Examining How Transit-Oriented Development Indicators Shape Ridership Demand: A Structural Equation Modelling Perspective

[1] Mudavath Meghanath; [2] Anuj Jaiswal; [3] Rajshree Kamat
[1,2,3] Department of Architecture and Planning, Maulana Azad National Institute of Technology, Bhopal, India

Corresponding Author: Mudavath Meghanath

Abstract: The paper investigates the impact of Transit-Oriented Development (TOD) variables such as Design (D), Land-Use Diversity (LUD), Destination Accessibility (DA) and the Distance to Transit (DT) on the ridership demand (RD) in Bengaluru. It is based on a major survey of 970 commuters conducted within an 800-meter area around metro stations. The respondents were to complete a structured questionnaire on a five-point Likert scale; the data analysis was conducted with the help of Partial Least Squares Structural Equation Modelling (PLS-SEM). It was identified that all four TOD factors had statistically significant and positive effect on the ridership demand. It reveals that improved urban design, a mixed land use, easier access to destinations, and a closer distance to transit stations are all ways of enhancing the use of public transport. The study contributes to the existing literature regarding sustainable urban mobility in India by confirming the connection between TOD characteristics and transit demand. Its results provide concrete recommendations to planners and policymakers on how to incorporate the TOD principles in development plans to boost ridership and reduce the use of private vehicles.

Keywords: Transit-Oriented Development, TOD indicators, Ridership Demand, Mass Transit, PLS-SEM

1 Introduction

The development of cities and populations in the world has led to tremendous emergence of the need to have sustainable and efficient transport systems. The solution to this issue lies in the public transport (with integrated land planning like Transit-Oriented Development (TOD). TOD develops small, mixed-use and walkable communities surrounding transit hubs, which promote the replacement of automobiles with public transportation. TOD lowers Car dependency enhances accessibility to urban centers and environmental sustainability by offering higher density, various land uses combined with good design and walkability. Several TOD assessment systems and scoring systems have been designed to estimate such factors as density, land-use mix, and access to transit. India: Cities such as Bengaluru are now embracing TOD concepts in and around metro and railway stations as a way of dealing with issues of mobility and sustainability. Empirical studies on the correlation of TOD indicators and transit ridership in Indian cities are few, even though its advantages are realized. Thus, the research problem of the study is exploring the effects of major TOD dimensions like design and destination accessibility, land-use diversity, and distance to transit on ridership demand on the metro corridors in Bengaluru.

2 Literature Reviews

The rapid urbanization and the rising use of the personal automobile have augmented journey periods, traffic congestion, fuel consumption, and air contamination in urban areas. These issues pose a threat to the environment and health of the people. It has been found that car dependency is the main cause of congestion, and population increase does not significantly raise the same, which is why the expansion of the public transport is a matter of urgent necessity (Paolo Mattioli et al., 2020). Planned solutions like Transit Oriented Development (TOD) are necessary to move people out of cars and into the buses. TOD is a linkage between land use and transit which promotes compact, mixed-use, high-density, walkable neighbourhoods around transit nodes (Robert Cervero and Kara Kockelman, 1997). It puts homes, employment, services, and pedestrian areas within reach, eliminating reliance on cars and enhancing sustainability. To work, governments should offer enabling policies, finance systems and make plans fit the local environment. The recent research proves the broader advantages of TOD. They demonstrate financial benefits, increase in property prices and employment, and refer to institutional and financial obstacles. In India, a TOD Suitability Index of metro cities indicates the differences in potential of TOD due to land and governance constraints. A Bhopal PLSSEM study concluded that transit ridership is motivated by the behavioural intentions and quality of the services to the residents. The investments in infrastructures must be supported by TOD -oriented policies. Successful TOD areas are usually medium- to high-density mixed-use projects that are within a radius of approximately 800 meters of large-scale transit stations (Peter Calthorpe, 1993), which illustrates that land-use and transport planning must be used in concert with one another.

2.1 Conceptual Framework and Hypothesis Development of TOD Indicators (4Ds)

Incorporating new perspectives and recent findings, this extended literature review examines how four primary Transit-Oriented Development (TOD) indicators; Design, Destination Accessibility, Land Use Diversity, and Distance to Transit, impact ridership demand. The overarching aim of TOD is to promote public and non-motorized transport while reducing reliance on private vehicles. TOD neighbourhoods are therefore structured to combine diverse functions, including commercial, residential, leisure, and retail activities, while adhering to the principles of density, diversity, accessibility, and design. This integrated urban strategy enhances land use efficiency, enabling residents to meet daily needs without depending heavily on automobiles, thereby reducing car trips and fostering sustainable urban development.

Design is crucial in determining TOD effectiveness, as it directly influences pedestrian accessibility, mobility patterns, and the overall quality of the transit experience (Molster& Schuit, 2013). Well-designed TOD environments improve ridership by creating pedestrian-friendly spaces around transit stations. Key elements include ensuring adequate street intersections, extending walkway networks, and facilitating smooth pedestrian flow. Walkability, an essential design factor, is central to TOD success.

Hypothesis (H1): The design of TODs indicator has a positive influence on ridership demand.

Destination Accessibility: In urban planning, accessibility refers to how easily key amenities such as business districts, educational institutions, parks, and medical facilities can be reached from a specific location using a particular mode of transportation. Because it connects two vital components of an urban environment, the land use pattern and the transportation network, it is an essential measure for evaluating urban development. While the transportation network determines how easily these facilities can be accessed through different modes, the land use pattern influences their spatial distribution(Shirzadi et al., 2016; Babakan and Taleai, 2015).

Hypothesis (H2): Destination accessibility within TODs has a positive influence on ridership demand.

Land Use Diversity: Integration of various land uses in Transit-Oriented Developments (TODs) creates vibrant, dynamic, and attractive neighborhoods that increase the number of people using the public-transit. The diversity is a major metric of urban planning that reflects the number of different uses existing within a given location. Promoting a variety of residential, commercial and service demands results in more coherent and habitable communities. To the extent that there is high diversity, i.e. the increase of entropy, there is also an increase in walking and cycling since the residents have important services nearby. Research by Cervero and Kockelman (1997) and subsequent research by Ewing and Cervero revealed that the higher the land-use diversity the higher the trip generation, walking, and reliance on public-transit.

Hypothesis (H3): Land use diversity within TODs has a positive influence on ridership demand.

Distance to Transit:Being close to transit stations is generally considered as a major determinant that defines how people use the transportation. Individuals and businesses located near transit hubs are more likely to depend on transportation since when the distance to work is shorter and the cost reduced; it becomes more convenient to use the transit. Saleem and Jaiswal (2024) conclude that proximity to the stations is closely associated with active travel methods such as walking and cycling. These services enhance accessibility and better chances of people using the public transport as they can connect homes, workplaces and transit stations. Distance to transit is quantified with the help of the formula below.

Hypothesis (H4): Distance to transit stations has a positive influence on ridership demand.

This research presents four hypotheses (refer to figure 1), each positing a direct and positive relationship between specific Transit-Oriented Development (TOD) indicators and transit ridership. The TOD indicators examined include design, destination accessibility, land use diversity, and distance to transit facilities.

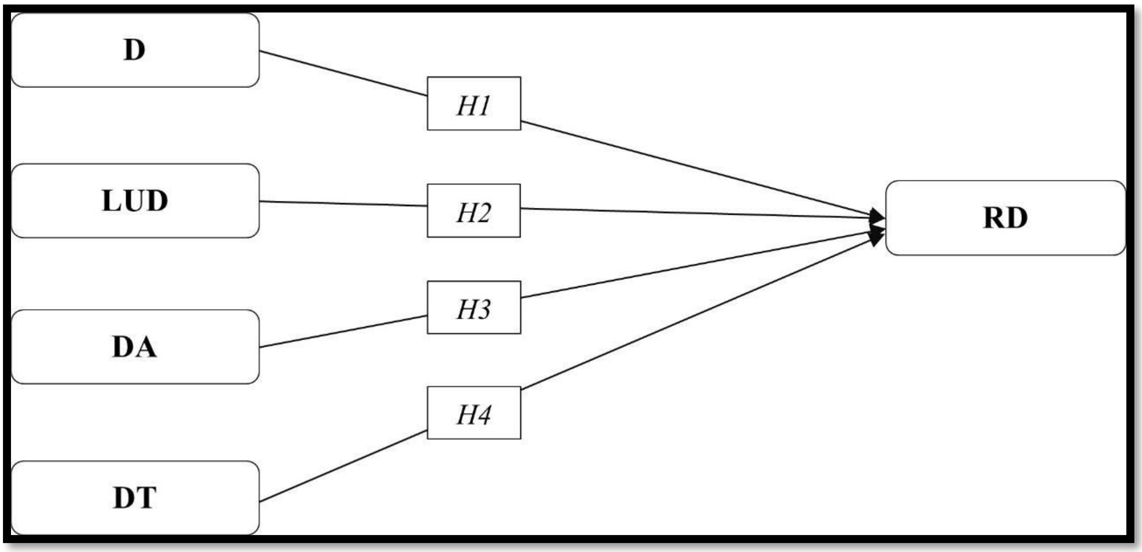

Figure 1: Conceptual Framework of TOD indicators and Ridership demand

Note(s): D = Design
LUD = Land use Diversity
DA = Destination Accessibility
DT = Distance to Transit
RD = Ridership demand
H1, H2, H3 and H4 are TOD indicators hypothesis direct positive impact on ridership demand.

3 Methodology

The paper is a quantitative analysis of the relationship between transit-oriented development (TOD) indicators and the ridership demand. It targets metro corridors within Bengaluru which is an urbanising city with a high transport and infrastructure of growth. It focuses on the 800-metre catchment radius around every metro station, which is a walking distance of commuters. A total of 970 respondents were used to collect primary data using a structured questionnaire that measured four TOD indicators: Design; Land-Use Diversity; Destination Accessibility; and Distance to

Transit. The demand of the ridership was measured based on the perception of the respondents regarding connectivity, centrality, time and cost effectiveness. All variables were rated out of five points Likert scale, where a strongly disagree (1) was the lowest and a strongly agree (5) was the highest. The Cochran formula was used to calculate the sample size and meets the suggested recommendations in structural-equations modelling. The analysis of data was done using SmartPLS 4.0. Path coefficients (b), t-values, and p-values were used to analyse the structural model and bootstrapping (5000 resamples) was used to test the significance of the hypotheses. The t -value is more than 1.96 at 5% level, which shows statistical significance. Findings validate that all the four indicators namely Design, Land-Use Diversity, Destination Accessibility, and Distance to Transit positively and significantly influence ridership demand. Figure 2 explain the research methodology of study.

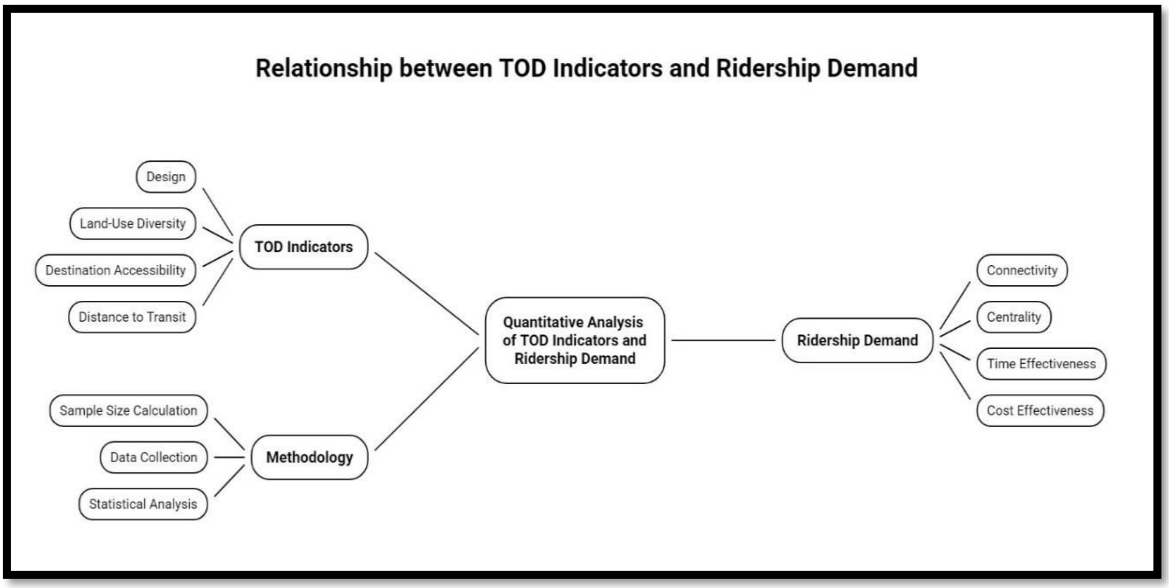

Figure 2: conceptual research methodology

3.1 Study Area

The fifth-largest city in India is Bengaluru also known as the Silicon Valley in the country. Its population increased by 2.6 million to reach 9.1million between 2001 and 2011. Analysts forecast that it will exceed 20 million by 2031. This rapid, unplanned growth has caused a heavy burden to the infrastructural services of the city, particularly transportation. It has increased the number of private cars in the streets and made the streets to be congested and reduced travel time, as well as undermined the effectiveness of the bus system in the city. The city has tried to contain such issues by having massive investments in mass-transit, including the Namma Metro and the suburban rail. Such projects provide an excellent opportunity of simplifying the process of traveling and increasing the sustainability of this city in the long term. This study was conducted in Bengaluru due to its high growth in infrastructure, extended metro zones, and potential of Transit-Oriented Development (TOD). The study studies a few transit hubs with emphasis on the 800 meters areas surrounding the stations. It evaluates the existing TOD at these locations and how the 5Ds concept density, diversity, design, destination and demand can enhance connectivity, reduce dependency on cars, and enable sustainable development of cities. An image of the Bengaluru metro station profile (refer to figure 3).

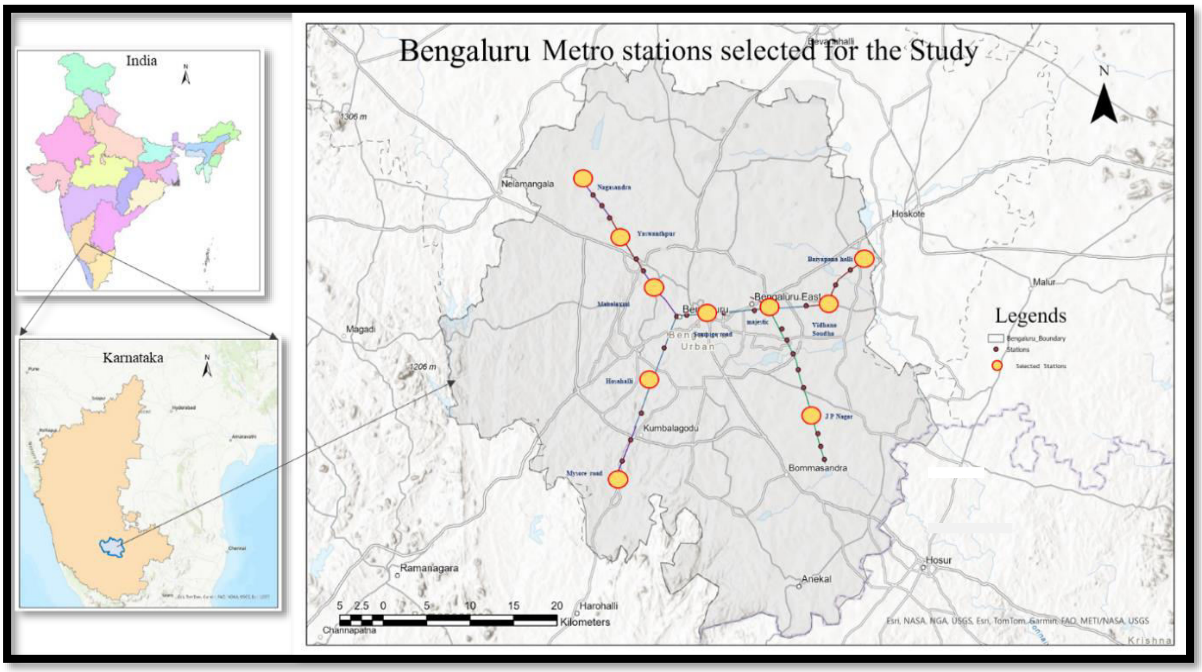

Figure 3: Bengaluru metro stations

Source: Authors own creation

3.2 Data Collection and Samples

Primary data were collected from 970 respondents along the corridors, we used Cochran's formula for sample data collection, for robust we used this sample (970). The survey items related to four TOD indicators: Design (e.g., pedestrian infrastructure, street connectivity), Destination Accessibility (proximity to key facilities and employment centers), Land Use Diversity (availability of mixed land uses), and Distance to Transit (walkability and ease of access to stations), as well as perceived ridership demand(connectivity, centrality, time efficiency, and cost effectiveness). Each TOD indicator is designed for measurement on a Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Table 1 presents the detailed demographics of the commuters.

Table 1: Sample characteristics

Category	Particular	N	Percentage
Gender	Male	463	47.7
	Female	507	52.3
Age	15-25	199	20.5
	25-35	305	31.5
	35-45	272	28
	45-55	145	15
	Above 55	49	5
Income	Less than 20,000	158	16.3
	20,000 - 39,999	199	20.5
	40,000 - 59,999	301	31.5
	60,000 - 79,999	147	15.2
	80,000 - 99,999	172	10
	100,000 or more	57	6.5

Source: Authors own creation

The size of the sample (between 150 and 400) used in this study is acceptable according to the scholar standards. According to Qureshi and Mehraj (2022), management study requires 200-500 participants, a method that can follow the approach adopted in our research and attest the fact that the sample size selected is sufficient to yield useful data. According to Hair et al. (2012), the number of responses to the questionnaire item should be 1-5 to reflect sufficient interest in ridership. These rules assure that the sample size we selected is sufficient to be able to have strong and valid results.

3.3 Measurement of variables

The paper utilizes a holistic model to evaluate the relationship between various transit-oriented development (TOD) measures and ridership demand in the vicinity of the metro stations. The analysis will focus on five indicators (based on Table 2), which are determined by certain measurable elements. Design (D) is an assessment of the quality of urban environment, in terms of pedestrian-friendly facilities, facilities on the streets, the urban vegetation and the connectivity of the streets that can help people to walk. Land-Use Diversity (LUD) looks at the degree to which the different land uses are balanced and the degree to which the local environment satisfies daily demands within walking distance. The third indicator is Destination Accessibility (DA) which evaluates the ease at which individuals can get to key locations including places of work, schooling, and key services- a factor that directly determines the probability of individuals using a public transportation mode. Distance to Transit (DT) evaluates walkability and the time that it takes to transit to metro stations and considers it as an element that affects the frequency with which people use transit. Lastly, the Ridership Demand (RD) is measured by evaluating the perception by people regarding connectivity, centrality, travel efficiency and the cost benefits of metro services. Collectively, these criteria offer a holistic approach to the issues that motivate or discourage the metro usage in cities.

Table 2: TOD criteria align with the specific description applied in this study

Construct	Item Code	Description
Design(D)	D1	The walking paths to and from the transit station are safe and well-designed
	D2	Streets around the station are well-connected and easy to navigate
	D3	Public spaces, greenery, and urban furniture around the station are well-maintained
	D4	The station area is designed to encourage walking and cycling
Land Use Diversity (LUD)	LUD1	The station area includes a good mix of housing, shops, and services
	LUD2	I can fulfil multiple purposes (work, shopping, leisure etc.) within walking distance of the station
	LUD3	Mixed land uses make it convenient for me to use transit instead of a private vehicle
	LUD4	A variety of land uses near transit make the area more vibrant and usable
Destination Accessibility (DA)	DA1	I can easily access my daily destinations using public transit
	DA2	The transit system connects well to significant employment and education centers
	DA3	Transit allows me to reach essential services (e.g., hospitals, markets) efficiently
	DA4	High accessibility to destinations motivates me to prefer public transit
Distance to Transit (DT)	DT1	The transit station is within a comfortable walking distance from my home/work
	DT2	It takes me less than 10 minutes to reach the transit station
	DT3	The distance to the station affects how often I use public transportation
	DT4	If the station were closer, I would use it more frequently
Ridership Demand (RD)	RD1	Public transit in my area provides good connectivity to different parts of the city
	RD2	Transit locations are convenient for my daily trips
	RD3	I usually arrive on time when I use public transport
	RD4	Public transportation is more affordable than other travel options

Source: Authors own creation

4 Results and Discussions

It was done using a Confirmatory Factor Analysis (CFA) to determine the convergent and discriminant validity of the latent constructs, and it was conducted as recommended by Hair et al. (2012). The latent constructs were characterized by a number of observed variables classified into composite indicators which represent theoretical underpinnings. We also tried to test discriminant validity using Fornell and Larcker (1981) criterion according to which the square root of construct AVE should be greater than its correlations with other constructs. The findings satisfied this requirement: none of the inter-constructs correlations exceeded the respective square root of the AVE, which proves that the constructs are empirically different. We checked the convergent validity through factor loading and AVE values. The loading of all the factors was greater than the minimum factor loading of 0.50 indicating adequate reliability of all items. The Cronbach's Alpha and Composite Reliability (CR) were also utilized to evaluate internal consistency which were greater than the acceptable level of 0.70. Table 3 reveals the Alpha of Cronbach is between 0.750 and 0.845 and CR between 0.761 and 0.851. These values validate high internal consistency of all the constructs. In this way the measurement model is valid and reliable. The construct validity and reliability evidence enhance the methodological rigour of the study, which adds strength to its robustness, accuracy, and credibility.

4.1 Assessment of Measurement Model

The internal consistency and reliability of the constructs were evaluated using Cronbach's Alpha (α) and Composite Reliability (CR). The results showed that, for all constructs, both α and CR values exceeded the recommended threshold of 0.70, thereby confirming strong internal consistency and measurement reliability (Hair et al., 2017).To establish convergent validity, the Average Variance Extracted (AVE) and outer loadings of the constructs were examined (Hair et al., 2017). The results indicated that AVE values were all above the accepted threshold of 0.50, while outer loadings exceeded 0.70 across all items (refer totable 3). These outcomes confirm that the constructs demonstrate strong convergent validity (Hair et al., 2012; Hulland, 1999).

Table 3, Overview of findings from the measurement model

Construct	Item Code	Outer Loadings	Cronbach's Alpha	CR Values	AVE Values
Density(D)	D1	0.799	0.844	0.851	0.681
	D2	0.815			
	D3	0.763			
	D4	0.645			
Land Use Diversity(LUD)	LUD1	0.823	0.752	0.761	0.506
	LUD2	0.836			
	LUD3	0.734			
	LUD4	0.828			
Destination Accessibility(DA)	DA1	0.789	0.845	0.849	0.684
	DA2	0.799			
	DA3	0.853			
	DA4	0.857			
Distance to Transit(DT)	DT1	0.828	0.750	0.752	0.575
	DT2	0.835			
	DT3	0.861			
	DT4	0.780			
Ridership Demand (RD)	RD1	0.801	0.841	0.843	0.677
	RD2	0.817			
	RD3	0.845			
	RD4	0.826			

Source: Author's own creation

The Fornell-Larcker method was used to evaluate the study's discriminant validity. The results showed that the square roots of the AVEs, represented by the values on the diagonal (see table 4), were higher than the correlation values among the different constructs. This demonstrates that the Fornell-Larcker standard was satisfied (Fornell & Larcker, 1981; J. Hair et al., 2017).

Table 4: Fornell-Larcker criterion

Indicators	Design	Land Use Diversity	Destination Accessibility	Distance	Ridership Demand
D	0.825				
LUD	0.642	0.711			
DA	0.629	0.574	0.827		
DT	0.624	0.604	0.469	0.758	
RD	0.645	0.585	0.616	0.546	0.823

Source: Authors own creation

Common bias method (CMB) and fit model, when data is collected from a single respondent, (CMB) is a significant concern in survey research (Guide & Ketokivi, 2015).The study asked key respondents with the most relevant experience, especially supply chain leaders, to complete the questionnaire to reduce this risk. To detect possible CMB, the study also used the full collinearity variance inflation factors (VIFs) test, which Kock (2015)recommends. (Kock, 2021)advises a VIF threshold of 3.3 for factor-based PLS-SEM techniques and 5 for methods that account for measurement errors. All VIF values were below 3.3, as shown in Table 5, indicating that CMB is unlikely to affect the study model (Kock, 2021).

Table 5: Collinearity statistics (VIF)

Item Code	VIF
D1	1.698
D2	1.824
D3	1.451
D4	1.208
LUD1	1.552
LUD2	1.441
LUD3	1.489
LUD4	1.041
DA1	1.658
DA2	1.785
DA3	2.230
DA4	2.080
DT1	1.924

DT2	1.964
DT3	2.148
DT4	1.643
RD1	1.825
RD2	1.834
RD3	2.261
RD4	2.188

Source: Authors own creation

The Goodness of Fit (GoF) score was calculated for the model. According to the SmartPLS website, certain factors must be met for a model to be considered sufficiently good. The criteria include a Root Mean Square Theta (RMST) of 0.102, a Standardized Root Mean Square Residual (SRMR) of 0.10 or 0.08, and a Normed Fit Index (NFI) that should be between 0 and 1, with higher values closer to 1 indicating better fit(J. Hair et al., 2017). Table 6 summarizes the results of the analysis conducted.

Table 6: Fit model

Fit summary	Saturated model	Estimated model
SRMR	0.070	0.070
Chi-square	379.096	379.096
NFI	0.762	0.762

Source: Authors own creation

4.2 Assessment of Structural Model

The parameter values, and t-statistics from the inner model (structural model) analysis were used to assess the hypotheses. The validity of each hypothesis was evaluated using t-statistics, p-values, and the strength of the relationships between the constructs. SmartPLS (Partial Least Squares) 4.0 software was used to test the study's assumptions, and bootstrapping provided the required data. A positive beta value, a significance level of 0.05 (5%), and a t-statistic larger than 1.96 were deemed significant for this analysis (Hair et al., 2017). Table 7 displays the study's findings.

Robustness checks:Table7 displays the values of path coefficients (β), t-values, and the corresponding significance levels for all connections from the bootstrap technique with 5000 resamples.

Table 7: Result of testof hypothesis to path coefficients

Hypothesis	Path Relation	β	M	SD	T Values	P Values	Results
H1	Design Ridership Demand	0.157	0.162	0.076	2.072	0.038*	Supported
H2	Land Use Diversity Ridership Demand	0.147	0.153	0.074	1.991	0.047*	Supported
H3	Destination Accessibility Ridership Demand	0.273	0.266	0.109	2.514	0.012*	Supported
H4	Distance to transit Ridership Demand	0.285	0.289	0.106	2.673	0.008**	Supported

Notes: * denotes significance at the 5% level.
** denotes significance at the 1% level.

Source: Authors own creation

The path coefficient will be considered significant in Smart PLS 4.0 if the t-value exceeds 1.96 at a 5% significance level, as determined by a two-tailed t-test (see figure 3). The data for the variables are as follows: Design (β = 0.157; t-value = 2.072; p = 0.038), Land use diversity (β = 0.147; t-value = 1.991; p = 0.047), Destination accessibility (β = 0.273; t-value = 2.514; p = 0.012), and Distance (β = 0.285; t-value = 2.673; p = 0.008). These values (TOD Ds) indicate a statistically significant and positive relationship with Ridership demand (connectivity, centrality, time efficiency, and cost effectiveness). Therefore, the constructs of distance, land use diversity, destination accessibility, and design were accepted.

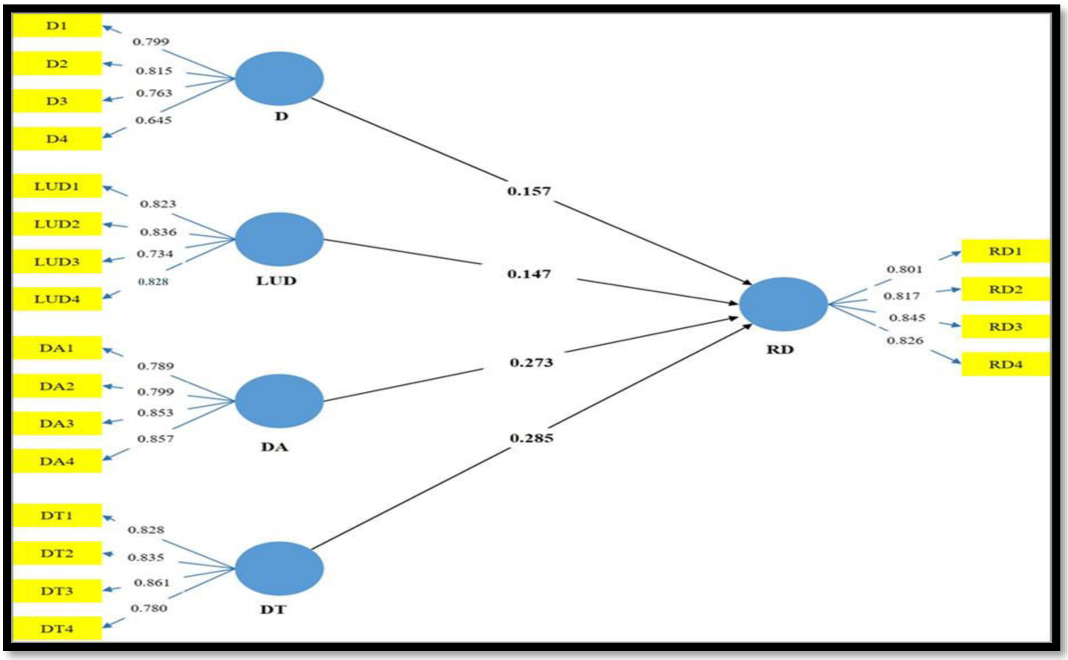

Figure 3: Structural equation modelling of TOD and ridership demand
Source: Authors own creations

Note: The beta coefficients are accompanied by their respective t-values enclosed within brackets.

5 Conclusion

This paper has investigated how critical designed Transit-Oriented Development (TOD) predictors, i.e. Design, Land Use Diversity, Destination Accessibility and Distance to Transit, affect ridership demand along Bengaluru metro corridors. We tested the relationships using Primary data of 970 respondents in the zone of the influence of the station and applied the partial least squares Structural Equation Modelling (PLS-SEM). The findings indicate that all the four TOD factors have a positive and significant effect on ridership. Improving building design-friendly walking infrastructure, station area planning enriches and improves the commuter experience and stimulates transit use. Similarly, various land-use patterns and ease of access to destinations combine residential and commercial and workplaces space, thus making metro services more appealing. The distance to stations is also crucial, which supports the significance of tight and reachable urban structure. The paper reveals that the increase in infrastructure will not increase ridership unless it is coupled with organized land-use planning and TOD-related policies. This study provides evidence-based opinions by empirically validating the role of TOD characteristics in metro demand in Bengaluru that guides planners and policymakers. The strategic use of TOD principles in the areas of the station can contribute to an increase in the number of people using the public transport, a decrease in the reliance on private means, and a sustainable urban environment.

Declarations

1. **Conflict of Interest:** The author declares that there is no conflict of interest related to this study.
2. **Author's Contributions:** The authors solely conceptualised the research idea, designed the methodology, conducted the literature review and analysis, and developed the manuscript in its entirety.
3. **Funding:** This study did not receive any financial support.
4. **Availability of Data and Materials:** Upon reasonable request, the corresponding author provides access to some or all the data, models, or code that substantiate the findings of this study.

References

1. Ali, L., Nawaz, A., Iqbal, S., Aamir Basheer, M., Hameed, J., Albasher, G., & Bai, Y. (2021). Dynamics of transit-oriented development, role of greenhouse gases and urban environment: A study for management and policy. Sustainability, 13(5), 25–36.
2. Anuj Jaiswal, Garima Jain, & Subhash Goswami. (2023). Assessment of Satisfaction Level for Existing Public Transport Systems using Machine Learning: A Case of Bhopal (India). European Transport.
3. Babakan, A.S.; Taleai, M. Impacts of transport development on residence choice of renter households: An agent-based evaluation. Habitat Int. 2015, 49, 275–285.
4. Calthorpe, P. (1993). The Next American Metropolis. 12-45
5. Cervero, R., Ferris, E., & Guerra, E. (2004). Transit-oriented development and the regional development agenda. Urban Land Institute.
6. Cervero, R., &Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design. Transportation Research Part D: Transport and Environment, 2(3), 199–219.
7. Chin, W. W. (1998). PLS path modeling. Computational Statistics & Data Analysis, 295(2), 295–336.
8. Ewing, R., & Cervero, R. (2010). Travel and the built environment: A meta-analysis. Journal of the American Planning Association, 76(3), 265–294.
9. Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research, 18(1), 39.
10. Guide, V. D. R., &Ketokivi, M. (2015). Notes from the editors: Redefining some methodological criteria for the journal. Journal of Operations Management, 37, v–viii.
11. Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. Journal of the Academy of Marketing Science, 40(3), 414–433.
12. Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. Industrial Management & Data Systems, 117(3), 442–458.
13. Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. Strategic Management Journal, 20(2), 195–204.
14. Ke, L., Furuya, K., & Luo, S. (2021). Case comparison of typical transit-oriented-development stations in Tokyo district in the context of sustainability: Spatial visualization analysis based on FAHP and GIS. Sustainable Cities and Society, 68, 102–788.

15. Kock, N. (2015). Common method bias in PLS-SEM: A complete collinearity assessment approach. The International Journal of E-Collaboration, 11(4), 1–10.
16. Kock, N. (2021). Deploying artificial intelligence for climate change adaptation. Technological Forecasting and Social Change, 180, 121–662.
17. Mattioli, G., Roberts, C., Steinberger, J. K., & Brown, A. (2020). The political economy of car dependence: A system of provision approach. Energy Research & Social Science, 66, 101–486.
18. Molster, A.; Schuit, S. Voetsporenrond het station. In Proceedings of the Het NationaalVerkeerskundeCongres, Rotterdam, The Netherlands, 21–22 November 2013.
19. Qureshi, I. H., & Mehraj, D. (2022). Identifying the factors of internal green marketing: a scale development and psychometric evaluation approach. International Journal of Manpower, 43(3), 786–804.
20. Saleem, S., & Jaiswal, A. (2024). Indicators for Active Transportation in Tier II Indian Cities: A Case of Bhopal, India. Journal of Advanced Transportation, 2024(1), 217–564.
21. Shirzadi Babakan, A.; Alimohammadi, A. An Agent-Based Simulation of Residential Location Choice of Tenants in Tehran, Iran. Trans. GIS 2016, 20, 101–125.
22. Shirzadi Babakan, A.; Alimohammadi, A.; Taleai, M. An agent-based evaluation of impacts of transport developments on the modal shift in Tehran, Iran, Journal of Development Effectiveness. 2015, 7, 230–251.