

Strategic analysis on improving the proximity and accessibility in China: an exploratory development based on the study of the 15-minute city

Junxiang Gong *

HNU-ASU Joint International Tourism College, Hainan University, Hainan, China

* Corresponding author: jgong36@asu.edu

Abstract. Against the backdrop of rapid urbanization in China's megacities, the growing need for accessible and convenient transportation has become more pronounced. The rise of the 15-minute city concept in chrono-urbanism has become increasingly evident in recent years. In this context, the paper presents a comprehensive strategic analysis and explores future possibilities for enhancing proximity and accessibility in urban transportation. The focus is on the exploratory development of the 15-minute city concept. By adopting a qualitative analytical approach, the paper delves into an analysis based on Melbourne's '20-minute city' to assess the applicability and diverse development of the 15-minute city model in Chinese urban centers. By acquiring current data and examples, the findings reveal the strengths and challenges of the 15-minute city concept, underscoring its adaptability and uniqueness across different geographical, national, and targeted contexts. The paper indicates that among megacities in China, the 15-minute city highlights the potential for integrating advanced technology to enhance urban mobility and proximity. It also calls for a shift towards high-quality development in urban planning to strengthen the resilience of city transport. The study's exploratory nature also opens up avenues for future development within the 15-minute city framework, providing a robust base for improving urban transportation in China. The significance of this research lies in its contribution to shaping high-quality and livable urban environments, thereby supporting the ongoing transformation of China's large urban centers into more accessible and human-centered spaces.

Keywords: 15-minute city, Accessibility, Urban Public Transportation, Transportation Modes, Proximity.

1. Introduction

With the rapid development of China's economy, cities like Shanghai and Beijing are now grappling with the unintended consequences of rapid urbanization. At the same time, the explosion in the number of cars has caused the streets to be frequently clogged with traffic. Beijing, for instance, has seen its roads groan under the weight of over 6 million vehicles, painting a tableau of urban gridlock that brings entire districts to a standstill [1]. In addition to the immediacy of traffic congestion, China, with its large urban population, is also experiencing a significant aging trend [2]. These growing elderly demographic, considering the long-held beliefs, body health, travel habits so forth, is a huge power that can lead to the great alteration of the Chinese transportation structure, which can cause a big collision with the current transportation system. Implications coupled with the sheer volume of inhabitants, have begot declination of satisfaction with public transport, limited level of walkability around the city, and traffic system equipment maintenance problems——necessitate innovative transportation strategies.

Moreover, as cities expand and public transport becomes more saturated, urban dwellers find themselves living further from essential amenities, from grocery stores to hospitals. This expansion has led to a dependency on vehicles, both private and public, escalating pollution levels in these cities. For instance, despite efforts to combat air pollution, cities like Chengdu and Tianjin have faced days where particulate matter levels soared past acceptable thresholds, emphasizing the environmental cost of this vehicular dependence. Yet, this evolving urban crisis is not without its silver linings. The rapidly changing dynamics have necessitated a reevaluation of conventional urban planning paradigms. Past data, though valuable, often fails to capture the nuance and fluidity of contemporary

urban Chinese life, prompting the search for innovative frameworks. One such emerging concept is the 15-minute urban living circle. Pioneered in cities like Paris, this model envisions a city where every essential service is accessible within a 15-minute walk or bike ride. In addressing the multifaceted transportation challenges inherent in China's mega-cities, the implementation of the 15-minute living circle presents an incomparable advantage by fundamentally restructuring urban mobility patterns to reduce commute times and alleviate congestion, thereby significantly contributing to the enhancement of overall urban efficiency and residents' quality of life.

This research delves into the strategic analysis and exploration of enhancing transportation proximity and accessibility in China's large cities, through the lens of the 15-minute urban living circle. By juxtaposing China's unique urban challenges with the potential of this model, the ultimate mission is to chart a path for future urban mobility solutions. Solutions that are not only efficient and sustainable but also resonate with the lived experiences of China's vast urban populace. Through this exploration, we seek to offer insights that can shape the next chapter in China's urban transportation narrative, ensuring cities that are both vibrant and livable.

2. 15-minute city definition and scale

The "15-minute city" paradigm, based on European urbanistic theories, proposes that residents should access key facilities within a 15-minute walk or bike ride. The concept of the 15-minute living circle defined the fundamental unit of urban space. Conceptually, it comprises two parts: "15 minutes", concentrating on the fundamental necessities of life at the community level, and "life circle," emphasizing the necessity of basic service functions and public activity space for life [3]. Determining community unit scale involves time, space, and population scales, forming the community scale reference system [4]. This feature is reflected in the concept of a 15-minute life circle, which consists of a 15-minute walk, a radius of 1 km, and a population of 50,000 to 100,000 people [5]. The relevance of geographical scale and population scale was previously emphasized in community unit models like the neighborhood unit, and residential district. Shanghai launched the exploration of life circle planning earlier in China with cities like Beijing, Jinan, Changsha, and Zhengzhou following suit [6]. However, China's 15-minute city construction remains a regional experiment, lacking national prominence and popularity. International examples, like the 15-minute city in Paris, the 20-minute city proposed by American scholars, the 20-minute neighborhood in the US and Australia, and the 20-minute town in Singapore, also focus on time scales. This paper references city zoning based on time, not exclusively the "15-minute city."

3. 15-minute city Advantage and Controversy

Exploring the role of the 15-Minute City in Chinese urban environments necessitates a careful examination of its intrinsic strengths and weaknesses. This section explores how the principles of the 15-Minute City can be integrated into China's urban transportation and planning landscape. It assists in uncovering possibilities and challenges without preconceived conclusions, fostering educated and exploratory discoveries.

3.1. 15-minute city advantage

3.1.1. Utilization of Diverse Modes of Transportation

The 15-Minute City offers an integrated urban transportation approach, accommodating various modes of transport, from bicycles to pedestrian walkways and public transit. By incorporating these diverse transportation options within a 15-minute radius, traffic congestion is minimized, enhancing sustainability. This multiplicity of transportation alternatives has achieved great advantage in places such as Copenhagen. The city plans an extensive network of bike lanes, pedestrian-friendly paths, and efficient public transportation networks to encourage alternate modes of transportation, thereby, minimizing traffic congestion. Under the impact of this strategy, over 40% of Copenhagen inhabitants

use bicycles as their major form of transportation, resulting in fewer automobiles on the road, lower pollution, and less traffic congestion.

3.1.2. Comprehensive Local Facilities and Infrastructure

In this concept, strategically locating facilities reduces the need for long-distance commuting, ensuring that essential services are within each urban section's reach. As a result, the volume of cross-city traffic has reduced. A successful example of this can be seen in Barcelona's superblocks model. Pedestrian zones, green spaces, and accessible amenities reduce the need for vehicular movement. Data have shown a 21% reduction in traffic within these blocks, decreasing congestion not only within districts but also in buffer zones between different areas [7].

3.1.3. Advancement of Public Transportation

A well-integrated and efficient public transportation system is central to the 15-Minute City model. Personal vehicles can be substituted for a sustainable alternative. This shift significantly lowers the urban carbon footprint and pollution levels. Singapore's public transport system, renowned for its efficiency, serves as a case in point. With a 67% share in morning peak travel, its contribution to reducing the city's carbon emissions and traffic congestion is substantial [8]. Buses and trains are designed to be low-emission, ensuring an eco-friendly, green transit infrastructure.

3.1.4. Enhanced Accessibility through Public Transportation

Public transportation in the 15-Minute City model is not just about moving people; it's about connecting communities efficiently. Increased use of public transit systems enhances the city's overall accessibility. With a 95% customer satisfaction score, Vienna's public transit system epitomizes this mentality. A single ticketing system connects buses, trams, and metros, simplifying journeys, improving accessibility, and dramatically reducing travel times. The city becomes more navigable, inhabitants enjoy a greater standard of living.

3.1.5. Standardization of Traffic Regulations within the Living Circles

In the 15-Minute City, standardization of traffic rules and regulations is essential for fostering efficient and safe mobility within the living circles. Tokyo, a city known for its stringent traffic rules and meticulously planned zoning regulations, provides a blueprint for this aspect. Despite the city's high population density, effective traffic management ensures fluid mobility. Each district operates under autonomous traffic management protocols, yet aligns with a centralized regulatory framework, creating an environment where movement is not just facilitated but is efficient, safe, and sustainable.

3.2. Controversy

With different aspects' advantages, the 15-minute City mode has been questioned by throngs of people under certain social circumstances. So, it is inevitable that a variety of challenges emerge in building and bettering 15-Minute City.

3.2.1. Utopian Illusion

Critics often label the 15-Minute City as a utopian fantasy, an imposition that can potentially restrict individual freedoms. Critics argue that the focus on localized living might limit choices and mobility, potentially stifling the dynamism of expansive urban landscapes. The challenge lies in finding a balance between efficiency and urban spontaneity.

3.2.2. Lack of Future Orientation

The 15-Minute City, though progressive, faces scrutiny for its adaptability to evolving demographic, vehicular, and infrastructural trends. Critics point to historical urban planning paradigms, such as the Neighbourhood Unit Theory, arguing that the new model, in essence, is a reiteration rather than an innovation [9]. For example, certain design principles underpinning the 15-Minute City echo the structure and ethos of the Garden City movement, raising questions about its novelty and adaptability to future urban challenges.

3.2.3. Community Merging Limitations

Another contention is the perceived simplicity of merging adjacent communities without substantial innovation. Critics suggest the model is merely a rebranding of existing urban layouts rather than a transformation [10]. Enhancing inter-community connections and creating a more integrated urban experience is essential. This involves integrating community centers into the web of activity hubs, limiting expansion while fostering community cohesion.

4. Melbourne's "20-Minute Neighbourhood"

Having assessed the theoretical and practical dimensions of the 15-Minute City, an examination of global implementations aids our exploration. This paper pays attention to case studies in Melbourne. This instance provides empirical insights to evaluate the model's adaptability and potential integration in the complex urban narratives of China, enhancing the rigor of this paper's exploratory analysis.

4.1. Melbourne's "20 Minute neighborhood" vision in transportation aspect

The Melbourne City Council advocates for a "living locally" way of life, praising the value of using neighborhood services and active transportation. In terms of the planning strategy, the "drawing circle" of neighborhood space, which means city spaces determined the boundaries of a neighborhood or residential area by authority, is less significant than the agglomeration of public activities in the neighborhood center, which embeds the neighborhood center into the urban activity center system and connects with the development control, while the suitable walkable radiation range around the neighborhood center focuses more on the urban design of public space (Fig. 1) [11].

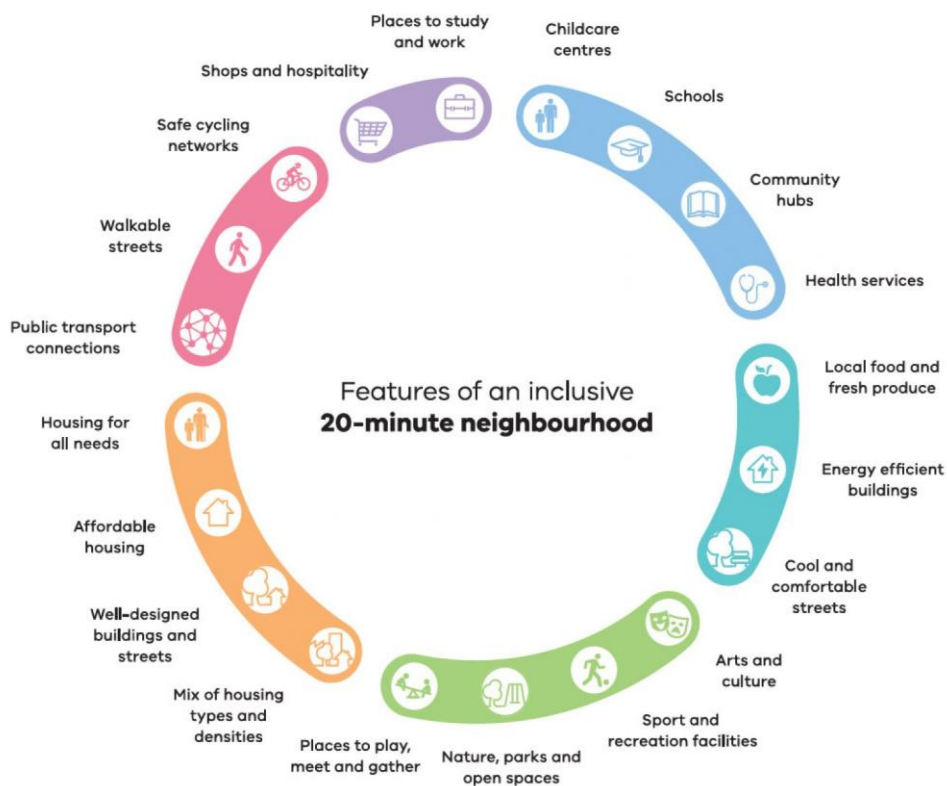


Figure 1. Australia's 20-minute neighborhood [11].

4.2. Melbourne's "20-Minute neighbourhood" strategy

Melbourne's 20-Minute Neighbourhood concept epitomizes a holistic approach to urban development, seamlessly weaving together meticulously phased planning and both macro and micro perspectives, complemented by a dynamic assessment mechanism. Initially, the city adopts a

progressive stance, revising planning provisions intimately tied to pivotal projects and the blueprinting of community activity centers. As a result, this initial phase harmonizes regulatory scaffolding with tangible urban developmental initiatives, ensuring a grounded and pragmatic inception.

Strategically, Melbourne’s model is intricately designed to a phased development plan and dual-scale perspectives. In its foundational stage, a systematic revision of planning provisions is observed, marked by emphatic associations with major projects and the strategic blueprint of community centers. A harmonious synchronization between regulatory adjustments and tangible urban developmental actions is a notable characteristic, yielding an empirically grounded commencement to the urban metamorphosis.

Subsequently, the developmental trajectory transits into a phase characterized by cooperative management. Here, government and residents morph into collaborative entities, steering the city’s evolution. The neighborhood’s enhancement is a product of this participatory approach, culminating in an urban environment reflective of collective aspirations and governed by shared ownership.

On another front, policies at the macro scale foster the genesis of mixed-function neighborhoods. Significantly, the symbiotic relationship between transport infrastructures, like the Metro Tunnel, and residential areas comes to the fore[11]. This integration paints a picture of a city where seamless connectivity is a conduit for localized employment, enriched social interactions, and enhanced neighborhood engagement.

Conversely, at the micro-scale, Melbourne’s strategy exhibits detailed finesse. A considerable focus is devoted to the granular aspects of urban living. Specifically, commercial zones witness a strategic reduction in speed limits, a move aimed at bolstering pedestrian safety and enhancing the walking experience. Additionally, the revamping of road signs stands as another meticulous effort to augment navigational ease and safety. Elevated zebra crossings are indicative of a city where every detail is attuned to elevating the pedestrian experience, underscoring safety and mobility as core tenets of the urban developmental agenda. Innovative conduct is that the city’s suburbs, characterized by expansive green spaces, are encased by systematically designed tree-lined avenues, a testament to ecological integration and urban design (Fig.2) [12]. Pedestrian and cycling paths are marked with precision, offering clear navigation while limiting vehicular interference. The intersection of large transport means is redirected to vertical crossings, ensuring undisturbed green space usability. These planned interventions, rooted in empirical analysis and spatial design precision, demonstrate an equilibrium between urban mobilization, safety, and environmental preservation, offering a cohesive and articulate perspective on urban ecology and mobility enhancement.



Figure 2. 20-Minute neighbourhood of Melbourne [11].

In the final phase, the evolution of the city culminates with the incorporation of a dynamic assessment mechanism, anchored in community index monitoring. Indeed, it’s a reflective phase where insights are perpetually gleaned and integrated, ensuring an adaptive and responsive cityscape.

In light of China's urban planning exploration, Melbourne's model offers invaluable insights. It underscores a balanced integration of macro and micro developmental initiatives within a phased, adaptive framework. Particularly, the detailed attention to micro-level initiatives provides a rich repository of insights for enhancing pedestrian safety, mobility, and the overall qualitative experience of urban living. Thus, every element, from speed limit adjustments to enhanced signage and pedestrian crossings, could be meticulously evaluated for potential integration into the urban landscapes of China's sprawling cities, aligning with the explorative analysis underlined in this study.

5. 15 minutes Urban inspiration and self-renewal for the development

5.1. Smart city technology

In the context of evolving urban landscapes, the 15-Minute City model has surfaced as a beacon of innovation, particularly illuminating pathways to refine and redefine urban transport systems. The concept is not isolated but finds its resonance and practical application when intersects with the advent of smart city technologies. Take, for instance, the seamless integration of autonomous driving technology into public transit systems. Cities like Singapore have begun piloting autonomous buses, underscoring a future where technology and urban living converge to enhance transport efficiency and reduce congestion. Moreover, the application of sensors and big data analytics in traffic management is no longer theoretical. In Los Angeles, for example, the Adaptive Traffic Control System has been instrumental in optimizing traffic signal timings in real time, responding to the dynamic flow of vehicular traffic [13]. Data informs decision-making, leading to a 12% reduction in traffic delays and contributing significantly to the mitigation of traffic congestion, a prominent challenge in modern urban centers.

5.2. Green nurturing

Parallel to the technological innovation, the physical layout of the cityscape is paramount. Drawing insights from Melbourne's urban planning, pedestrian zones and green corridors in the city's heart are not casual incorporations. The urban design, informed by data and strategic foresight, serves as visual and practical incentives for walking and cycling. Especially in a 15-minute city, the harmonious integration of nature within the urban areas not only enhances aesthetic appeal but also facilitates an intuitive shift towards more sustainable modes of transit, reducing car dependence and alleviating traffic congestion.

5.3. Underground transport

Integrating the "15-Minute City" ethos deeply into the fabric of underground transportation can revolutionize urban mobility in China's expansive cities. Ma et al. [14] forecast, Beijing's population peak in 2030, then stabilize at around 20 million by 2040, traditional surface solutions are insufficient. By designing underground transit hubs as community-centric spaces, replete with amenities and services, the ethos of local living can be amplified. For example, envision Beijing Metro Line 6 stations not just as transit points, but as localized community hubs underground, local stores, recreational zones, and more [15]. Such a fusion not only promotes efficient travel but also reshapes urban lifestyles, ensuring that daily necessities are a mere subway stop away, epitomizing the "15-Minute City" in the subterranean realm.

6. Conclusion

This paper meticulously analyzed possibilities for enhancing transportation proximity and accessibility in China's major cities, employing an exploratory approach rooted in the 15-minute urban living circle concept. The findings in this paper initially underscore the inherent strengths and challenges tied to the 15-minute urban framework.

The assessment highlights potential meritorious lightspots of 15-minute city modes of transportation. Through its appropriate deployment, advancements in public transportation and various transportation facilities and tools can be promoted and optimized, thereby achieving accessibility and convenience throughout the city region. At the same time, the 15-minute mode, reshaping the road space, is a revolution long required by “design for all” urban design criteria, especially under the current situation of the aging population scenario. In contrast, with latent challenge and questions of critics including a lack of future orientation, the 15-minute city contains uncertainty and variation which still need to discover testaments to prove its practicability and feasibility of addressing future public transportation conundrums.

The comprehensive analysis of Melbourne's implementation progresses the views on the 15-minute city's diverse trajectories and unique developments across regions, nations, and objectives. This assessment emphasizes implementing different stages of planning, combining diverse actors' participation and overall consideration, to realize a miniaturized ideal urban transportation web for propinquity and accessibility.

Inspired by but not restricted to an array of potential extensions for the 15-minute urban paradigm, some advancing transportation endeavors fortified the foundation for China's urban transportation development: Given the reality of the 21st century, on the one hand, people entail pay attention to cutting-edged technology which can better urban mobility and proximity. On the other hand, a shift in the mindset of urban planning is that high quality development amid urban transportation needs to be focused on enhancing city's transportation resilience.

Moving forward, a deeper exploration of the integration of advanced technological solutions, coupled with socio-cultural adaptations in distinct regional contexts, opens up the possibility of a hybrid, inclusive, multitask accessibility that prioritizes the integration of urban density with transport capacity, alternating timetables, and coworking hubs. This may represent the next frontier in urban transportation research.

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