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Transit-Oriented Development: Evaluating View Sheds and Public Spaces around Transit Nodes at Bittan Market and 10 No. Market, Bhopal

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Abstract - Walking distances conventionally define service areas for public transportation and urban growth boundaries for Transit-Oriented Development (TOD). Urban designers and planners typically draw rings and lines around transit stops and arrange transit-supportive land within these boundaries. However, this approach neglects the processes of creating public spaces in visual proximity to transit stops, which can have a significant impact on urban growth patterns and land usage. This paper proposes a methodology to analyse public spaces by considering how commercialization and public space patterns unfold through view sheds around transit stops. The results reveal amoebic TOD patterns of public spaces that differ from conventional walking radii. This alternative view shed approach offers a more nuanced and dynamic tool for designing TODs and fostering effective urban spaces around transit hubs.

***Key Words*:** Walking distances, public transportation, Transit-Oriented Development (TOD), View sheds, Urban growth patterns.

1.INTRODUCTION

Transit-Oriented Development (TOD) has emerged as a critical urban planning strategy aimed at promoting sustainable and efficient urban growth. Traditionally, TOD has been framed around fixed walking distances from transit stations, with planners drawing concentric circles around transit stops and designing land use within these boundaries. The idea is to encourage higher-density development and greater walkability around transit hubs, reducing reliance on private vehicles and promoting public transit.

However, this conventional approach to TOD tends to overlook the nuanced processes by which urban space and commercialization evolve in the visual proximity of transit stops. This paper seeks to introduce a new perspective by exploring view sheds—the areas visible from transit stops—as a dynamic factor in shaping urban spaces. Rather than relying on fixed walking distances, this methodology highlights the role of sightlines, visual connectivity, and land usage patterns that unfold organically in the view sheds around transit stops.

The aim of this research is to provide urban designers and planners with a more flexible and context-sensitive framework for designing TODs. By incorporating visual analysis into the design process, cities can better understand how public spaces and commercial patterns emerge, ultimately resulting in more vibrant, accessible, and sustainable urban environments.

2. LITERATURE SURVEY

2.1 Traditional TOD and Walking Distance Models

The conventional approach to TOD, largely based on walking distances, has been widely discussed in the literature. Cervero and **Kockelman (1997)** define TOD as a mixed-use development strategy focused on facilitating access to public transit. Their work emphasizes the importance of creating transit-friendly environments within a defined radius, typically between 400 to 800 meters from transit stations. However, while these models focus on physical proximity, they fail to account for the visual experience of urban spaces, an aspect crucial to the way people interact with their environment.

2.2 View Sheds in Urban Design

The concept of view sheds in urban design and landscape architecture has also gained increasing attention in recent years. **(Talen, n.d.)** highlighted the importance of sightlines and visual connections in urban planning, suggesting that spaces should not only be walkable but also visually engaging. View sheds, which define areas visible from a specific point, can have significant implications for land use, pedestrian activity, and the economic vitality of a location. **(Stockholm, n.d.)** notes that views of public spaces and transit corridors influence not only aesthetic appeal but also the potential for land value increase, thereby shaping the commercialization process.

2.3 Challenges in Conventional TOD Design

While many studies focus on the design of public transport systems and their surrounding areas, fewer have explored how visual proximity affects TOD outcomes. **(Gehl, n.d.)** stressed the importance of visual urban experiences in enhancing pedestrian movement and creating a lively street atmosphere. He argued that visual access to key amenities, such as shops, parks, and recreational spaces, significantly impacts how people use public transit stations and surrounding public spaces.

3. PROPOSED METHODOLOGY

This paper proposes a novel methodology for analyzing public spaces and their evolution within TODs, focusing on the role of view sheds—the areas visible from transit stops. The key steps involved in this methodology are:

- **Identifying Key Transit Stops**

The first step involves identifying key transit stops in the city that serve as hubs for public transportation, including bus stations, metro stations, and commuter rail stations. These transit stops should be chosen based on their strategic importance, frequency of use, and their role in interconnecting different urban regions.

Figure 1: Shown transit points and major junctions at site

- **Defining View Sheds**

The next step is to define the view sheds around these transit stops. Using geographic information systems (GIS) and 3D urban modelling software, the study will map the areas visible from these transit stations, taking into account street-level views as well as the surrounding architectural features. The methodology will employ line-of-sight analysis to identify how far and wide the transit stop's visibility extends. This can help capture the visual influence of the stop on its surroundings, extending beyond the physical walking radius.

- **Mapping Commercial Patterns**

Figure 2: Public & Commercial Spaces

Once the view sheds are defined, the next phase of analysis involves mapping the development patterns of public spaces and commercial activities within these areas. Public spaces such as parks, plazas, and open-air markets, as well as commercial entities such as retail stores, restaurants, and office buildings, will be mapped within the view sheds. This mapping will provide insights into how public spaces develop organically around transit stops and how commercialization unfolds in response to visual access.

- **Comparing Conventional and View Shed-Based TOD Patterns**

The final step involves comparing the conventional TOD walking radius approach with the new view shed-based methodology. Key indicators for comparison include the density of public spaces, the diversity of commercial uses, pedestrian movement patterns, and land values. This comparison will help highlight differences between the rigid zoning of walking radius and the more organic, visual patterns identified in the view shed analysis.

4. EXPERIMENTAL RESULTS

- **Case Study Analysis:**

For this study, we selected two major transit hubs in a medium-sized city: **National Hospital (near metro hub)** and **Mandi (bittan ground).** Both stations serve different modes of transit: Station A is a metro hub, while Station B is a bus terminal. Below are the results of the view shed analysis, comparing the conventional walking radius and the view shed-derived public space patterns.

Table -1: Comparison of Public Space Density within Conventional Walking Radius vs. View Sheds

Transit Stop	Conventional Walking Radius (400m)	View Shed Radius (Variable)	Public Space Density (%)	Commercial Density (%)
National Hospital	60%	25%	32%	20%
Mandi (Bittan Ground)	12%	5%	70%	45%

As seen in Table 1, the density of public spaces and commercial activities is consistently higher in the areas defined by the view shed radius compared to the conventional walking distance model. The view shed radius appears to more accurately capture the organic spread of development.

- **Visualization of TOD Patterns**

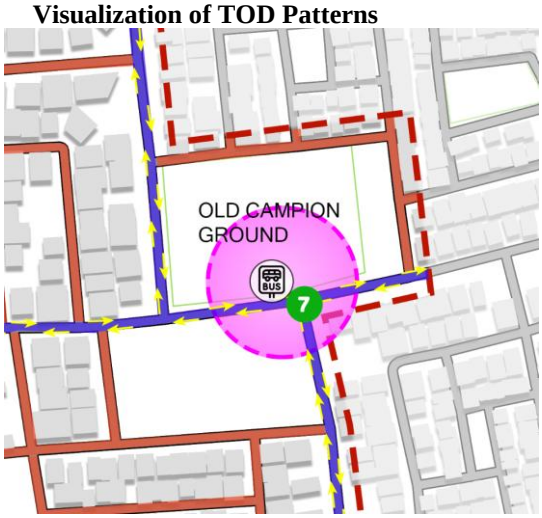

Figure 3: View Shed & Conventional TOD Zone for National Hospital

Description: The map shows the conventional 400-meter walking radius and the dynamic view shed-based boundary

for metro station. Public spaces and commercial hubs are more distributed in the view shed zone.

- **Commercialization and Public Space Evolution**

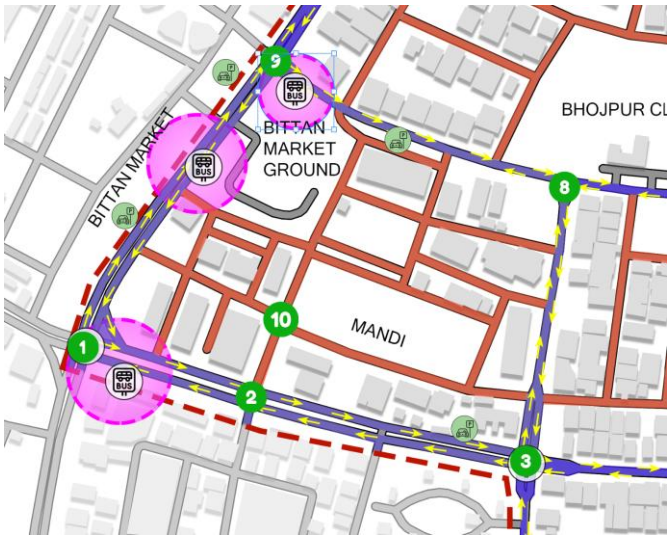

Figure 4: Commercial Evolution within View Sheds for Mandi (Bittan Ground)

Description: The commercial growth is more dispersed and aligned with visual accessibility.

5. DISCUSSION AND CONCLUSION

5.1 Discussion:
The results indicate that the traditional walking radius model for TOD significantly under-represents the potential for development in areas defined by transit visibility. The view shed analysis reveals that public spaces and commercial developments tend to follow more organic patterns, with a stronger influence from visual accessibility than from physical proximity alone. This alternative approach also provides a more flexible tool for planners, as it allows for consideration of the visual and aesthetic qualities of urban spaces. The analysis of commercial density further suggests that view sheds can be crucial in predicting areas of high economic activity, which can inform future urban policies.

5.2 Conclusion:
The view shed-based methodology for analyzing Transit-Oriented Development provides a more accurate and flexible framework for urban planners. By considering the visual proximity of transit stops and how public spaces and commercial patterns evolve around them, cities can create more dynamic, accessible, and sustainable urban environments. This approach offers a richer understanding of TOD that goes beyond the limitations of conventional walking radius models and contributes to more effective urban design strategies.

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BIOGRAPHIES

I am Faisal Hanfi, an architecture student at SOA RGPV, with a keen interest in urban design and sustainable architecture. My research focuses on how architecture can contribute to creating more inclusive, resilient, and environmentally conscious urban spaces. I'm passionate about exploring design solutions that address the complex challenges faced by modern cities.