic and street design data are difficult to collect and measure, which explains the relatively low use of these data in walkability studies <sup>[1]</sup>. However, street design qualities are known for having an overall positive impact on walking <sup>[22]</sup>.

## 4. Conclusion

During the last century, cities were planned for cars and the normal response to mobility issues was to increase road capacity. Over the last decades, a policy interest for creating more sustainable, healthier, and inclusive transport systems, including more walkable environments, increased worldwide <sup>[23]</sup>. Planning cities for people and for pedestrians is not a relatively new concept among local planners, but the relevance of walking as a mode of transport is not yet entirely recognised.

From the brief background provided, it can be concluded that a high-quality pedestrian network should include a set of factors and attributes that include built environment attributes, pedestrian infrastructure attributes and streetscape features. Planning approaches towards more walkable cities need to consider these different attributes, which involve planning decisions at different scales. As distance is the most critical aspect for whether people choose to walk or not, a key element is to use city planning to reduce the need of travel and car trips. In addition to land use attributes, recent studies showed that streetscape design attributes and the quality of pedestrian infrastructure should be taken into consideration when designing pedestrian planning policies and walkability indexes <sup>[23]</sup>. The promotion of compact urban structures and the creation of accessible, well-connected, safe and vibrant spaces and pedestrian facilities is critical to make journeys on foot more appealing, attractive and a feasible alternative to car trips.

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