A Critical Review on Transitopia of Tomorrow as a Solution of the Transit System to Stimulate the Use of Public Transportation to Make Cities Liveable

Snigdha, Charu Nangia, and Manoj Kumar

Abstract Urbanization has caused cities to grow horizontally, leading to issues with urban sprawl, longer commutes, and a rise in the demand for private vehicles, all of which have a negative impact on the environment. Adding new mass rapid transit systems (MRTS), such as metro railways and bus rapid transit systems, has boosted public transportation in many cities in order to address issues and fill in gaps (BRTS) [1]. However, in order to create liveable, healthy, and intelligent cities, it is crucial to utilize these systems effectively. Urban transportation is a serious concern in today's megacities. The transportation network extended and evolved to cover the new urban fabrics and connect them to the rest of the city because of considerable urban expansion and population growth. It is quite challenging to achieve growth and development, especially in developing cities. Urban transportation is facing a new issue due to the ever-increasing population of urban regions. The difficulty with which these options can be used to meet the current requirements as well as the constraints on the options' availability, space, and relationships with one another increase the complexity of the issue. The need for speedier communication, travel, and transportation is increasing quickly as the world gets smaller [2]. Technology both facilitates and offers answers for this process, functioning as both a catalyst and a supporter of it. Planners and engineers are interested in finding solutions for urban transportation, despite its complexity and difficulties. Public transit, or PT, is one such option that has shown promise in addressing the aforementioned issue. This paper explores the potential of TOD and IPT, as well as its viability in a developing country like India. This novel kind of urban transportation is thoroughly discussed in the paper, along with the transportation needs and potential use and solution for this technology to address them.

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Introduction: India is rapidly urbanizing, with urban population growth outpacing that of the country's overall population. India is up against the world's fastest growing nations. Urban sprawl issues were brought on by the cities' horizontal growth resulting in urbanization. Trip lengths have risen, private vehicle use has increased, there are pollution issues, and infrastructural needs have expanded as a result. Many cities have improved their public transportation systems to deal with these problems. To make cities liveable, healthy, and sustainable, it is crucial to combine land use and transportation infrastructure effectively [3].

Transitopia of Tomorrow: Transportation options are widely recognized as facilitating access to education, employment, and leisure activities, but they are also the source of many issues that cities face. Identifying the significance of change is needed to prevent the future of transportation from being dystopian. So to understand the need for alternative methods, think about planning for sustainable utopian transport. The mobility of people and goods, the physical aspects that support and inhabit mobility, and the governance framework with respect to formulating and implementing transportation policies and minimizing the negative effects of traffic on the environment to make the city liveable, sustainable, and healthy are the three components of the transportation system that should each be separately "utopianized" in Transitopia.

1 Urban Mobility Index in Transit-Oriented Development Zone

Urbanization is now occurring at the fastest rate ever. Urban agglomerations will be home to more than 5 billion people by 2030. With the urbanization of the world, a new age of prosperity, economic growth, and resource proficiency will start. Mobility is a key factor in urban economic growth [4]. It is true to say that the modern city's rise is based on mobility. Only improvements in mobility have allowed cities to grow from the mediaeval metropolis, where all moves were on foot, to today's enormous agglomerations. However, transportation systems need to change significantly, as cities develop.

When faced with a growing population, can a city that occupies a fixed area reduce congestion? Would it be possible to stop the lengthening of journey times as more people wish to travel? Can a city sustain or even improve its quality of life with or without making large expenditures on its transportation infrastructure? So on.

The demand for transportation in cities must be met through the effective and seamless use of already available transportation infrastructure and urban space in order to minimize bottlenecks by minimizing the frequency and length of vehicular

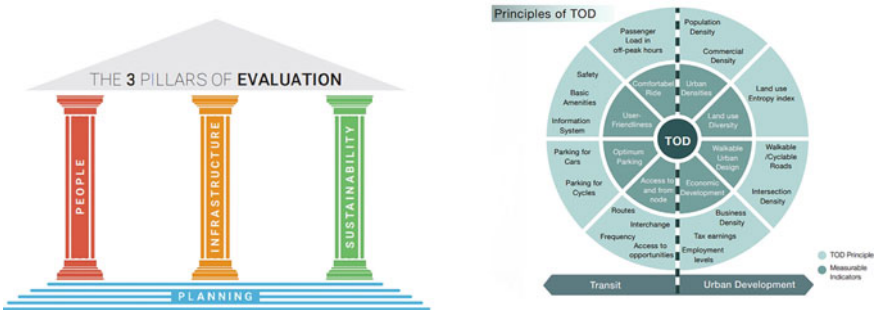


Fig. 1 Principles of TOD and measurable indicators (*Source* http://moud.gov.in/link/urdpfi-guidelines.php)

trips as well as the transit ridership itself. Less noise and air pollution, as well as lower greenhouse gas emissions, are the projected results of these initiatives. In metropolitan regions, there is worry over the growing influence of transportation on the environment, particularly the quality of the air [5]. Consequently, the innovative urban objective is to develop sustainable mobility based on eco-friendly modes of transportation. With a proper modal share of various modes of transportation and by figuring out how to provide transportation services in cities, sustainable mobility should satisfy the transportation demands of all groups.

Assessment of cities' accessibility in three crucial areas: sustainability, infrastructure, and people. These factors are frequently cited in statements of visions, aims, and goals, as well as in mobility planning papers for cities all over the world, which makes them a natural fit for the pillars of the Ease of Moving Index. Utilizing the Three Pillars of Evaluation—People, Infrastructure, and Sustainability—we can assess the general mobility of a city. Among the main dimensions of evaluation, the Accessibility of Moving Index would include details on how easy it is to relocate to a specific city [2]. How should my city develop going forward (Fig. 1)?

2 Pillars of Evaluation

Urbanization is a current and future trend since more than partial of the world's residents now live in cities. This number is projected to increase to 6.5 billion by 2050, or two-thirds of the completely human population. Urbanization offers a variety of opportunities and difficulties that call for planning with the goal of achieving an ideal coexistence and viable growth [6]. Metropolises all over the world have come to the realization that if we are to achieve the global agenda on sustainable development, our approach to planning and managing urban areas must undergo a profound transformation. In actuality, what makes cities distinct from one another are the different urban transportation systems that they have created to negotiate their

particular surface topography and urban consequences density, demographic trends, and form.

Urban mobility is defined as the movement of individuals through a Mode between a journey's senders to the receiver. Based on the assumption that people migrate to obtain housing, jobs, and amenities including education, health, recreation, etc., designing for urban mobility is necessary. Additionally, they anticipated that as cities improve and community grows more rich, users will prefer motorized transportation over non-motorized transit since the former is more practical and viewed as being more time-efficient than the latter. These assumptions may not be true, particularly in the current climate where technology has helped to modify perceptions about how people travel and how cities function. Due to the development of e-mobility and mobility as a service, commuters no longer need to move in order to access services. Due to growing public awareness of the negative effects that motorized mobility has on the environment, human health, and other factors, as well as the increasing acceptance of non-motorized transportation (NMT), such as travelling and walking, the trend of the future of mobility, as we currently understand it is changing.

As Shanghai Declaration on Better Cities, Better Life "Cities should respect nature, view the urban ecological environment as a resource, include environmental concerns into urban **planning** and management, and quicken the shift to **sustainable** development. They ought to encourage the development of low-carbon eco-cities and the utilization of renewable energy sources. They should fervently support resource preservation and **infrastructure** that is friendly to the environment [7]. Cities and their **citizens** should work together to develop ecological civilizations and sustainable lifestyles that allow people and the environment to coexist together." The four key principles of urban mobility—planning, infrastructure, and sustainability—are endorsed in this proclamation. We observe significant influences in India, in which the National Urban Transport Policy of India (NUTP), enacted in 2006, is considered as the cornerstone of Indian mobility [3]. According to the National Urban Transport Policy (NUTP) of India, our cities are the most liveable in the world and have the capability to become the "engines of economic growth" that drive India's development in the twenty-first century. Recognizing that people are at the centre of our cities and that all planning is for their benefit. Allowing our cities to grow into an urban shape that is most appropriate for the unique topography of their locations is the best approach to promoting the fundamental, social, and economic activities that take place in cities.

3 Global Trends Challenges and Forecasts

Although the transition to a largely urbanized world situated formally recognized everywhere, it acquired more than ten years to begin developing multinational regulatory frameworks on climate, sustainability, and biodiversity. Local and regional governments have aggressively embraced change alongside national governments,

and occasionally even more actively. They are on the front lines of everyday difficulties, including an extensive range of stakeholders from the communities and the commercial region. The most urgent issues affecting communities worldwide are those related to transportation, health, environmental responsive infrastructure, air index, and emissions. Cities now rely on quicker environmental transformation and adaptability as a result. This is taking place in the midst of more extensive industrial developments taking place on a worldwide scale, comprising digitization and expansion of on-demand mobility, which have prospective to greatly aid in the expansion of viable mobility approaches [1]. However, the leap from dispersed experimental tactics to major structural changes still needs to be in the world.

The Commonwealth of Independent States has seen an increase in the trend of car ownership during the last ten years. Nevertheless, because initial reference levels were low, these countries' motorization levels are today noticeably lower than those of industrialized nations; however, the ratio of automobiles per 1,000 people in several of these countries' largest cities is approaching 300–400, and it is expected to continue to climb. The majority of countries had seen increases in both the number of privately owned automobiles and the number of kilometres travelled per person in automotive usage (and the trend continues in many).

Local governments and civil society are pushing in the opposite direction in various parts of Europe because they believe that private car ownership and private car mobility, especially in cars that use fossil fuels, are major obstacles to living sustainably [8]. The recent significant social unrest in France, which was the idea of raising the price on fossil fuels, particularly diesel, in order to finance a more carbon–neutral economy, demonstrates that the equation is not that straightforward. Along with the ideas, steps were to lower the posted speed limits on the nation's roads. Car ownership is not just seen as a lifestyle choice that may be altered to fit current trends in the peri-urban and rural areas surrounding France's major urban centres.

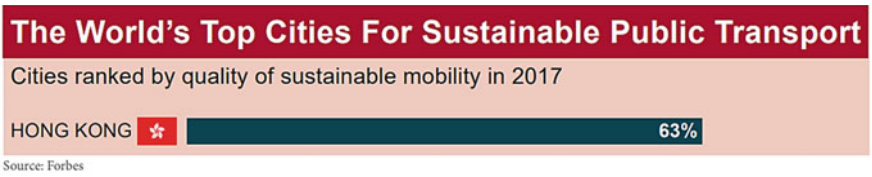
Global trends, whether they are related to electro mobility, shared mobility, or active mobility, are altering mobility patterns throughout the UNECE member nations and having an impact on transportation systems and cars. Industry, society, and urban governance are impacted by this. Urban patterns and mobility difficulties can be rethought in many ways, thanks to the economy's rapidly growing digitization, but doing so will require future cross-sectoral and multi-stakeholder collaboration.

4 Remarkable Success in Transit-Oriented Development

4.1 Case Study—Hong Kong

Geographical constraints have caused Hong Kong to grow into a dense metropolis. The public transportation network has expanded alongside the growth of the city to accommodate citizens. One of the most effective and diverse public rail networks

in the entire globe is Hong Kong. The city's vitality depends on its mass transit systems. A rail Transit-Oriented Development (TOD) has the ability to provide a superior alternative to private transportation in metropolitan areas and considerably enhance the quality of life for people by blending residential needs with alluring public transit options. It has been placed as the leading supplier of light rail, tramway, and metro conveyance in Hong Kong [9]. The World Bank (2019) ranked 14 cities with exceptional TOD achievement and chose Hong Kong as one of the top three benchmarking cities in its report, "Benchmarking Transit-Oriented Development."



The largest number of individuals who use public transportation is in Hong Kong. Public transportation accounts for 81% of all journeys undertaken in the city, with 12.4 million passengers boarding each day (Fig. 2).

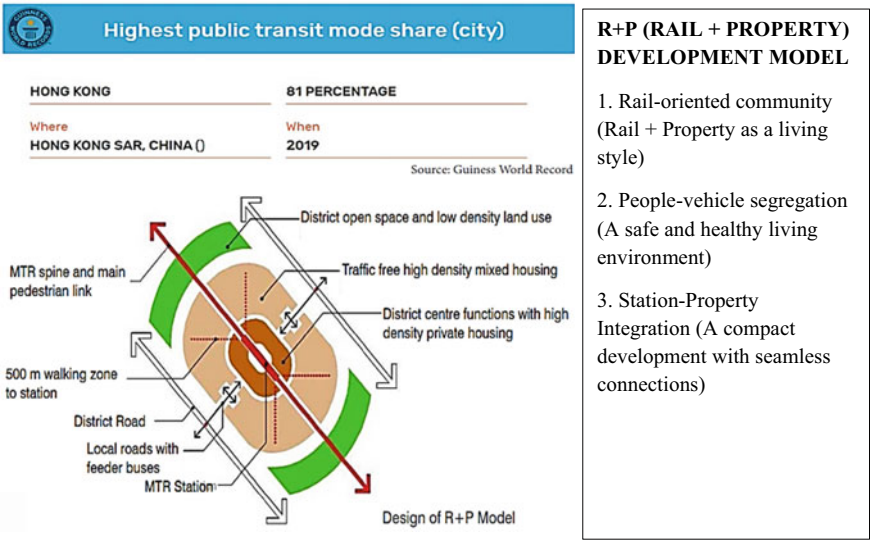


Fig. 2 Design of R+P Model in TOD Zone and measurable indicators (*Source* http://moud.gov.in/link/urdpfi-guidelines.php)

Fig. 3 Demand estimation and route network design technique (*Source* Author)

5 Ideologies of TOD in Hong Kong

The five "Ds" Approach of TOD applicable in the case of Hong Kong (Fig. 3).

6 Ease of Access and Growth Versus Congestion

> A city living on total automotive dependence becomes dysfunctional, inefficient and inconvenient for life. The goal of the transport system is to move people, not vehicles [10].

Urban transportation experts concur that traditional and developed cities don't elongate at ease to living as an outcome of the unchecked increase in the usage of privately owned cars. Urbanization and population growth increase the need for transportation, population mobility, and concomitant difficulties with access to some metropolitan areas, travel destinations, and transportation services. Large metropolitan road networks get congested because transportation demand exceeds the capacity of the available road infrastructure. Major city administrations have long viewed expanding the capacity of urban highways through their rehabilitation and development as the primary method of reducing traffic congestion [11]. The paradigm of "planning for vehicles in cities" served as the foundation for the respective transport planning theories that were adopted during the century noted for "rapidly growing motorization." The practise has demonstrated that these attempts to address the problems of enhancing accessibility to urban areas and reducing congestion never produced long-term favourable results of the creation of so-called "induced" mobility [12].

The reality of rising car ownership rates that have significantly exceeded the growth of urban road networks, as well as rising pollution and environmental damage brought on by increased road infrastructure, have emphasized the necessity for an innovative paradigm for urban transport development. The idea of "sustainable urban transport" or "sustainable mobility" is sought to retain the population's mobility by moving transportation demand towards safer and more environmentally friendly types of transportation, or "urban mobility planning" [13]. However, despite all

the advantages of this strategy, which is adopted in many large cities, it is still a result of the specific transportation needs for which the public transportation system was created. Forecasting metropolises and transportation infrastructure nearby motor vehicle traffic flow remains to have significant negative externalities related to transportation activities in particular, resulting in 1,250,000 deaths annually from traffic accidents and 3,200,000 deaths annually from air pollution. It is obvious that we need to change the current transport paradigm and concentrate efforts on building vivacious, vibrant cities that can accommodate people's daily activities. A rising number of experts are beginning to recognize the significance of this method of urban planning.

7 Comprehensive Mobility Plan (CMP)

Comprehensive Mobility Plan (CMP) is introduced in Indian cities by the Ministry of Urban Development as a toolkit, for Sustainable Urban Transport with the support of Global Environment Facility under the influence of the National Urban Transport Policy [14]. The main objective is to provide desired ease of access and mobility patterns for residents in the urban cluster. It emphasizes the mobility of people to address the issues and problems towards urban transport and encourage good practice around the globe which is essential for cities. The objectives of the tool kit were prepared to enhance the mobility pattern of residents rather than of vehicles, advancement of public transport, NMVs, and pedestrians in the context of Indian cities. The Sustainable Mobility Plan is a method to deal with transportation concerns efficiently [15]. In the existing practices, the governing outlines are formulated on a participatory approach for sustainability and an integrated approach to outline the vision, objectives, and measurable targets to review the costs and benefits of transport. CMP emphasis on four substantial essentials to promote sustainable urban mobility in the cities includes transit system, Land use, NMT, and Public Transport.

8 Lessons Applicable to Indian Cities

The outcome of the study is to provide steadily rising number of city residents with sustainable, rapid, comfortable, inexpensive, and safe access. This is intended to accomplish by

- **Local Area Planning for TODs**: Effective planning for TODs begins at the regional scale followed consistently by the level of station area planning, as evident in the case of Hong Kong.
- **Station Area Planning**: In India, the absence of station area planning and integration of adjoining private developments as part of the overall station design has led to substandard development, which is adjacent to transit. MTR station and its

above-station property development are excellent examples of TOD value capture [16].

- **Strategic Intensification along transit corridors**: High-density, high-rise development concentrated along strategic transit interchange nodes is a stable feature amongst a majority of Hong Kong's transit stations.
- **Design of the Public Spaces alongside Station Development**: Emphasis on, physical integration of R+P project with stations and surrounding buildings, vertical connectivity for pedestrians at above ground levels and vehicular connectivity at ground floor level and underground levels, integrating in-station retail with pedestrian footbridges and corridors; and presence of high-quality public spaces are some of the elements that have contributed in enhancing the overall quality of life and increased property values.

9 Issues and Gap

The types of pollutants produced by cars in cities that are contributing to an increase in air pollution have been the focus of numerous specialists' investigations. In several studies, researchers made an effort to monitor various data, including AQI of various city neighbourhoods, and then compare the primary data acquired with National Ambient Air Quality Standards to identify areas with high pollution levels. In megacities, some academics have tried to explore the connection between traffic congestion and air quality, while others have looked at how traffic congestion affects air pollution, which has had a negative impact on health, and still others have attempted to investigate the relationship between public transportation and its environmental impact. Some scholars have recently discussed vehicle air pollution in terms of CO_2 emissions, while others have attempted to examine the failure of TOD in terms of public transit. A few researchers have attempted to discuss modes of transportation in some studies, with the findings that vehicular congestion is the major cause of air pollution, and that the cause of vehicular congestion is a lack of proper connectivity and a shortage of public transportation within the city [17]. There was no thorough study that could highlight the various effects of traffic congestion in a city or the connection between transit-oriented development and urban mobility. In order to improve public transportation and investigate the effects of traffic congestion in the city, it has been decided to undertake thorough research and propose a recommendation on last-mile connection and TOD strategy [8].

10 Parameters of Evaluation

All around the world, there is a focus on assuring connectivity, ease of access, and sustainability. The Indian Government's Ministry of Urban Development (MoUD) has lately published a study titled Livability Standards in Cities that examines how

Fig. 4 Parameters of evaluation and measurable four key components of urban mobility (*Source* Author)

liveable Indian cities are [10]. The study names transportation and mobility as essential principles of assessment, highlighting mobility's importance in urban development and its commitment to enhancing the standard of living for Indian city dwellers [18]. When previous efforts by different organizations working on urban mobility are analysed, it is evident that mobility planning is prepared with a vision that is in accordance with the overall goals of sustainable development. A prime example of such a multinational endeavour was the Shanghai Declaration [19]. The Shanghai Declaration on Sustainable Communities, Better Standard of Living, which is identified as a major statement leading the world towards liveable cities, was signed by 192 countries in 2010, including India. This proclamation identifies consumer, governance, infrastructure, and sustainability as the four essential elements of urban transit (Fig. 4).

11 Conclusion

The outcome of this study is on how transit systems affect land use, which raises crucial questions about the locations, types, and costs of development projects, as well as accessibility issues and traveller preferences and performance. By focusing on parameters of evaluation, which include principles of TOD variables and measurable indicators of mobility patterns, the study seeks to uncover the traits of urban

transportation users, cars, modes, infrastructures, and services [20]. The strategies and recommendations for reducing traffic congestion, last-mile connectivity, and the environmental effects of transportation are required to investigate the effects of these elements on commuters' travel characteristics and mode selection choices. The indices outline critical goals to help each index achieve its objectives, but they are not viewed as least significant as achieving sustainability metrics. Based on the above case studies, the attributes and indicators are categorized to review the quality assessment to identify the intention of people from public transportation to private vehicles. Once the cities are willing to compete with fundamental knowledge of TOD and sustainable practices across and within various sectors of urban development, this index might be more advantageous in assessing efficiency guidelines for reimagining mass transit pertaining to urban mobility as a sustainable solution.

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