# **Improve Travel Conditions and Enhance Connectivity in 15, 20, and 45-Minute Urban Circles Based on Public Transportation Systems**

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Keywords: 15 Minute City, 20 Minute Town, 45 Minute City, Public Transportation, Sustainable Neighborhoods.

Abstract: In the field of urban planning, researchers are paying more and more attention to the accessibility of units and their convenience, so that residents can reach necessary places in a short time. This article examines the connections between 15-minute cities, 20-minute cities and 45-minute cities and public transport systems. This paper also conducted case studies on different representative cities to understand different urban strategies and public transportation policies, and conducted research on how to make more effective, convenient and fast connections in 15-minute, 20-minute, and 45-minute city circles. This paper provides a positive response on how to encourage more people to use convenient public transportation, improve its convenience in terms of price and riding methods, enhance urban sustainability, and ensure environmental-friendly. This paper studies the connection and practicality of urban circles and public transportation, and provides opinions and suggestions for future urban planning and urban transportation planning. It provides guidance and help for governments and transportation departments to make better and more localized decisions.

## **1 INTRODUCTION**

After experiencing a severe epidemic, researchers realized that the main challenge facing cities is transportation convenience and accessibility. Therefore, since the epidemic, the concept of 15minute cities has become an important research direction to solve this problem. This transportation network can effectively suppress the spread of viruses and respond to large-scale urban disasters in a short period of time, provide new solutions for future risk prevention, reduce the risk of cross-infection, and meet the needs of cross-regional activities. In addition, the planning of the 15-minute city will promote sustainable development and ecological city construction, alleviate current urban problems, improve people's travel convenience, and make the city more environmentally friendly.

It provides a more efficient and convenient experience in urban planning and transportation policy formulation and promotes people's daily lives and transportation, also helping solve the problem. Urban issues not only respond to urban emergencies, but also provide more diverse choices for people's

daily needs. This concept was originally considered the community and residential area units as the basic units and plans convenient conditions for pedestrians and bicycles to reach necessary places within 15 minutes. In recent years, people have increasingly applied its concepts and ideas to urban planning and transportation in many fields such as living, work, health, education, and entertainment. It is no longer limited to meeting basic needs or high-end emergency services. The demand for efficient transportation has also increased many demands with wider coverage and richer fields. At the same time, it has also put forward higher requirements for urban planners and transportation route planning. At present, scholars mainly focus on the application and research of 15minute cities in terms of providing travel efficiency and arrival efficiency and propose different targeted solutions based on specific cases in different countries and regions.

Most current research focuses on 15-minute urban walking and bicycle-sharing trips. However, there are no good plans and measures for longer distances and larger travel circles to connect with small traffic circles, resulting in many communities and residential

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units. It is only conveniently accessible within a small area, and for many people who work in remote areas or have other needs in further locations, there are no good convenience measures, so the process of reaching other transportation hubs they need to reach is still low. Efficiency and congestion have resulted in frequent traffic accidents and serious traffic congestion in many large cities. Public transportation routes and planning also have their unique drawbacks. For example, when designing transportation lines, the connectivity between arrival points was not considered the connectivity between arrival points was not considered transportation transfers from 15 minutes to longer distances were very inconvenient, causing people much time and effort to switch from short-distance transportation to long-distance transportation routes.

As far as London is concerned, in 2022, drivers will need to spend an average of 156 hours in traffic jams to reach their destination, and this has also caused a loss of \$5.7 billion to the city and a cost of £1,377 to drivers and individuals. loss. By connecting the 15-minute transportation circle with a variety of public transportation modes, closer linkage can be achieved. People may combine buses and subways but also reduces urban congestion. Create a sustainable travel model, improve people's quality of life and travel satisfaction, and make the city greener, more efficient, and safer. Solving the congestion problem, it also reduces the pressure on urban traffic through efficient public transportation networks and also makes greater contributions to the environment and sustainability. This article intends to conduct case studies and analysis on the 15-minute city combined with 20-minute and 45-minute transportation circles and provide opinions and improvement measures for a more convenient future transportation system so that the 15-minute city will have more possibilities in the future.

## 2 OVERVIEW OF 15-MINUTE CITY

#### 2.1 The Concept and Importance of a 15-Minute City

The concept of 15-minute cities is of great significance in urban planning. It emphasizes reasonable spatial and functional configuration within community units to ensure that residents can meet basic living needs within a 15-minute walking the process of creating an ideal city, the meaning of cities and community units no longer carries the travel needs of people but has more social and economic value. On the basis of the 15-minute city concept, scholars have also proposed the concepts of 20minute city and 45-minute city. These urban planning concepts of different time frames emphasize different levels of community services and life convenience. Among them, the 15-minute city serves as the detailed basis of this series of concepts, focusing on providing a more compact configuration of life services to ensure that residents can obtain the basic facilities they need in a shorter time. Based on this concept and promotion plan, the city's various forms can have more interpretations and changes. Taking the community as the basic structural unit, which was first proposed by Clarence Perry, later scholars combined the 15-minute travel circle to make it more integrated with specific residential units and people's life scenes and connect the necessities in people's daily lives facilities such as schools and hospitals. As shown in the Figure 1, the 15-minute city combined with community units also makes urban space and functional planning and allocation more orderly and efficient, providing great convenience for people to travel short distances and meet travel needs.



Figure 1: Schematic diagram of 15-minute neighborhoods circle (Photo/Picture credit: Original).

## 2.2 The Sustainable and Advantages of 15-Minute Cities

Governments and urban planning researchers are also promoting the creation of more sustainable and ecological future cities. In the past few years, great progress has been made in transportation, infrastructure, and green layout, activating the inherent potential of many cities(Moreno, 2021). The resulting 15-minute city mapping activity the researchers present is an important starting point that provides an initial overview of the innovation portfolio and analytical methods for collecting experiences, tools, and international practices for the steps of the guide for urban planning and urban transportation(Pozoukidou, 2021). The 15-minute city model aims to create more livable, sustainable, and equitable urban environments, aligning with broader goals of sustainable development and climate action. For access to essential services like grocery stores, schools, healthcare, parks, and recreational facilities without needing a car. Enhanced walkability and bike-ability foster a sense of community by social interactions and encouraging local engagement. And for the environment, fewer car journeys mean lower greenhouse gas emissions, contributing to the fight against climate change. Decreasing reliance on cars alleviates traffic jams and reduces air pollution, leading to better urban air quality. Increased walking and cycling promote the 15-minute city model not only has environmental advantages, but also has positive impacts on health and the economy physical health, reducing the risk of chronic diseases such as obesity, heart disease, and diabetes. More green spaces and reduced noise pollution from traffic contribute to improved mental well-being. For economic benefits, local businesses benefit from increased foot traffic and community support, potentially leading to more vibrant and resilient local economies. Households save on transportation costs, which can be significant over time. 15-minute cities can adapt better to crises such as pandemics by reducing the need for long commutes and enabling easier access to essential services.

At the same time, the economic benefits brought by the 15-minute city cannot be ignored. With increased walking and cycling within communities, local businesses receive greater support, promoting economic prosperity and resilience. These different dimensions of benefits are interconnected and together drive more sustainable and inclusive urban development. Ensures that all residents, regardless of socioeconomic status, have equitable access to essential services and opportunities. Promotes inclusion by making urban amenities accessible to people of all ages and abilities.

By fostering local interactions through walkable neighborhoods and public spaces, the 15-minute city also strengthens community bonds for local events, markets, and communal areas become central to daily life. Reducing the need for long commutes and promoting energy-efficient buildings and infrastructure within 15-minute neighborhoods can lower overall energy consumption. Decreased reliance on fossil fuels, lower energy bills for residents, and a smaller carbon footprint for the city. By addressing these issues through the principles of the 15-minute city, urban areas can become more livable, sustainable, and resilient, providing a higher quality of life for all residents.

## 2.3 The Transportation Within 15-Minute

In recent years, public transportation combined with people's walking travel has attracted more and more attention from all parties. From people's convenient travel circle to subway or bus station, it also provides a reference for the setting of public transportation stations. The continuous growth of the population has aconstantly increasing. At the same time, transportation lines cannot be rigid but need to be flexible to provide people with various combinations among various lines, allowing them to freely choose and match travel modes, and the distance from each point to the transportation station must be relatively reasonable and reasonable. Fair, and the lines cannot be too complicated and stacked. Economy and efficiency must also be considered, combined with sustainable urban planning. Most urban areas with existing public transportation seem to do a good job of making sure stops and routes are laid out intelligently to serve origins and destinations. However, for most people, taking transportation to work or traveling is still not as convenient as traveling by personal vehicle.

## **3** THE APPLICATIONS OF 15-MINUTE CITY

#### 3.1 15-Minute+20-Minute Towns

The 20-minute city is an extended concept based on the 15-minute city, which covers longer distances and

City and Organisation	Definition and policy for 20-Minute city
Melbourne	The concept is all about 'living locally' and giving people the ability to meet most of their daily needs, for return walk from home, with access to safe cycling and local transport options.
Portland	The 20-minute neighborhood is a place with convenient, safe, and pedestrian-oriented access to the places people need to go to and the services people use nearly every day: transit, shopping, quality food, school, parks, and social activities, that is near and adjacent to housing.
Royal Town Planning Institue	20MN are a concept of urban development that has ascended rapidly in the minds of policymakers, politicians and the general public across the world. The basic premise is a model of urban development that creates neighbourhoods where daily services can be accessed within a 20-minute walk.
SUS <b>trans</b> Sustrans	We need to ensure that it is easy for people to meet most of their everyday needs by a short, convenient and pleasant 20-minute return walk, 10minutes there, and 10minutes back,
Scottish	A method of achieving connected and often compact neighbourhoods designed in such a way that people can meet the majority of their daily needs within a reasonable walk, wheel or cycle (within approx. 800m) of their home.

Figure 2: Definition and policy for 20-minute city (Photo/Picture credit: Original).

20 has more complete facilities. Minute Neighborhoods is a platform for supporting strong, sustainable communities, where people can access community services, activities, facilities, social activities, greenery, a variety of buildings, secure pedestrian and bicycle networks, good public transport, and a rich social and cultural life. Making a plan for the zone-based 20-minute program is a placebased approach to planning. It can improve public health and well-being and social outcomes and integrate transportation and logistics optimization, including networks like public transport, walking, and cycling. The essence of the 20-minute zone is its flow and priority pedestrians for 800 meters, 20 minutes neighborhood distance or 20 minutes at a time, based on the average walking distance for a healthy adult and taking into account waiting at intersections and roundabouts.

As the Figure 2 shows, in Melbourne, the policy focus on meeting people' s daily travel needs; while in Portland, their government also emphasize safety and services. As for the royal town planning institute, they are promoting the concept of 20-minute cities around the world, making contributions for both urban planning and urban developments. And for Sustrans and Scottish, they want to ensure it is easy and convenient for people to travel the neighborhoods within 20 minutes. It is quiet different emphasis on the same topic, based on different regions and national conditions, in actual policy formulation, institutions and governments need to consider the specific conditions of cities.

A bike ride would be nice infrastructure for the idea of a 20-minute neighborhood, also suitable for pedestrians and walks. They would move towards pedestrian-friendly neighborhoods create more airspace and create more economically useful places. In addition, walking areas improve healthy lifestyles and skills, and make it convenient for everyone. In Portland, urban planning policies are well integrated with the concept of the 20-minute city, which is reflected in the fact that 90% of residents can meet their daily non-work needs by walking and cycling. The same policy is extended in Melbourne with the concept of 20-minute communities. They replace the concept of private car travel, making travel more efficient and safer, and providing new vitality for transportation. 20-minute travel cities are different based on each community, but they are all planned improvements for public health and well-being. They also make community units more ecological and sustainable and can be completed in 20 minutes based on the community, the basic needs of life are expanded and more infrastructure distribution is reasonably satisfied(Weng, 2019).

#### 3.2 15-Minute+45-Minute Towns

The concept of "45-minute cities" refers to urban planning where residents can meet most of their daily needs, such as jobs, shopping, education, health care, and recreation - within a 45-minute commute through walking, cycling, and public transport. The idea is to expand the "15-minute city" concept, emphasizing even shorter travel times and more convenience for more people. The idea was first proposed in Singapore, and its vision is to provide people with a 'convenient, well-connected, and fast' public transportation system(Abbiasov, 2022). Three main concepts were introduced on how to realize the vision: 20-Minute Towns and 45-Minute City; Transport for All; and Healthy Lives, Safer Journey. Among the three concepts, 20-Minute Towns and 45-Minute City gained wider attention nationwide. This concept means that they must be citizens who can access the center of the nearest district, another 20 minutes to go to work and do business. Centered within 45 minutes with vigorous movement, for example, walking, biking, or riding PMD. In Singapore, their first step is to bring more into the country facilities such as schools, hospitals, shopping centers, parks, and customers closer to neighborhoods. Another strategy is the expansion of walk and bike options available through expansion infrastructure and policies. Walking and cycling options consist of active forms of movement and, such as walking, biking, driving with PMD. For travel options they use public transport and cars provided by Grab and Uber are a great example.

## 4 RECOMMENDATIONS AND PERSPECTIVES FOR THE FUTURE

#### 4.1 Sustainable Urban Transportation

Urban transportation systems are central to sustainable urban development and influence

everything from economic vitality to environmental health and social justice. By combining the principles of the 15-minute city with sustainable urban transport strategies, cities can reduce car dependency, reduce carbon emissions, and create a better livable environment. This research explores how these two concepts can be effectively combined to transform urban areas into greener, more accessible, and sustainable communities. For walking and cycling infrastructure, they significantly reduce carbon emissions. Streets are better designed to be safe and pleasant for walking, with wide sidewalks, pedestrian crossings, and traffic-calming measures. And for bike lanes, protected bike lanes make cycling safe and accessible for everyone. While considering shared mobility services, shared bikes and scooters provide flexible, last-mile transportation options. In terms of evaluating the connection between 15 minutes and further urban circles (20 minutes and 45 minutes city), integrated transportation hubs, use these hubs to connect various forms of transportation, making it easier for people to switch between modes of transport efficiently. Therefore, streets and public spaces are enhanced with greenery, making the city more enjoyable for walking and cycling and improving air quality. Continuous involvement of residents in planning ensures that transportation systems meet their needs and remain sustainable. By tailoring sustainable transportation strategies to the specific needs of 20-minute and 45-minute cities, urban planners can ensure that residents have convenient, low-impact access to everything they need, regardless of the size and structure of their city (Figure 3).



Figure 3: Comprehensive sustainable development for cities (Photo/Picture credit : Original).

### 4.2 Benefits for Solving Congestion Issues

Taking Paris as an example, its clear road network units make the routes for people, bicycles, and other travel modes very clear and definite, which can effectively improve people's travel efficiency and divert traffic during peak hours (Figure 4).



Figure 4: The integrated bicycle and pedestrian network (Abbiasov, 2022).

By planning cities so that all essential services and amenities are within a 45-minute from people's homes, the need for long commutes and car-dependent travel is significantly reduced. This shift can lead to a variety of positive outcomes related to congestion. With essential services nearby, people are less likely to rely on cars for daily needs. This reduction in car trips leads to fewer vehicles on the road, directly decreasing congestion. Even when private vehicles are used, travel distances are shorter, reducing the overall time cars spend on the road. The common usage of public transportation is more efficiently utilized for longer trips, with fewer people driving, leading to reduced congestion on main roads. With citizens using public transportation, there are fewer cars on the road, and the demand for parking decreases, particularly in central areas. This frees up space that can be repurposed for other uses, such as green spaces or pedestrian zones, further reducing traffic congestion. By planning neighborhoods to be self-sufficient, with local services and amenities. This creates a more peaceful and less congested environment. People can use convenient public transportation during peak hours, which greatly

increases the carrying capacity and improves congestion on the roads (Sikorska, 2023).

#### 4.3 New Policies and Regulatory Frameworks

First in Singapore, the concepts of 20-minute and 45minute cities were proposed. This concept was considered to realize transportation services for the majority of the population, advocate healthy and green living and traveling methods, and create safer journeys. In terms of new policies, while we consider the specific conditions of the city, we also need to strengthen the rationality of the layout of transportation stations and improve the efficiency of transportation between different transportation transitions. For transportation network for connect the 15mintue, 20minute and 45minute cities, the local government can Invest in expanding and upgrading public transportation networks, including buses, trams, metro lines, and regional trains, to ensure that all neighborhoods are connected within a 45-minute transit radius. And for transit hubs, each city can develop major transit hubs that seamlessly connect different modes of transportation, for bus, train, bike and waling paths, enabling smooth and efficient transfers and save time for complex transit. Build dedicated cycle highways that connect outlying neighborhoods to city centers, encouraging longer commutes by bike, particularly with the support of ebikes, and provide more convenient equipment for bicycle riders. Additionally, to promote green travel, cities can take a page from the Dutch example and provide more convenient facilities for cyclists. For example, in the Netherlands, Implement a smart, unified ticketing system across all public transit modes, allowing for easy and cost-effective transfers within the 45-minute city. Provide subsidies or tax incentives for the purchase of e-bikes, particularly for commuters who travel longer distances (Ferrer-Ortiz, 2022).

#### 4.4 Incentives for Public Transportation

For the aspect of prices and measures, in terms of public travel expenses, governments can offer reduced fare options, such as student discounts, senior discounts, or off-peak fare reductions, to make public transport more affordable (Chiabaut, 2021). Provide discounted rates for monthly or annual passes, encouraging long-term use of public transportation. And encourage employers to offer transit benefits, such as pre-tax deductions for public transportation costs, or subsidized transit passes for employees. Offer first-time users free or deeply discounted rides to encourage them to try public transportation(Manifesty, 2022). Implement а rewards program where frequent riders earn points or discounts for future rides, similar to airline miles programs.

For improving the convenience of taking public transportation, governments are able to create a seamless travel experience by offering integrated ticketing that allows users to transfer between different modes of transport with a single ticket or card (Nieuwenhuijsen, 2020). Enable easy payment through mobile apps, contactless payments, or smart cards, making the process more convenient. Implement bus-only lanes or priority signaling at intersections to reduce travel time and make public transportation more reliable and efficient(Háznagy, 2015). Offer express bus or train services during peak hours that make fewer stops and minimize travel time.

For environmental-friendly process, governments can provide real-time information about bus and train arrivals through apps or digital displays, helping users plan their journeys more efficiently. Offer incentives like reduced fares or rewards for eco-friendly transportation options, such as electric buses or trains powered by renewable energy. Provide riders with the option to contribute to carbon offset programs, where a portion of their fare goes towards environmental initiatives. Organize car-free days in cities, where public transport is free or discounted, encouraging people to leave their cars at home. Partner with local events, such as festivals or sports games, to offer discounted or free transportation to and from the venue, promoting public transport use. Collaboration with different institutes is important as well, partner with educational institutions to provide free or discounted public transport for students, encourage lifelong public transport habits, and work with businesses to create incentive programs that encourage employees to commute via public transportation, such as rewards or recognition programs. By implementing these incentives, cities and transit authorities can make public transportation a more attractive option, reducing reliance on private vehicles and contributing to a more sustainable urban environment.

## 5 CONCLUSION

This article explores the 15-minute, 20-minute and 45-minute city, combining public transportation to provide a combination and reference for sustainable cities of fast and convenient transportation methods. In the future, people' s routes can reduce transfer time and use less time to reach necessary places. It also enables cities to increase their ability to respond to risks and bear risks when dealing with severe natural disasters or social unrest, and at the same time, they can quickly disperse people to make them safe hygienic.

Through research on different cities, different travel distances and needs, combined with public transportation, we have explored more efficient green travel modes, and at the same time provided a reference for future urban planning and urban route setting. At the same time, the article analyzes the existing urban travel problems at the specific application level based on specific cities and travel circles, and cuts in from different perspectives from multiple dimensions to provide current solutions to solve serious traffic congestion problems. Through the incentive mechanism for public transportation, explore ways to enable more people to take public transportation, and improve the existing model to make public travel more ecological, convenient and sustainable.

In the future, cities can have clearer road grading that combines different modes of transportation, and work with urban planning for roads and daily equipment. Make the city more ecologically sustainable while maintaining a green and ecological travel concept, making the environment better and travel more efficient. Convenient public transportation systems can also solve many urban problems.

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