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EVALUATION OF PEDESTRIAN PLANNING IN BHUBANESWAR

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Abstract

The paper examines the prevalence of vehicular-centricity over pedestrian-centricity in Bhubaneswar's road infrastructure, despite its planned city status. Urbanization challenges prioritize roads and vehicular traffic, neglecting pedestrian-centric design. The study systematically analyzes four urban road categories, collecting pedestrian and vehicular flow data. Surveys and interactions identify challenges related to the absence of pedestrian-oriented streets. Findings reveal varied significance of pedestrian roads based on administrative classification, with widths ranging from 20% on 60-meter roads to almost 0% on 9 to 30-meter roads. The research investigates walkability factors contributing to limited pedestrian road usage, citing infrastructure constraints, safety concerns, socio-economic factors, and urban planning policies. The low pedestrian traffic in urban areas is a significant concern, influenced by a confluence of these factors. Overall, the paper underscores the need to rebalance urban planning priorities to foster pedestrian-friendly environments and addresses the multifaceted challenges impeding the utilization of pedestrian roads in Bhubaneswar.

Keyword: Pedestrianism, Walkability, Vehicular - Centricity, Pedestrian - Centric, Vehicular Flow.

1 Introduction

Urbanization stands as a defining characteristic of the 21st century, witnessing unprecedented growth and transformation in cities globally. The design and development of cities play a pivotal role in shaping the quality of life for residents. The road network, a critical component of urban infrastructure, serves not only as a transportation means but also reflects the priorities and values of city administrations.

Bhubaneswar, the capital city of Odisha, exemplifies a rapidly evolving urban center that has become a hub for education, business, and culture. Despite government initiatives such as the Sustainable Habitat Development Programme (SHDP) and Pradhan Mantri Gram Sadak Yojana (PMGSY), the city faces challenges, particularly in traffic management and pedestrian safety. The emphasis on accommodating vehicular traffic has often come at the expense of pedestrians' safety, comfort, and convenience, resulting in a cityscape where motor vehicles dominate, diminishing the overall quality of life for residents. The paper explores the reasons behind the low prioritization of pedestrian safety, investigating factors that contribute to this imbalance in urban planning.

An examination of the factors influencing the insufficient provision of pedestrian pathways, considering aspects of infrastructure, planning policies, and urban development challenges. Identification and anal-

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ysis of the key challenges and hazards experienced by pedestrians due to the current road infrastructure and traffic-centric planning. The paper explores strategies and recommendations for promoting proper use of pedestrian pathways, fostering a culture of pedestrian-friendly urban spaces.

The research delves into the historical context and the current state of Bhubaneswar's road infrastructure, aiming to provide insights for urban planners, policymakers, and the general public. By fostering a broader dialogue on sustainable and inclusive urban development, the paper seeks to contribute to the creation of a city that prioritizes the well-being of all inhabitants, with a specific focus on pedestrians.

2 Literature Survey

It was noted by (Gehl, 2023) that the concept of a compact city, characterized by development centered around public transport, walking, and cycling, is deemed the only environmentally sustainable urban form. However, achieving the vision of a compact city requires an increase in population densities and the creation of well-planned, aesthetically pleasing public spaces that prioritize the human scale. These public spaces should be designed to be sustainable, healthy, safe, and vibrant.

The method developed in the present study utilizes a combination of the historical crash data analysis, the analysis of pedestrian-vehicular conflict i.e., pedestrian-vehicular post-encroachment time along with pedestrians' risk perception toward the built environment and traffic parameters, to identify the key factors influencing pedestrian safety and to recognize potential risk-prone intersections in India. (MUKHERJEE) It is being stated by (MUKHERJEE) stated in his paper that the outcomes indicate that vehicle speed, lack of enforcement, absence of traffic signal (for traffic as well as pedestrians), land use type, slum population, inadequate sight distance, pedestrian's state of crossing, and pedestrian's risky crossing behavior substantially affect the average PET at road network-level.

It is written by (Galston) in his paper that the allure of public spaces lies not only in the physical environment but also in the social connections they facilitate. People are drawn to public spaces for a variety of reasons, and the social aspect plays a pivotal role. This can be observed through two main types of interactions. It is being mentioned by (Lynch) in his paper that the analysis of an environmental image can be broken down into three distinct components: identity, structure, and meaning. Although these components can be abstracted for analytical purposes, it is crucial to recognize that, in reality, they are interconnected and often coexist within the overall context of the image.

Intersections

The roundabouts in Bhubaneswar were initially designed to improve safety and efficiency for drivers, pedestrians, and cyclists at intersections. Nevertheless, as the city witnessed a consistent rise in traffic volume over the years, an intervention was introduced—flyovers constructed above roundabouts. While the primary purpose of these flyovers was to mitigate traffic congestion, they inadvertently gave rise to bottlenecks at connecting roads, leading to an escalation in road accidents and an overall increase in traffic congestion. The construction of flyovers, meant to facilitate vehicular traffic, introduced elevated risks and detours for pedestrians and cyclists. The Comprehensive Development Plan (CDP) study and various street design projects in the city reveal that a majority of intersections in Bhubaneswar are either multi-legged or skewed, contributing to heightened conflict zones and prolonged signal phases for both pedestrians and vehicles. Moreover, the prevailing traffic system in Bhubaneswar prioritizes motor vehicles, neglecting the safety concerns of pedestrians and cyclists. The placement of traffic signals far apart from each other in Bhubaneswar exacerbates the issue, allowing for increased motor vehicle speed and impeding the smooth movement of people between neighborhoods. Despite being a planned city with an interconnected street network, residents grapple with safety concerns, extended waiting times, and challenges in crossing due to the absence of mid-block crossings. This observation rightly emphasizes the crucial need for a more balanced and inclusive approach to urban planning. Prioritizing the safety and convenience of all road users, including pedestrians and cyclists, is fundamental for creating sustainable and livable urban environments. A holistic and inclusive urban planning strategy can address various challenges and promote the well-being of the entire community.

Road Safety

Bhubaneswar faces significant challenges due to the substantial volume of regional traffic passing through the town, resulting in conflicts between slow-moving and fast-moving vehicles. The mingling of various types of traffic and conflicts between pedestrians and vehicles significantly contribute to the escalating risk of accidents. Notably, the busiest crossings in terms of vehicular traffic volume, such as Rajmahal Square, Vani Vihar Square, Kalpana Square, Ram Mandir Chowk, Ravi Talkies, and Saheed Nagar Chowk, also witness

the highest volume of pedestrian traffic, further intensifying pedestrian-vehicular conflicts. Unfortunately, many of these critical intersections lack proper pedestrian facilities, exacerbating safety concerns.

One of the fundamental challenges in addressing these issues lies in the fragmented nature of legislation related to urban transport. Urban transport is not a single unified subject matter under the Constitution, resulting in multiple laws and agencies at the national, state, and city levels with overlapping roles. While the provision of urban transport infrastructure falls under the responsibility of the urban local body, specifically the Bhubaneswar Municipal Corporation (BMC), the current system faces several problems:

- Multiple organizations, including BMC and PWD, are involved in transport infrastructure provisioning, leading to a lack of accountability in ownership, performance, and maintenance of transport infrastructure.
- There is no dedicated agency overseeing the design, enforcement, and safety of non-motorized transport, including pedestrians.
- The absence of a separate budget allocation for non-motorized transport, which is often subsumed within the roads budget, hinders focused efforts on improving pedestrian and cycling infrastructure.
- A dearth of technical expertise and insufficient data on walking, cycling, and public transit within the authorities impedes the effective implementation of urban transport projects.

Addressing these systemic challenges requires a holistic approach, involving coordinated efforts among various agencies, clear accountability structures, and dedicated oversight for non-motorized transport, appropriate budget allocations, and the development of technical expertise and data capabilities within the relevant authorities. This approach is crucial for fostering safer and more sustainable urban transport systems in Bhubaneswar. Case in point being in spite of the continued presence of BDA, BMC, PWD & DTP, Orissa, only a very small portion of the city is covered by Pedestrian pathways as shown in the map below.

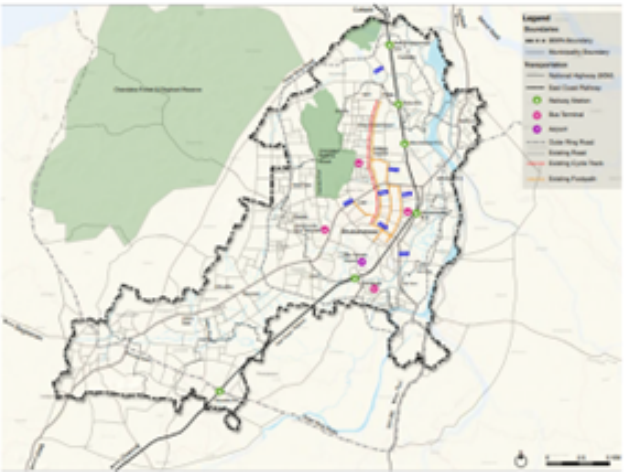

Figure 1: Map showing Bhubaneswar Road connectivity (guide)

3 Methodology

The suitability of an index to evaluate the walkability level of an urban street lies in the examination of pedestrians' use of the street. Enhancing pedestrian safety, mobility, and convenience is a crucial step toward promoting sustainable mobility in urban areas. In this study, three key indexes were explored:

- Pedestrian Traffic Flow:
- Assessment of pedestrian traffic flow in both highly populated and lowly populated areas to gauge the intensity of pedestrian usage.
- Walking Behavior of Pedestrians:
- Examination of the walking behavior of pedestrians to understand patterns, preferences, and challenges in their movement within urban streets.
- Motorized Traffic Flow:
- Analysis of motorized traffic flow during different intervals of the day to comprehend the dynamics of vehicular movement.

The study commenced with an extensive literature review encompassing urban planning and transportation studies, along with case studies of cities that have successfully implemented elevated pedestrian pathways. Subsequently, a meticulous site selection process was undertaken, considering factors such as traffic density, pedestrian footfall, and urban connectivity, to identify suitable locations for proposed elevated pathways.

The study area focused on the streets of Bhubaneswar, comprising four urban streets (Janpath, KIIT Square, Esplanade Square, and Nayapalli) situated nearby or within the central area of the city. Data collection involved a combination of quantitative and qualitative methods, including traffic flow analysis, observations of pedestrian behavior, and surveys to gauge public opinion on safety and convenience. The research employed statistical analyses to evaluate the potential impact of elevated pedestrian pathways on reducing traffic-related accidents and enhancing overall urban livability. This comprehensive methodology aims to provide a clear understanding of the importance and feasibility of implementing pedestrian pathways above traffic-oriented roads.

4 Data Collection

The Street Design Guidelines for Bhubaneswar in 2021 highlight the presence of a grid iron pattern in the city's road network, particularly in areas with wide roads. However, a Critical observation has been made that traditional planning approaches have traditionally prioritized vehicular movement over pedestrian mobility. Notably, a significant percentage of last-mile trips are covered by motorcycles and bicycles, often utilizing pedestrian pathways.

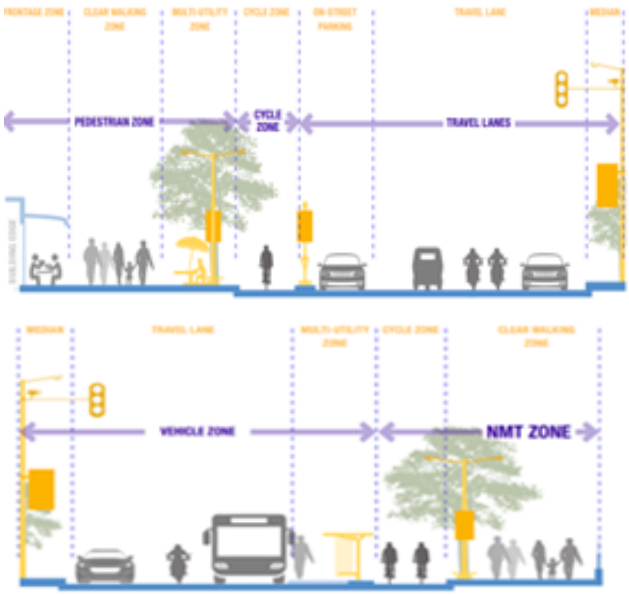

Figure 2: Bhubaneswar Road Section (guide)

NAME OF THE ROADS	VEHICULAR ROAD	PEDESTRIAN ROAD	MAINTAINANCE OF PEDESTRIAN ROAD	USAGE OF PEDESTRIAN ROADS
JANPATH ROAD	GOOD	GOOD	GOOD	GOOD
ESPLANADE SQUARE	GOOD	POOR	POOR	POOR
NAYAPALLI	GOOD	MODERATE	POOR	MODERATE
KIIT SQUARE	GOOD	MODERATE	POOR	GOOD

Table 1: Comparative analysis between the four major traffic nodes in Bhubaneswar (Author).

Inequitable allocation of road space

The Bhubaneswar Street network exhibits a clear dichotomy, incorporating both traditional and modern planning principles, reflecting the evolution of the city over different periods. The old historic core, characterized by streets with Right of Way (RoW) less than 12 meters, was originally designed as shared spaces accommodating walking and cycling as the predominant modes of transportation. However, the surge in motorized vehicles has disrupted the inherent balance of these shared streets. This transformation has led to an emphasis on private motor vehicles, thereby marginalizing pedestrians and cyclists to the peripheries of safe movement. In contrast to the historic core, the planned city's road hierarchy was primarily delineated based on traffic volumes, resulting in expansive RoW. Notably, roads with widths of 60 meters and 45 meters dominate this landscape. However, the allocation of space for Non-Motorized Transportation (NMT) on these wide roads is disproportionately minimal compared to motorized vehicles. Additionally, these broad thoroughfares are supported by substantial building setbacks ranging from 6 to 15 meters, further elongating NMT access time between the two building facades. This urban layout underscores the challenges in integrating traditional and modern planning principles, especially in reconciling the needs of different modes of transportation within the evolving cityscape. The capital town of Bhubaneswar faces challenges in providing adequate pedestrian and cycling infrastructure, particularly in comparison to its extensive road network. Even after having a total road length of 1,468 km, the city only has footpaths of 120 km and cycle tracks of 40 km. The existing pedestrian facilities, where available, are often inadequate, characterized by narrow widths, elevated surfaces, and poor conditions. Additionally, these footpaths are frequently obstructed by various elements such as large tree pits, distribution boxes for electricity, street lights, vendors, bus stops and parked vehicles, impeding pedestrian movement and safety.

Figure 3: Pedestrian Street image for KIIT Square, Esplanade Square and Nayapalli road (Author)

In the older part of Bhubaneswar, there is a noticeable absence of a well-planned road system. The current road infrastructure fails to cater to the needs of bicycles and pedestrians, leading to a situation where people opt to walk on vehicular rights-of-way. This preference for walking on roads designed for motorized traffic contributes to heightened conflicts between pedestrians and motorists, posing safety risks and diminishing the overall quality of the urban environment. Addressing these issues necessitates a comprehensive approach to urban planning that prioritizes the creation of pedestrian-friendly spaces and dedicated cycling infrastructure within the city.

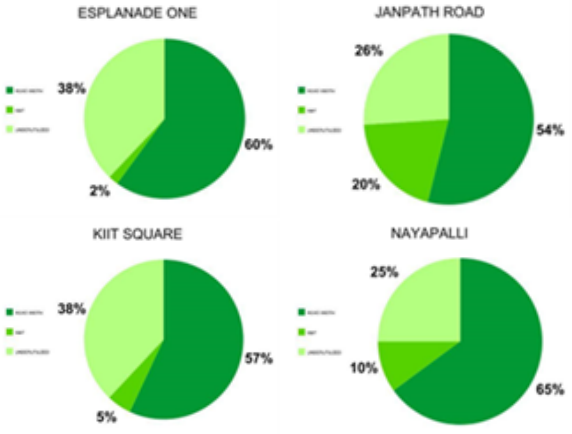

Figure 4: Pie chart analysis of Main Road, NMT and Underutilized Road for Esplanade Square, Janpath, KIIT square, Nayapalli (Author)

5 Data Analysis

Bhubaneswar presently demonstrates a 12% mode share for Non-Motorized Transport (NMT) and pedestrians, coupled with a 26% mode share for public transport modes, encompassing autos and buses. Nonetheless, there is a disconcerting trajectory marked by a growing prevalence of motorization and a corresponding decline in NMT travel. This shift has precipitated a host of challenges, including traffic issues, environmental deterioration, and elevated occurrences of road accidents, and encroachments, all of which collectively pose considerable impediments to the city's overall development.

The challenges you've highlighted regarding the pedestrian pathways in Bhubaneswar underscore critical safety and accessibility issues. These concerns include:

Uneven and High Pedestrian Pathways: Pedestrian pathways with uneven surfaces and elevated heights of approximately 0.5 meters pose safety risks and inconvenience for pedestrians. This can create difficulties, particularly for individuals with mobility challenges.

Misuse by Motorized Vehicles: The misuse of pedestrian pathways by motorized vehicles, such as bikes and cycles, as shortcuts is a significant safety concern. This practice not only jeopardizes pedestrian safety but also contributes to conflicts between different modes of transportation.

Lack of Pedestrian Pathways: The absence of pedestrian pathways in certain areas forces people to use the main road for walking, posing heightened risks, especially for vulnerable groups such as children and the elderly. This lack of dedicated infrastructure undermines pedestrian safety and well-being.

To address these issues, a comprehensive approach is necessary: Infrastructure Improvement: Addressing the uneven surfaces and high elevation of pedestrian pathways to ensure a safe and accessible walking environment.

Enforcement of Regulations: Implementing and enforcing regulations to prevent the misuse of pedestrian pathways by motorized vehicles.

Expansion of Pedestrian Infrastructure: Extending the network of pedestrian pathways to areas where they are currently lacking, especially in zones with a higher likelihood of pedestrian activity.

Community Engagement: Involving the community in discussions about pedestrian safety, gathering input on where improvements are needed, and raising awareness about the importance of pedestrian-friendly infrastructure.

Ensuring safe and well-maintained pedestrian pathways is crucial for fostering a city that prioritizes the safety and accessibility of all residents, including children and the elderly.

Recognizing the need for a people-centric approach, Bhubaneswar has taken a significant step by initiating a Transit Oriented Development (TOD) Policy. This policy holds the potential to coordinate land use planning, transportation system design, and infrastructure investments in an integrated manner. By prioritizing Transit Oriented Development, the city aims to create a more sustainable and livable urban environment that places people at the center of the planning process.

TOD emphasizes the efficient integration of public transportation with land use, promoting mixed-use development around transit nodes. This approach not only enhances mobility but also addresses environmental concerns, reduces congestion, and fosters a more inclusive and accessible urban fabric. By adopting a philosophy that puts people first in the design of city systems and processes, Bhubaneswar is taking a positive stride toward building a more resilient and sustainable urban future.

6 Conclusion

The research underscores the urgent need to address the challenges posed by Bhubaneswar's changing climate on residential housing. With the city experiencing alarming increases in temperature, humidity, and urbanization, the demand for effective solutions to enhance thermal comfort and sustainability in homes is paramount. Bioclimatic design emerges as a promising approach to mitigate these challenges, offering cost-effective strategies to optimize indoor environments while reducing energy consumption. By investigating the impact of climate on residential units and exploring bioclimatic design principles, this research contributes valuable insights for architects, planners, policymakers, and residents alike. It highlights the importance of site-specific and context-sensitive design solutions that prioritize natural ventilation, daylighting, and thermal comfort. Additionally, the case studies and data analysis shed light on the inadequacies of current building practices and underscore the need for improved materials and construction techniques. Bhubaneswar can pave the way for resilient, energy-efficient, and comfortable residential housing that meets the needs of its residents while safeguarding the natural environment for future generations.

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