

Optimizing Resource Allocation and Achieving Balanced Development in Expanding TOD Networks: A Multi-Perspective Approach to Prioritizing TODs

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論 文 名 : Optimizing Resource Allocation and Achieving Balanced Development in Expanding TOD Networks: A Multi-Perspective Approach to Prioritizing TODs
(拡大する TOD ネットワークにおけるリソース配分の最適化と均衡な開発: TOD の優先順位付けに対する多面的アプローチ)

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論 文 内 容 の 要 旨

Transit-oriented development (TOD) is a strategic approach that aims to enhance public transportation usage and promote sustainable urban growth by creating mixed-use, compact communities centered around high-quality public transportation hubs, such as train stations, bus terminals, and transit stops. TODs also seek to attract businesses and boost property values, leading to increased job opportunities, tax revenue, and overall economic vibrancy. TOD networks consist of interconnected TOD communities linked by a robust public transportation system, enabling easy travel between them without relying on automobiles. TOD networks are a crucial element of sustainable urban planning.

From 1900 to 1950, cities around the world adopted rail transit systems, and the focus of rail transit development shifted to developing regions, especially in Asia, including China, India, Thailand, and Indonesia, where the TOD concept gained traction. Many expanding TOD networks leverage rising property values near transit stations to recapture previous investments and promote sustainable rail transit development. However, TOD implementation varies within cities due to differences in infrastructure, land use, accessibility, development stages, and local government policies. This diversity complicates evaluating these factors and making detailed development plans for each TOD. Some researchers advocate for prioritizing development to expedite profit generation by concentrating limited resources on the most critical projects, minimizing resource dispersion, and maximizing immediate benefits.

Recognizing the importance of identifying priority TOD stations, there is a notable gap in comprehensive and systematic research on achieving this goal. This study introduces a multi-perspective methodology for identifying priority TOD stations in cities with expanding TOD networks. The methodology encompasses three key perspectives: balanced development of transit and activity intensity, efficiency in activity development, and the level of livability within TOD areas.

The methodology was applied to Hefei City, a mid-sized Chinese city with a growing TOD network, as a case study. The findings from this case study were utilized to evaluate and enhance the methodology's applicability to other cities.

This thesis is divided into five chapters. As an introduction, Chapter 1 presents the context, goal, and organization of the thesis, as well as the scientific basis and theoretical framework of this research.

Chapter 2 identified priority TODs by evaluating the balanced development of transit accessibility and activity intensity. Hefei, the capital of Anhui Province in China, has experienced rapid growth since 2010, driven by population expansion and urbanization. To address the challenges of traffic congestion

and environmental pollution, the Hefei government introduced the TOD concept in 2017, alongside the launch of its subway system. By 2020, 77 TOD projects had been implemented. However, some TODs have struggled to attract transit ridership and boost economic activity. This study evaluates the Hefei City TOD network, aiming to identify priority TODs for further development and optimize resource allocation. The node-place model was employed to measure accessibility and activity intensity at each TOD. Subsequently, the 77 TODs were categorized into four priority levels using the silhouette method. Level 1 and level 2 TODs, referred to as "Unstable TODs" and "Unbalanced TODs," respectively, were identified as having the most urgent development needs. The study recommends addressing the specific challenges that hold back optimal performance by involving targeted interventions to enhance accessibility and elevate activity intensity in these priority TODs.

Chapter 3 identified priority TODs by evaluating the interdependency of accessibility and activities. TODs foster a mutually beneficial relationship between accessibility and urban land use (activities). However, not all TODs achieve this combined effect, hindering their development potential. This study investigates this relationship by applying the SBM model and the super-efficiency SBM model to TODs in Hefei City. The findings reveal TODs where activities and accessibility are not mutually reinforcing, indicating areas requiring prioritization in future planning. Two types of priority TODs emerged from the analysis: "Undersupplied TODs" and "Underdeveloped TODs." This methodology proposes the ranking of TODs based on their efficiency in achieving this interaction. This prioritization can aid urban planners in promptly identifying weak TODs within the network.

Chapter 4 identified priority TODs by evaluating livability conditions at TODs. Enhancing livability is an integral aspect of TOD development. This chapter assesses the livability of TODs in Hefei City by evaluating whether the daily needs of residents of all ages are adequately met within existing TODs. The study identifies TODs requiring further development and proposes strategies to ensure equal access to resources for residents across different TODs. Hefei City, as a representative second-tier Chinese city implementing TODs, serves as the case study. The findings indicate that only a small proportion of TOD residents have convenient access to elderly care facilities. Livability is generally higher in well-developed areas, such as new and old city centers and transportation hubs. This chapter proposes strategies to foster a more equitable distribution of resources and amenities for residents in various TOD scenarios.

The research's multi-perspective framework for prioritizing Transit-Oriented Developments (TODs) was discussed in Chapter 5, along with a summary of the study's conclusions. The integration of transportation accessibility and activity intensity of TODs, the effectiveness of the dynamic interaction between accessibility and economic activities, and the livability of TODs—a measure of the quality of life for residents—are evaluated by this multi-perspective framework for selecting priority TODs.