

報告番号	甲 第 12925 号
------	-------------

## 主 論 文 の 要 旨

論文題目    **EXAMINATION ON THE INFLUENCE  
AREA OF TRANSIT-ORIENTED  
DEVELOPMENT: CONSIDERING  
MULTIMODAL ACCESSIBILITY IN  
NEW DELHI, INDIA**  
(トランジット指向開発の影響地域に関する調査：インドのニューデリーにおける多  
モードアクセシビリティを考慮して)

氏    名    **Sangeetha Ann    Wilson**

## 論 文 内 容 の 要 旨

Transit oriented development (TOD) is a land use and transport integrated urban planning strategy that is highly acclaimed for promoting sustainable city development. The catchment or influence area of transit stations is a key factor in TOD planning. This research aims to identify the problems regarding adoption of TOD influence zone standards/ guidelines formulated by developed countries in developing countries and the necessity of conducting adaptability studies on TOD influence areas.

As Indian cities adopt the concept of TOD, concerns have arisen regarding the applicability of TOD standards formulated in developed countries in the Indian context. The literature review chapter highlighted the non-consensus existing regarding the size of TOD influence areas. The commonly adapted standards have been challenged by researchers and new sizes of influence areas have been estimated in various studies for various cities, depending on type of access modes and type of main mode. Evidently, a single influence zone size is not suitable for all cases. Because there is no consensus

among researchers on whether the half-mile radius is the appropriate distance for catchment areas, such a criterion should be carefully examined in the planning of TODs in Indian cities. In light of the TOD policy in India, it is imperative that the size of TOD influence zones be determined for Indian cities. In most Indian cities, mobility patterns vary compared with those of developed countries. The multitude of various types of last mile connectivity modes and the difference in willingness to walk between cities in developed and developing countries have to be considered before adopting standards formulated for developed countries in countries like India. Accordingly, it is proposed that the local characteristics of cities be carefully studied in relation to the influence zone of the TODs. Moreover, it is not advisable for cities in India to consider only the walk-based TODs. This is because last-mile travel patterns are multimodal. Therefore, these modes need to be taken into consideration in the design of TOD.

This study aims to estimate the TOD influence areas in New Delhi by examining the last mile connectivity patterns of passengers on the Delhi Metro Railway (DMR) across the city and at specific stations, taking into account the various modes used for access. Questionnaire survey conducted on the last mile connectivity reveals use of various access modes for metro stations in India, although current research only considers walking and cycling to be universal forms of access. Therefore, this study focuses on the DMR's multimodal accessibility to investigate the last mile distance of each mode. In order to offset the rounding errors of reported distance, a heaping model and multiple imputation (MI) were employed to improve the accuracy of the reported distance. Afterward, distance decay analysis and receiver operating characteristic (ROC) curves were used to determine the thresholds of last mile distances.

The last mile distances estimated in the first part of the study give a generic estimation and it highlighted that the current guidelines gave a very conservative distance regarding size of influence areas. It can be used as a guideline for deciding extent of influence zone areas for stations well within the city limits. Upon examining the last mile distances for individual stations, it was found that there are variations for different modes. Walking distances (mean and 85th percentile) did not vary much between stations, however while comparing other modes large variations were observed. The outer station, Vaishali exhibited longer distances for informal modes, bus and private modes. This illustrates that

in such stations, commuters tend to travel longer distances on motorized modes to access metro stations. Therefore, while considering multimodal accessibility and multimode based TODs, these differences in accessibility needs to be taken into account.

The findings show that the influence area differs across station types and travel modes; increasing in the order of walking, informal transit, buses, and private transport, respectively. The study highlights that the current TOD influence zone standards adopted are conservative when compared to the actual distances walked by commuters to transit stations, and the distance is considerably high when other modes are included. The results are aimed at influencing the TOD policy in India and helping create TODs that is suited to Indian urban and transport characteristics. The research provides valuable input for TOD planning, especially for policy recommendations which can increase size of influence areas. This can lead to development of TOD plans which consider a wider influence area, extending the benefits of TOD over a larger area and incorporating current transit users into TOD planning. It can lead to inclusive planning by considering various access modes, especially informal modes. The resultant improved infrastructure over the actual influence area for walking and informal modes will be a boon for transit commuters and improving the attractiveness of public transit. The study approach can be applied in other developing countries especially where there is multimodal last mile connectivity. Many cities in south east Asian countries also have the presence of informal transport modes as well as buses and private vehicles (cars and two-wheelers). These cities can use the empirical findings and the methodology of this study to understand the last mile distances travelled by various modes to transit stations when they explore the concepts of TOD in urban planning.