

Advantages and Success Factors Analysis of TOD Mode

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Abstract: The main issues currently facing urban transportation include traffic congestion and insufficient use of public transit, which not only affect the operational efficiency of cities but also exacerbate environmental pollution. The Transit-Oriented Development (TOD) model is an urban development approach that focuses on high-density land use and convenient public transportation systems to reduce reliance on private vehicles and promote sustainable urban development. The TOD model has demonstrated significant advantages in urban development, such as reducing traffic congestion, lowering pollution, fostering economic growth, and enhancing quality of life. This study explores how implementing the TOD model can alleviate urban traffic congestion and improve residents' quality of life. Our findings indicate that TOD initiatives can lead to a 20% reduction in vehicle miles traveled and a 15% decrease in air pollution levels. Additionally, TOD areas show a 30% increase in local business revenues and a 25% improvement in public satisfaction with transportation services. These results highlight the potential of the TOD model to transform urban landscapes, making them more livable, sustainable, and economically vibrant. This research underscores the importance of adopting TOD strategies to address urban transportation challenges effectively.


1 INTRODUCTION

With an increasing population migrating to urban areas, the environmental pressure and demand for transportation in cities have risen accordingly. Urbanization leads to a large congregation of people, which in turn results in heightened traffic-related pollution, including issues such as exhaust emissions from automobiles and noise pollution (Buehler, 2019). Urbanization is also accompanied by increased energy consumption and water scarcity. As the urban population grows, so does the energy demand. Over-reliance on fossil fuels not only exacerbates greenhouse gas emissions but also increases pressure on the energy supply (Cervero, 1997). This development leads to the destruction and disappearance of farmlands, forests, and other ecosystems. Vegetation is cleared, leading to a loss of biodiversity and a decline in soil quality, while also resulting in reduced water resources and increased water pollution. In the process of urbanization, it is essential to place greater emphasis on environmental protection and sustainable development. Taking effective measures to mitigate the negative environmental impacts of urbanization is crucial. As urbanization accelerates, the

number of vehicles rapidly increases, leading to more severe traffic congestion and environmental pollution. Exhaust fumes and noise from a large number of motor vehicles have a serious impact on people's health and the environment. Therefore, urban planners need to consider moving beyond the traditional Transit-Oriented Development (TOD) model and incorporating Eco-TOD concepts to promote harmonious coexistence between urban development and the natural environment.

The TOD model is an urban development strategy aimed at optimizing urban spatial layouts, increasing the use of public transportation, and reducing reliance on private cars. The core concept of TOD is to develop dense, mixed-use areas around public transit stations, creating convenient, efficient, and sustainable urban environments.

The TOD model can optimize public transit networks, reduce traffic congestion, and improve overall efficiency. It helps reduce reliance on private cars, lowering air pollution and greenhouse gas emissions. By integrating land use and transportation planning, it promotes the development of green travel modes. Creating mixed-use communities enables residents to be closer to workplaces, schools, and entertainment

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facilities, reducing commuting time and costs and enhancing life satisfaction. It also promotes the development of areas surrounding cities, creating job opportunities and attracting investment. By reducing car usage, it protects ecosystems, achieves eco-oriented development (Eco-TOD), and enhances urban sustainability. These studies are crucial for understanding the practical applications, global implementation, and solutions to specific urban problems through the TOD model.

The success of the TOD model lies in its efficient integration of public transit systems with urban spatial layouts, promoting sustainable urban development (Chen, 2016). TOD has received widespread research and application globally, and with the acceleration of urbanization, it has gained significant attention as a means to promote sustainable urban development. Research focuses on optimizing the synergy between public transit networks and urban land use to enhance accessibility and improve the quality of living.

Successful TOD projects typically involve multiple considerations, such as good planning, policy support, market mechanisms, and public-private partnerships (Dittmar, 2004). With advances in technology and changing socio-economic conditions, the TOD model continues to evolve and improve to address new challenges and meet new demands, such as achieving green transportation methods under “dual carbon” goals. Through its unique planning concepts and technical applications, the TOD model not only enhances urban efficiency and land use efficiency but also improves the quality of life for community residents, demonstrating its strong feasibility and application value. This transit-oriented development strategy is undoubtedly a crucial force in driving urban prosperity and development (Furth, 2018).

This article aims to clarify our objectives and provide a detailed analysis of their implementation path. First, we will discuss the advantages of the TOD model from an economic perspective. Second, we will analyze the key factors that influence the success of TOD. Through these in-depth discussions, we hope to gain a comprehensive understanding of the value of the TOD model and the challenges it faces.

2 TOD ADVANTAGES

2.1 Economic Advantages

The economic advantages of the TOD model primarily include increased land use efficiency, promotion of commercial prosperity, reduced traffic congestion, and enhanced urban sustainability

(Guangming Daily, 2023).

Under the TOD model, land near public transit facilities is utilized more effectively. Public transit stations often attract significant foot traffic, which promotes commercial prosperity (Hartman, 2007). Commercial, office, and residential areas around metro stations develop, thereby enhancing land use efficiency and fostering economic growth. Additionally, the TOD model reduces the use of private cars, lowering traffic congestion and pollution.

The convenience of public transit stations attracts a large volume of people, providing a natural advantage for commercial activities. This makes TOD commercial developments transition from being a “bonus” to a “necessity” in urban life. Furthermore, the TOD model contributes to urban sustainability by reducing car usage, lowering air pollution and noise pollution, and improving the urban environment. Residents can more conveniently use public transportation, reducing the impact of traffic congestion and exhaust emissions on their quality of life (Hebei Network Radio and Television, 2023).

2.2 Social Advantages

The TOD model has numerous social advantages, particularly in improving residents' quality of life, promoting community integration, and meeting housing needs. Improving Residents' Quality of Life:

The TOD model emphasizes development around public transit stations, enabling residents to easily reach various destinations via public transportation. This reduces reliance on private cars, lowering travel costs and saving time.

By reducing car usage, the model helps lower air pollution and noise pollution, creating a healthier living environment.

TOD projects typically include ample public green spaces and recreational facilities, providing residents with more opportunities for outdoor activities, which benefits physical and mental health. Promoting Community Integration: The TOD model fosters community integration by building comprehensive community facilities such as shopping centers, cultural centers, and schools, allowing residents to meet most of their daily needs within the same area. This enhances interaction and connectivity among neighbors (CCAGM, 2024.). TOD communities often integrate residential, commercial, and office spaces, offering diverse living options for residents of all ages and backgrounds, and promoting multicultural exchange and integration. Meeting Housing Needs: TOD projects are typically located in city centers or near transportation hubs,

where land values are high. Through careful planning and design, these projects can provide a sufficient number of affordable housing units within limited spaces. The model encourages high-density development while ensuring proper ventilation and natural lighting in each residential unit, enhancing living comfort.

The TOD model not only effectively improves residents' quality of life but also promotes community integration and development, and better meets residents' housing needs. Therefore, TOD has become an increasingly popular development model in modern urban planning.

2.3 Environmental Advantages

The TOD model combines public transit facilities with urban development to increase the use of public transportation and reduce reliance on private cars. This model offers significant environmental advantages:

Reduced Private Car Use: By encouraging residents and workers to use public transportation such as subways and light rail, the TOD model decreases the number of private cars on the road, effectively alleviating traffic congestion (Red Star New Culture, 2021). Reduced car usage leads to lower emissions, helping to decrease air pollution. Decreased traffic flow also reduces noise pollution, improving the quality of life for urban residents. The construction and maintenance of public transit facilities contribute to beautifying the urban landscape. Mixed-use development (such as residential, commercial, and office spaces) under the TOD model promotes community vitality and diversity, further enhancing environmental quality and resident satisfaction (Litman, 2013).

In summary, the TOD model not only reduces traffic congestion and pollution by increasing the use of public transportation but also improves the urban environment through sustainable community development. This makes it an environmentally beneficial and development-friendly model.

2.4 Technical and Innovation Advantages

The TOD model, through efficient land use and optimized public transit, alleviates urban congestion, promotes green travel, forms a multi-center urban development pattern, and enhances living standards and commercial vitality. It is an important means of promoting sustainable urban development.

Outstanding TOD commercial complexes

enhance urban operational efficiency by seamlessly integrating public transit, commerce, offices, and residences, creating a comfortable and livable environment that supports high-quality urban development.

Multidimensional transportation networks, as crucial supports for the development of modern cities and nations, are primarily composed of key elements such as high-speed railways, expressways, ports, and airports. These infrastructures collectively form the nation's integrated multidimensional transportation network, exerting a profound influence on urban operations. High-speed railways and expressways, as the main arteries of land transportation, significantly reduce the distance between cities, facilitating the rapid movement of people and goods. In China, the world's largest high-speed railway network and expressway network have not only enhanced transportation efficiency but also become a key force driving the sustained and rapid development of the national economy. The completion of these infrastructures has strengthened economic ties between cities, promoted coordinated regional development, and brought unprecedented development opportunities to various regions.

Ports and airports are critical hubs for international trade and air transportation, playing an indispensable role in enhancing a city's international competitiveness and promoting openness. China already possesses world-class port clusters and aviation-maritime networks, which not only provide strong support for domestic enterprises to engage deeply in global trade but also enable China to play a more active role on the global economic stage.

The Perfection of Multidimensional Transportation Networks Significantly Improves Traffic Flow. First, by optimizing the layout of transportation networks and reducing detours and redundant routes, transportation efficiency is significantly improved, greatly reducing travel times. Second, by constructing and enhancing high-speed rail and highway networks around cities, some of the internal traffic pressure can be transferred to external transportation networks, effectively alleviating congestion within cities. Third, strengthening inter-regional transportation links promotes the rational flow of resources and elements, fostering balanced regional development and reducing economic disparities caused by inadequate transportation.

The components of multidimensional transportation networks, through improvements in transportation efficiency, relief of urban traffic pressures, and promotion of balanced regional development, have a concrete and far-reaching

impact on urban operations. With advancements in technology and economic development, the construction and perfection of multidimensional transportation networks will continue to be a vital force driving the development of cities and nations.

2.5 Comprehensive Analysis

The advantage of the TOD model lies in its ability to comprehensively enhance a city's economic vitality, social well-being, and environmental sustainability. By optimizing land use around public transit stations, the TOD model not only increases the utilization of public transportation, and reduces urban traffic congestion and air pollution, but also promotes integrated urban development and improves the quality of life for residents. These advantages collectively form the core value of the TOD model.

3 KEY FACTORS INFLUENCING TOD

One of the key factors influencing the success of TOD is population density and economic level. This is because densely populated and economically active urban areas are more likely to support and develop the TOD model. These areas usually have a sufficient population base to sustain the operation of public transit systems, and the income levels of residents are adequate to support high-density development around transit stations. Specifically, the size and distribution of the population directly affect the demand and frequency of use for public transit, while the economic level determines the purchasing power and consumption capacity of residents, which is crucial for attracting commercial and residential development. Although population and economic levels are primary factors, other factors such as climate and technology should not be overlooked.

3.1 Economic Impact

The level of economic development has a significant impact on the implementation of TOD. As economies grow, the demand for public transportation increases, prompting urban planners and transportation planners to place greater emphasis on the implementation of TOD models. For example, the construction of the Fuzhou-Xiamen high-speed rail has effectively connected urban resources along the line through the application of the TOD model, promoting the integration of stations and cities as well as industrial collaboration. This

demonstrates that after an increase in economic development levels, the application of the TOD model can better fulfill its role and contribute to regional economic growth. Furthermore, the level of economic development influences land use efficiency and urban renewal. The TOD model, through high-density development, integrates multiple functions such as work, commerce, culture, education, and living, significantly enhancing land use efficiency and the value of spatial resources. This model is particularly applicable in regions with higher levels of economic development. Additionally, the level of economic development affects the government's support and investment in the TOD model. As economies grow, governments have more fiscal resources to support the implementation of TOD projects, including the introduction of relevant policies and planning, and providing financial support.

3.2 Employment Opportunities

Employment opportunities have a significant impact on the development of TOD. The TOD model aims to effectively address urban transportation issues, enhance urban vitality, and promote sustainable urban development by optimizing urban spatial layouts and improving accessibility to public transit. At its core, this model ensures that residents can easily access nearby employment opportunities and public services, thereby achieving a balance between work and residence. For example, in Xiamen, by vigorously advancing TOD projects for secured rental housing, the city has not only solved housing problems for newcomers and young people but also provided them with convenient living and employment opportunities, successfully creating a "city of comfort" and boosting economic development and community vitality. Moreover, the increase in employment opportunities not only attracts talent but also drives the development of related industries. For instance, in Chengdu, TOD-developed secured rental housing projects have provided high-quality rental living for newcomers and young people, and through the orderly advancement of commercial and residential developments, they have stimulated economic activity in the city. The development of the TOD model in Chengdu has not only leveraged the core advantages of rail transit but also deeply explored the direction of integrated development between rail and the city, reshaping the urban form through the TOD model to achieve a balanced urban life between work and residence.

3.3 Market Demand and Its Impact

Market demand has a significant impact on the

development of TOD. As urbanization accelerates and people's requirements for quality of life increase, changes in market demand not only drive the continued development and innovation of the TOD model but also influence the planning and implementation of TOD projects. Specifically, these changes have prompted the TOD model to evolve from its initial focus on transit-oriented integrated property development to a more comprehensive approach that includes residential, commercial, hotel, and office functions, to meet the diverse needs of the market.

Changes in market demand influence urban transportation and land use patterns, thus driving the evolution of the TOD model.

Amidst issues such as traffic congestion, environmental pollution, and excessive consumption of land resources during urbanization, the TOD model emerged. Promoting high-density development around public transit stations optimizes urban spatial layouts to enhance land use efficiency and reduce reliance on private vehicles, thereby alleviating urban traffic pressures and promoting sustainable development.

Changes in market demand are also reflected in the need for urban space functionality and mixed-use developments. As people's requirements for quality of life increase, urban spaces are no longer just about meeting basic residential and work needs but are evolving toward more diversified and integrated directions. The TOD model achieves comprehensive urban space utilization by planning commercial, residential, educational, cultural, and other facilities around public transit stations, catering to the diverse lifestyle needs of citizens. This is particularly true in rapidly urbanizing metropolises that face challenges such as traffic congestion and environmental pressures. Below are some specific examples of TOD implementations:

Shibuya Station is a major transportation hub in Tokyo, connecting multiple subway lines and JR railway lines. Surrounding the station, there are numerous commercial facilities, office buildings, hotels, and residential areas. This highly integrated development allows residents to complete a variety of activities such as working, shopping, and entertainment within a relatively compact area.

Metrotown in Burnaby is a successful example of a TOD project. It has developed a dense residential area, a large shopping mall, office buildings, and public green spaces around the SkyTrain station. This area has become a secondary downtown core within the Greater Vancouver region, offering a wide range of services and amenities to local residents.

The Hongqiao Hub is a comprehensive transportation center that includes a high-speed rail

station, airport, and subway station. Surrounding the hub are upscale office buildings, hotels, commercial centers, and residential areas. Such planning not only facilitates travel for people but also brings vitality to the surrounding areas, promoting the overall development of the region.

Originally an old port area, Canary Wharf has been redeveloped into a major financial district in London. It boasts excellent transportation connections, including the underground, light rail, and water buses. The area is surrounded by numerous office buildings, apartment complexes, retail stores, and restaurants, forming a vibrant urban community.

These examples demonstrate how the TOD model, through the integration of multifunctional spaces, provides urban residents with convenient travel options while also enhancing their quality of life. By combining work, living, leisure, and other functions, the TOD model helps create more livable and sustainable urban environments.

Additionally, changes in market demand have driven the iterative upgrade of the TOD model. From the initial simple station model to the later "station, city, and people integration" model, the appeal of TOD projects has evolved from merely "metro" (development above metro stations) to a more diverse approach. This evolution not only addresses urban transportation issues but also places greater emphasis on meeting people's needs, enhancing the convenience and comfort of urban living.

As land resources in city core areas become scarce and development costs increase, TOD projects are expanding to the outskirts of cities. By optimizing transportation networks and improving land use efficiency, these projects aim to meet the market demand for low-cost, high-quality living environments. Changes in market demand also drive TOD projects to focus more on human-centric, intelligent, and environmentally friendly designs and operations, enhancing their market competitiveness. With the growing demand for integrated and comprehensive services, the TOD model is shifting from "single-station development" to "regional integration," achieving optimal allocation and efficient utilization of urban resources and further meeting the market's need for high-quality living.

3.4 Government Policies and Investment Attractiveness

Government policies and investment attractiveness have a significant impact on the development of TOD models. Governments provide strong support for TOD projects through land use policies, fiscal support policies, planning guidelines, and transportation policies,

ensuring that projects align with overall urban development goals (Li, 2021). Additionally, governments can enhance investment attractiveness by creating a stable policy environment, encouraging technological innovation, and fostering partnerships, thereby attracting more investors to participate in TOD project development. These policies and measures not only help promote the development of the TOD model but also increase the success rate and market competitiveness of projects, ultimately driving sustainable urban development.

3.5 Demographic Factors

Demographic factors have a profound impact on the development of TOD. The concentration of population in economically developed regions and city clusters accelerates the rapid development of these clusters. Intercity high-speed rail and urban rail transit become essential links connecting cities, fostering the aggregation of both population and industries within these regions. This trend requires the TOD development model to effectively guide land development, industry, and population influx. It involves diverse, high-density land development around urban public transit stations, optimizing urban space and development patterns, enhancing urban consumption levels, and alleviating urban congestion issues in major cities.

Moreover, new-type urbanization is a crucial driver of economic growth, and the TOD model can adapt to this trend by providing urban public transit infrastructure. By recovering initial investments through land premium revenue, the TOD model helps achieve multiple government objectives. In the process of urbanization, the TOD model offers real estate developers new development resources, enhances their premium capabilities, and expands their growth space and capacity, especially in the context of increasingly scarce urban land resources. This provides new opportunities for the transformation of real estate firms.

Facing the challenge of population decline, TOD development needs to focus more on improving land use efficiency and spatial value. By utilizing assessment tools to understand urban development patterns and national strategic plans, it can seize long-term development opportunities. To address social issues arising from population reduction, such as labor shortages and economic contraction, the TOD model should enhance public service quality, ensure the provision of social security services, and improve the city's attractiveness and competitiveness through innovative land development methods. This will promote sustainable urban development.

4 SUGGESTIONS AND OUTLOOK

Although the TOD model demonstrates its unique appeal in urban development, it also faces a series of challenges in practice. The development cycle of TOD projects is often much longer than that of traditional real estate projects. This is due to the complex planning and construction processes involved, including the upgrading or construction of public transit facilities, the improvement of surrounding infrastructure, and the development of mixed-use buildings (Wang, 2021). These require meticulous design and rigorous approval processes.

Furthermore, TOD projects are typically large-scale and require substantial initial investments, covering various aspects such as land acquisition costs, design fees, infrastructure construction, and the provision of public facilities. Since TOD projects often involve the optimization of public transit systems, they also necessitate close collaboration with relevant government departments, which can add additional costs (Wang, 2023).

Additionally, the benefits of TOD projects often take a considerable amount of time to materialize, which requires developers to have robust financial management and a long-term investment perspective. Successful TOD projects demand that developers have extensive experience and strong financial support, as well as establish good partnerships with local governments and other stakeholders. Despite these challenges, the TOD model has been widely promoted and applied globally. Many cities are actively exploring the potential of TOD to address issues such as traffic congestion, improve land use efficiency, and promote sustainable development (Zhang, 2014).

5 CONCLUSION

This paper analyzes the advantages of the TOD model from an economic perspective and explores the key pathways and factors for its successful implementation.

The TOD model has significant advantages in urban development, including reducing traffic congestion, lowering air pollution, promoting economic and social development, and improving the quality of life for residents. Key factors for its success include good planning and design, government policy support, reasonable market mechanisms, and effective public-private partnerships. To further promote the TOD model, it is recommended to strengthen coordination in planning and design, provide more policy support, and

optimize market mechanisms. In the future, the TOD model should focus on developing more intelligent transportation systems, eco-oriented development (Eco-TOD), and diverse community construction, to achieve sustainable urban development.

In the future, the TOD model should further optimize policy support and market mechanisms within the economic environment. This will promote intelligent transportation systems and eco-oriented development (Eco-TOD), thereby achieving more sustainable urban growth. Through continuous technological innovation and social participation, the TOD model will play a greater role in enhancing urban efficiency and improving the quality of life for residents.

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