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Strategies for Enhancing Walkability in Central Business District

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Abstract: Walking is a fundamental and sustainable mode of transportation, particularly crucial in Central Business District (CBD) where economic, social, and commercial activities are concentrated. Despite nearly half of urban commuters in India depending on walking, rapid urbanization has led to inadequate pedestrian infrastructure, increasing risks and diminishing accessibility. This study emphasizes the urgent need to evaluate and enhance walkability within CBD, addressing challenges such as pedestrian-vehicular conflicts, unsafe crossings, congestion, and lack of inclusive infrastructure. The research aims to analyze key factors affecting pedestrian movement, assess existing conditions, and propose strategic urban interventions to improve pedestrian safety and mobility. Anchored in literature on walkability parameters and indices, the study also explores the relationship between pedestrian-friendly environments and public transport usage, environmental comfort, and urban vitality. Through a focused scope limited to a specific CBD, the study incorporates walkability audits, international best practices, and planning strategies—such as tactical urbanism, urban cooling, and mixed-use development—to frame a replicable model for improving pedestrian environments in dense urban cores. The findings contribute toward sustainable urban mobility and the creation of safer, accessible, and vibrant public spaces.

Keywords: Walkability, Pedestrian Safety, Central Business District (CBD), Pedestrian Infrastructure, Traffic Congestion, Walkability Index.

I. INTRODUCTION

Walking is a fundamental mode of transport, especially vital in Central Business Districts (CBDs), where economic and social activities are concentrated. According to the *Integrated Transport Indicators in India* (2007), nearly 50% of urban citizens rely on walking for daily commutes, underlining the need for pedestrian-friendly infrastructure. Moura et al. (2017) define walkability as the ease and safety of walking in urban environments, which is linked to health, reduced emissions, and stronger social ties.

However, rapid urbanization often leads to inadequate pedestrian infrastructure—narrow sidewalks, unsafe crossings, and vehicular conflicts—that reduce safety and accessibility. Studies like those by Wicramasinghe and Dissanayake (2017) highlight the health and environmental benefits of walking, reinforcing its value in city planning. In CBDs, improved walkability not only supports mobility and inclusivity but also boosts commercial activity and urban vibrancy. This research focuses on evaluating and enhancing walkability in CBDs through targeted urban design and infrastructure strategies to create safer, more sustainable, and economically vibrant public spaces.

1. NEED OF THE STUDY

In urban areas, especially in Central Business Districts (CBDs), pedestrian and vehicle conflict is a major safety concern. A study by the National Institute for Transportation and Communities (NITC) found that around 80% of pedestrian fatalities occur in urban settings where space is shared with vehicles. High congestion further worsens the issue—according to INRIX (2019), Indian cities like Mumbai (53%) and Delhi (44%) rank among the most congested globally, increasing pedestrian-vehicle interaction and risk.

The lack of pedestrian infrastructure also plays a critical role; as per the Indian Roads Congress (IRC), only 40% of roads have pedestrian-friendly features. A Ministry of Urban Development study highlighted that 70% of urban streets lack proper crossings, footpaths, or signage. Safety is a growing concern—WHO reports that pedestrian deaths make up nearly 40% of road fatalities in India, and NCRB data shows over 40% of urban road accidents involve pedestrians, particularly in CBDs. Further, INRIX's Global Traffic Scorecard (2020) notes that Mumbai commuters spend an average of 6 hours weekly in congestion, creating more conflict zones between vehicles and pedestrians.

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II. OBJECTIVE

a) To analyze the key factors influencing pedestrian movement.
b) To evaluate the current conditions and challenges for pedestrians in the Central Business District.
c) Identify Strategies to Improve walkability in Central Business District.

III. SCOPE & LIMITATION

The scope of this study centers on the Central Business District (CBD), with particular emphasis on zones experiencing high levels of pedestrian and vehicular conflict. It involves a comprehensive assessment of existing pedestrian infrastructure, safety measures, traffic management practices, and urban design elements that influence walkability. The research aims to identify critical issues affecting pedestrian movement and propose strategic interventions to enhance safety and accessibility. However, the study has certain limitations. It is confined to a specific CBD and does not extend to suburban or peripheral urban areas, which may have different mobility patterns. Additionally, while urban mobility encompasses various modes of transport, this research focuses primarily on pedestrian movement, walkability, and conflict with vehicular traffic, and may not comprehensively address other aspects such as public transport or cycling infrastructure.

IV. LITERATURE STUDY

4.1 Walkability and its Parameters

Urban Central Business Districts (CBDs) in India face Walkability. Walkability refers to the extent to which the built environment supports and encourages walking by providing safe, comfortable, and accessible conditions for pedestrians. According to Lo (2009), walkability is defined by the quality through which the built environment enables pedestrian mobility. Traditionally, pedestrians have been defined as individuals traveling by foot. However, this definition has broadened to include those using wheelchairs or other assistive devices, recognizing the importance of inclusive urban mobility.

Key parameters influencing walkability are summarized in Table 1. These parameters encompass both physical infrastructure and broader planning aspects that facilitate or hinder pedestrian movement

Parameter	Description
Pedestrian Infrastructure	Quality of sidewalks, pedestrian crossings, street furniture, and accessibility features (ramps, benches, etc.).
Land Use	Presence of mixed-use developments, encouraging proximity to destinations and services.
Street Connectivity	The extent to which streets and pedestrian paths are inter-connected, allowing easy access to different locations within the CBD.
Traffic Calming	Measures to slow down vehicular traffic, such as speed bumps, narrow lanes, and raised crossings.
Safety and Security	Ensuring safety through well-lit streets, visible surveillance, and reduced traffic conflict zones.
Public Transport Accessibility	Proximity and ease of access to public transportation, including bus stops, metro stations, and bike-sharing facilities.
Environmental Comfort	Protection from elements like sun, rain, and wind, through shade, trees, canopies, or weatherproofing.
Pedestrian-Friendly Policy	Policies that prioritize pedestrian movement, such as pedestrian zones, reduced parking spaces, and car-free days.

Table -1 Walkability parameter

4.2 Walkability Index

The Walkability Index, also referred to as Walk Score, is a widely recognized metric for assessing the pedestrian-friendliness of urban areas. It assigns a numerical score ranging from 0 to 100, reflecting how easily residents can access essential amenities, such as shops, schools, parks, and public transport hubs, on foot. The methodology, as adapted from the World Health Organization (WHO), incorporates a combination of spatial, design, and infrastructural variables, including:

a) Street network density – a higher density facilitates easier pedestrian movement.
b) Mixed-use development – integration of residential, commercial, and recreational functions.
c) Pedestrian infrastructure – availability and quality of sidewalks, pedestrian crossings, and lighting.
d) Access to public transport – proximity to transit stops and connectivity options.

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Minhas & Poddar (2017) provide clear guidelines to interpret Walk Scores:

Walk Score	Rating	Description
90–100	*Walkers' Paradise*	Daily errands do not require a car; most amenities are within a 5–10 minute walk.
70–89	*Very Walkable*	Most errands can accomplished on foot; the area has good pedestrian infrastructure.
50–69	*Somewhat Walkable*	Some amenities are within walking distance, but many require use of a car or transit.
25–49	*Car-Dependent*	Most errands require a car due to sparse amenities and poor pedestrian infrastructure.
0–24	*Highly Car-Dependent*	Almost all errands require a car; the area lacks pedestrian-friendly features.

Table 2: Walkability Index Rating Scale
Source: Minhas & Poddar (2017)

4.3 Central Business District

The Central Business District (CBD) represents the economic and cultural core of a city. Characterized by a dense concentration of commercial establishments, retail outlets, and office spaces, it serves as the hub for business activities and public services. Due to its central role in urban life, the CBD typically experiences a high volume of pedestrian movement throughout the day. According to A. M. L. Jones, the CBD is more than just a geographical center ; it is a distinct urban zone defined by several characteristics such as high land values, intensive commercial activity, and significant pedestrian traffic. The unique combination of spatial, economic, and social attributes makes the CBD a critical focus area for urban planning, especially concerning walkability and pedestrian safety. The following Table 3 shows the parameters summarize the key characteristics of a typical Central Business District:

Parameter	Details
Spatial Layout and Zoning	Mixed land use: commercial, residential, retail, recreational; High-rise buildings & dense development; Open spaces (parks, plazas, etc.)
Transport and Accessibility	Public transport connectivity (metro, buses, trams); Pedestrian connectivity (safe walkways, crossings); Traffic management and parking strategies
Economic Activity	Business hubs: corporate offices, financial institutions; Retail & commercial spaces (shops, restaurants, entertainment); Business diversity
Infrastructure and Utilities	Technology infrastructure (high-speed internet, smart city features); Utilities (water, waste management, drainage); Smart lighting & signage
Walkability and Pedestrian Movement	Wide sidewalks & pedestrian zones; Safety measures (lighting, surveillance); Public amenities (seating, fountains, toilets)
Cultural and Social Space	Public art, monuments; Event spaces for festivals, performances; Civic buildings (government, cultural institutions)
Environmental Considerations	Green and blue infrastructure (trees, water features); Climate resilience (sustainable materials, green spaces); Energy efficiency
Safety and Security	Crime prevention (lighting, sightlines); Emergency services accessibility; Public safety measures (security personnel, surveillance)
Social and Demographic Aspects	Diverse population (age, income, culture); Affordable housing availability; Inclusivity and community engagement

Table 3: Parameter of Walkability

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4.4 Issues Related to Walkability in the CBD

The Central Business District (CBD) faces multiple urban challenges that significantly affect its walkability and pedestrian safety. Traffic congestion and vehicular conflicts are among the most pressing issues, with high volumes of vehicles disrupting the smooth movement of pedestrians and increasing the risk of accidents. A lack of pedestrian infrastructure, such as proper sidewalks, safe crossings, and dedicated pedestrian zones, further worsens mobility conditions. In addition, environmental pollution—both air and noise—caused by dense traffic and intense urban activity negatively impact the quality of the pedestrian environment. Safety and crime concerns also deter walking, as poorly lit areas and inadequate surveillance contribute to an unsafe atmosphere. Moreover, overcrowding and a lack of pedestrian space—often encroached upon by street vendors or parked vehicles—limit comfortable movement. Lastly, ineffective traffic management and unregulated parking practices lead to chaotic road conditions, further exacerbating pedestrian-vehicle conflicts and reducing overall accessibility within the CBD.

4.5 Promoting Greater Adoption of Public Transportation through Walkability

Enhancing walkability—the ease and convenience with which pedestrians navigate urban spaces—is a vital strategy for increasing public transportation usage. Research by Zhao et al. indicates that the willingness to walk to a transit stop drops significantly beyond a distance of 580 meters, while Loutzenheiser found that the probability of walking to a station decreases by 50% for every additional 500 meters. These findings highlight the importance of compact, pedestrian-friendly urban design in improving access to transit. Beyond proximity, the quality of the walking environment—including safety, accessibility, and aesthetic appeal—also plays a crucial role. Well-maintained sidewalks, safe crosswalks, adequate street lighting, and tree-lined streets contribute to a more pleasant pedestrian experience, thereby encouraging transit use. According to the Institute for Transportation and Development Policy (ITDP), cities with higher walkability scores consistently demonstrate higher public transit ridership. Moreover, integrating walkable environments with public transport networks yields broader societal benefits such as reduced carbon emissions, improved air quality, and enhanced public health through increased physical activity. Therefore, investing in pedestrian infrastructure and designing urban areas that offer safe and enjoyable access to transit hubs is essential for fostering sustainable mobility and increasing the adoption of public transportation.

4.6 Strategies Implemented to Improve Walkability

1. Urban Cooling Strategies

To mitigate the urban heat island effect and enhance pedestrian comfort, many cities are integrating urban cooling techniques such as green roofs, expanded tree canopies, reflective pavement materials, and shaded pathways.

- City Example: Melbourne, Australia, has implemented a comprehensive Urban Forest Strategy that increases tree coverage and green infrastructure across the city.
- Benefit: Cooler microclimates in urban areas reduce heat stress, making streets more comfortable and attractive for walking, particularly in warmer seasons.

2. Tactical Urbanism Initiatives

Tactical urbanism involves low-cost, temporary changes to the built environment to improve street life. These include pop-up bike lanes, temporary pedestrian plazas, parklets, and street art installations.

- City Example: San Francisco, USA, has effectively used tactical interventions through its “Pavement to Parks” program to reclaim underused streets and test pedestrian-friendly designs.
- Benefit: These interventions provide immediate improvements, allow for community engagement, and serve as pilots for permanent redesigns with minimal financial risk.

3. Promoting Mixed-Use Development

Integrating various land uses—residential, commercial, institutional, and recreational—within walkable distances reduces travel demand and supports vibrant street life.

- City Example: Portland, Oregon, USA, has adopted mixed-use zoning policies to foster compact neighborhood with high walkability and accessibility.
- Benefit: Residents can meet daily needs within walking distance, leading to reduced vehicle dependency, enhanced public safety, and dynamic local economies.

4. Conducting Walkability Audits

5. Walkability audits are structured assessments of pedestrian infrastructure, including sidewalk conditions, lighting, crossings, accessibility, and comfort levels. These evaluations help in identifying critical barriers and prioritizing interventions.

- City Example: Adel, Iowa, USA, conducted a detailed audit to enhance downtown walkability, resulting in infrastructure upgrades such as widened sidewalks, new crossings, and improved lighting.

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- Benefit: Offers data-driven insights into pedestrian needs, ensuring that investments directly target problem areas and improve safety and accessibility.

6. Park-and-Ride Facilities

These facilities are strategically located at urban peripheries and linked to public transportation hubs. Commuters park their vehicles and switch to buses, metros, or trains for the remainder of their journey.

- City Example: London, UK, features a well-integrated park-and-ride system that supports daily commutes from suburbs to the city center via rail and tube networks.
- Implementation Features: Secure parking, seamless transit connections, real-time transit info, and affordable rates.
- Benefits: Reduces urban congestion, promotes public transit use, cuts emissions, and limits the number of private vehicles entering the city core.
- Challenges: High initial infrastructure costs, land acquisition, and ensuring user convenience and frequency of connecting transit services.

7. Pop-Up Street Activations

These are temporary events or installations that transform public streets into vibrant pedestrian spaces through elements such as outdoor seating, street performances, food stalls, temporary bike lanes, and art displays.

- City Example: New York City, USA, has used pop-up events through its “Weekend Walks” initiative to revitalize neighborhood streets and promote local engagement.
- Impact on Walkability: Activations draw residents and visitors into public spaces, encourage walking and social interaction, and foster a strong sense of community. They also serve as testing grounds for long-term pedestrian infrastructure improvements.

V. CASE STUDY ANALYSIS

5.1 Case Study 1: Khan Market, New Delhi

- Initiated by- New Delhi Municipal Corporation (NDMC) Delhi Development Authority (DDA
- Stakeholders: Transport Authorities, Urban Planners and Architects, Residents and Public
- Companies Involved- Green Infrastructure Providers, Design and Planning Consultancies , Construction Companies

This budget was used for:

- Construction of pedestrian-friendly streets
- Widening of footpaths
- Installation of street furniture, lighting, and other amenities
- Landscaping and green space development

- Area Covered- approximately 1.5 kilometers

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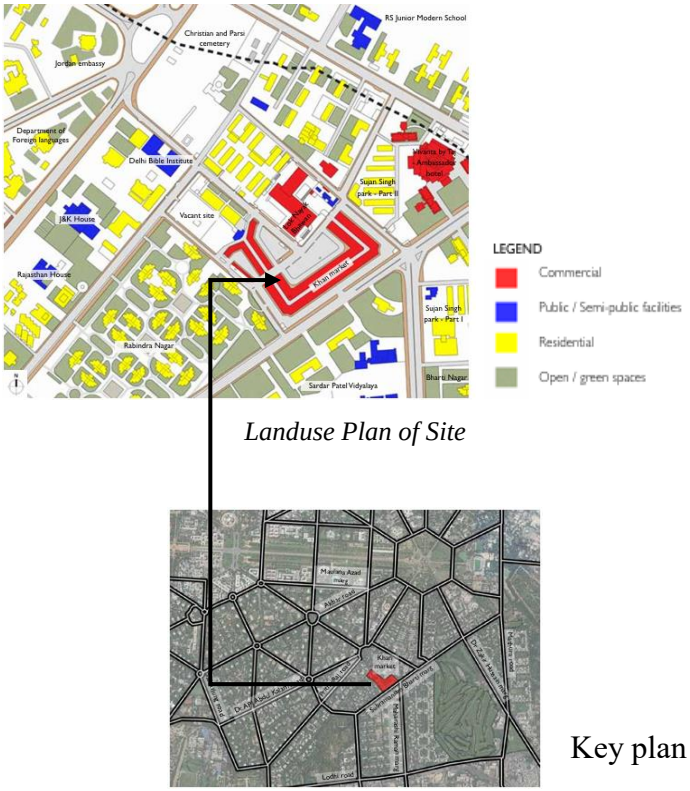

Landuse Plan of Site

Key plan

Figure 1 Location of Site(Khan Market)

Issues:

In Khan Market, several issues hinder pedestrian and vehicular movement, impacting overall walkability and user experience. The footpaths along the side lanes are only 1.0 meter wide, which restricts two pedestrians from crossing each other comfortably. Additionally, many grocery stores encroach upon the limited footpath space by displaying items outside, further breaking pedestrian continuity. The middle lane lacks shade and is poorly maintained, with broken pavers making walking inconvenient. Vehicular movement is disrupted by auto-rickshaws idling at the market entrance, as there are no designated pick-up or drop-off points for intermediate public transport (IPT) such as autos or cabs, leading to congestion on surrounding roads. Parking-related issues also persist; vehicles parked along roads and shopfronts cause congestion and visually disconnect the shopfronts from the street. Although free parking is made convenient for shoppers through designated on-street spaces and attendants, it contributes to overall congestion. Furthermore, essential utilities like solid waste and wastewater management remain unplanned. The market buildings are old and retrofitted without proper systems in place for efficient utility maintenance, adding to the operational challenges of the area.

Strategies Implemented

1. Widened Footpaths: Expanded footpaths eased pedestrian movement and reduced overcrowding.
2. Encroachment Removal: Cleared vendor/shop blockages improved footpath continuity and safety.
3. Traffic Management: Restricted vehicle entry and added drop-off zones reduced congestion.
4. Shaded Walkways: Installed shade structures and furniture enhanced walking comfort.
5. Wayfinding Signage: Clear signage improved navigation and encouraged walking.
6. Parking Regulation: Reduced on-street parking and promoted multi-level parking freed up pedestrian space.
7. Aesthetics & Landscaping: Beautification with planters and street art made the area more inviting.
8. Utility Management: Formalized waste and utility systems ensured cleaner and better-maintained surroundings.

Govt. Strategies:

- Converting parts of the market into pedestrian-only zones.
- Widening sidewalks to accommodate more foot traffic and improve safety.
- Introducing public amenities such as benches and better lighting.
- Greening the area by adding trees and landscaping elements.
- Traffic management strategies to reroute vehicles around the market area.

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5.2 Case Study 2: Manek chowk, Ahmedabad

Initiated by- Municipal Corporation of Ahmedabad
Area Covered- approximately 1.5 kilometers
Stakeholders: Local Traders and Market Associations, Heritage, Conservationists, residents and Public
Companies Involved- Green Infrastructure Providers, Design, Planning Consultancies and Construction Companies

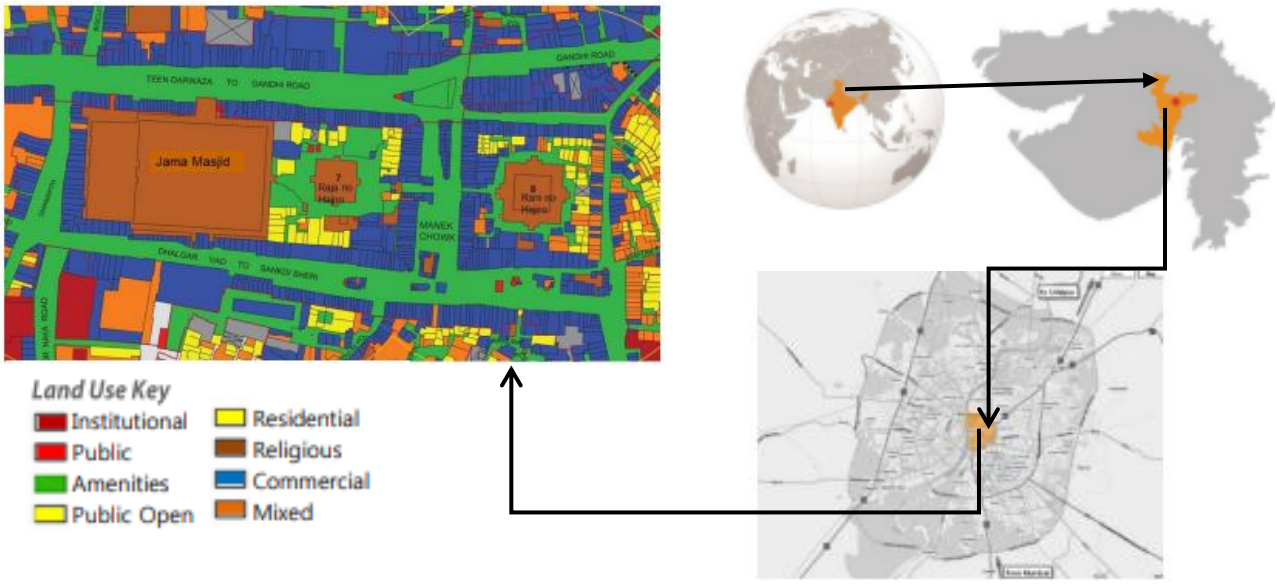

Figure 2 Location of Study (Manek Chowk)

Issues:
In the precinct, parking occupies approximately 25% of the area, leading to conflicts with other land uses and hindering pedestrian movement due to haphazard vehicle placement. To address this, multi-level parking was proposed along with designated on-street spaces for persons with disabilities (PWD) and the identification of parking zones within a 500-meter radius. Traffic congestion is exacerbated by bottlenecks and illegal two-way streets, while jaywalking further intensifies pedestrian-vehicular conflicts. In response, the area was restructured to segregate pedestrian zones from vehicular rights of way, pedestrianize the central space, and implement traffic calming measures like raised intersections, improved paving, geometric corrections, and re-routing strategies. Public open spaces lacked continuity, shade, seating, and essential amenities such as toilets and drinking water. Strategies included creating continuous shaded walkways, adding seating and lighting, and improving public signage. Informal vending contributed to visual and spatial clutter, especially in underutilized residual spaces. To manage this, designated vending zones were introduced with proper waste management systems and paved, well-structured vendor platforms. Lastly, heritage structures were deteriorating and lacked prominence. Paved walkways were developed around these sites, facades were restored, and visual access to key heritage elements was enhanced to integrate them into the public realm meaningfully.

Strategies Implemented

- Pedestrianization & Traffic Management: Limited vehicle access improved walkability and safety.
- Vendor Organization: Designated spaces with utilities enhanced efficiency and accessibility.
- Street Furniture & Amenities: Benches, bins, restrooms, and fountains boosted comfort and public use.
- Community Engagement: Trader and resident involvement ensured higher satisfaction and better upkeep.
- Safety Enhancements: CCTV, lighting, and emergency systems reduced crime and improved public security.

5.3 Case Study 3: Shariatmadari Street, Sabzevar City, Iran

Located in the heart of Sabzevar's CBD, Shariatmadari Street is a 2 km stretch rich in heritage, commerce, and public activity. Initiated in 2021 by the Sabzevar Municipality, the project aims to transform the area into a vibrant, walkable, and sustainable urban space, with expected completion by 2024.

Funding: Local government, public-private partnerships, and local business contributions
Key Stakeholders: Local Vendors & Businesses: Consulted for flow and access changes

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- Heritage Groups: Preserve landmarks and promote tourism
- Residents & Public: Beneficiaries of improved spaces

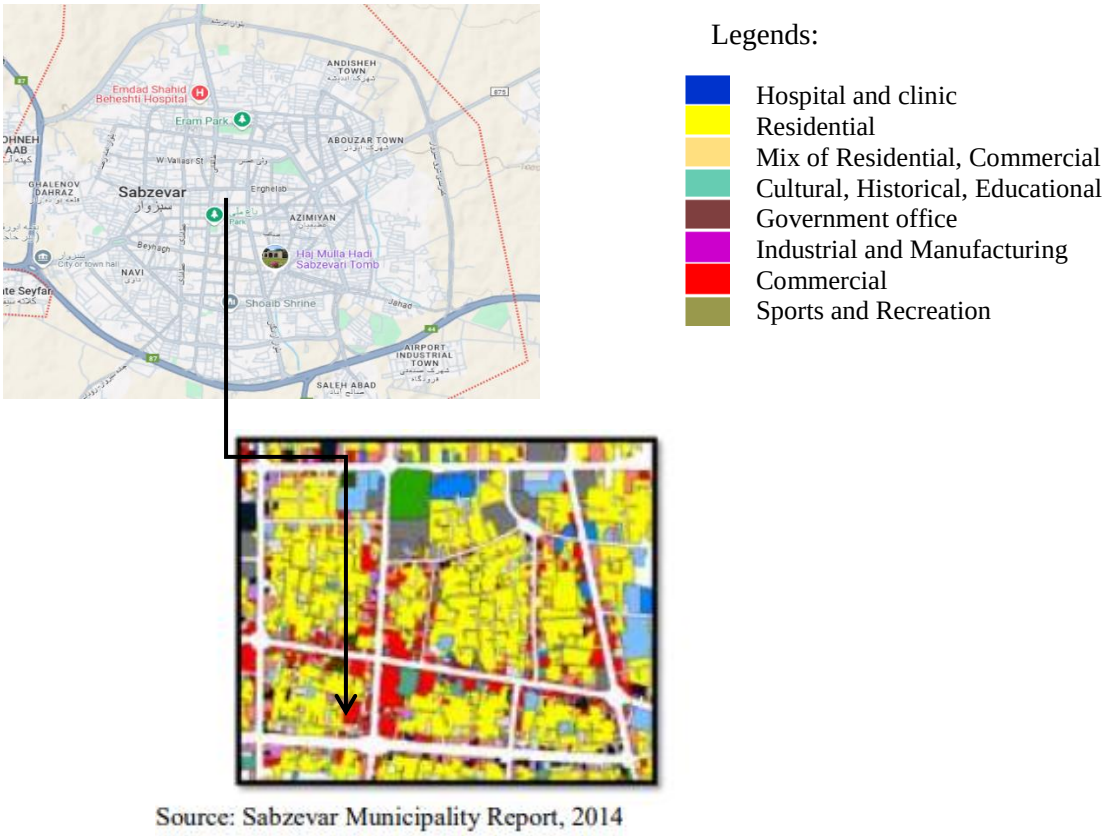

Figure *3* Location of Shariatmadari Street, Sabzevar City, Iran

Key Involvement:

- Design & Planning: Urban development and landscape firms
- Execution: Infrastructure and construction companies

The project integrates streetscape enhancements, pedestrianization, and heritage conservation to create a dynamic, inclusive city center.

Issues:

Shariatmadari Street faced multiple urban challenges prior to its revitalization. High vehicular traffic caused frequent delays and created unsafe conditions for pedestrians, while the absence of proper pedestrian infrastructure such as continuous sidewalks and designated crossings further compromised safety and accessibility. The area also lacked essential pedestrian amenities like benches, lighting, and landscaping, leading to a low walkability score and an uninviting walking environment. Traffic congestion contributed to elevated air and noise pollution levels, exacerbated by the absence of green spaces. Additionally, commercial activities were poorly integrated with pedestrian needs, resulting in a disjointed urban experience. The street environment was particularly unsafe during evenings and nights due to poor lighting and inadequate surveillance. Haphazard parking practices further encroached upon pedestrian areas and obstructed traffic flow. Moreover, the cultural and historical identity of the street was under represented in the urban design, diminishing its heritage value. Finally, there was minimal community involvement in planning processes, leading to interventions that often did not align with local needs or expectations.

Strategies Implemented

- Traffic Management: Implement traffic calming, one-way flow, and better public transport.
- Pedestrian Infrastructure: Create wide, shaded sidewalks with crossings.
- Amenities: Add benches, lighting, and landscaping for safety and comfort.
- Environmental Improvements: Introduce green belts, trees, and emission control.

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- Commercial Integration: Design pedestrian-friendly zones to boost commerce.
- Safety Enhancements: Install CCTV, better lighting, and improve visibility.
- Parking: Organize parking zones and limit on-street parking.
- Cultural Preservation: Highlight cultural landmarks through design.
- Community Involvement: Hold workshops to gather local input.

VI. RESULT & DISCUSSION

Walkability enhancement is a multidimensional objective that relies on the integration of infrastructure, policy, and community engagement.

Key observations include:

1. Interlinked Mobility Systems: Walkability is not an isolated feature but is strengthened when aligned with public transport, car flow regulation, and well-planned public spaces.
2. Soft Mobility Promotion: Cities that invest in dedicated pedestrian and cycling infrastructure observe a reduction in vehicular dependency and improved health outcomes.
3. Effective Car Management Policies: Implementation of car-free zones and congestion pricing has shown success in reducing traffic and pollution in global CBDs.
4. Public Space Design: Prioritizing pedestrians in the urban design process—through elements like shaded walkways, resting areas, and weather protection—encourages foot traffic and enhances comfort.
5. Data-Driven Strategies: Incorporating pedestrian data into urban planning results in targeted interventions and smarter allocation of resources.
6. Tech-Enabled Urban Amenities: The inclusion of interactive street furniture enhances the usability and attractiveness of public spaces.
7. Beautification and Aesthetics: A well-maintained and visually appealing urban environment draws more pedestrian activity, supporting economic and social vibrancy.
8. Safety and Surveillance: Smart lighting, secure pedestrian-only zones, and appropriate enforcement mechanisms enhance safety and pedestrian confidence.

VII. CONCLUSION

Improving pedestrian movement and safety in CBDs is not only a matter of urban design but a strategic necessity for achieving sustainable and inclusive urban mobility.

The findings clearly establish that walkability is deeply inter-connected with land use planning, transportation policies, public health, and environmental resilience. Cities that prioritize pedestrian infrastructure and integrate walkability into their broader urban development framework report significant improvements in safety, economic activity, and quality of life.

In the context of Indian CBD, especially congested and dynamic zones like Kanpur's, this research underscores the urgent need for targeted planning interventions. These include:

- Redesigning intersections and crossings to prioritize pedestrian safety,
- Implementing mixed-use zoning to reduce trip lengths,
- Enforcing parking regulations and curbing encroachments, and
- Adopting tactical urbanism to test pedestrian-friendly changes.

A Walkability Index, tailored to Indian urban conditions, can serve as a critical planning tool for assessing and improving pedestrian environments. With informed policies, participatory planning, and context-sensitive design, Indian cities can transform their CBDs into safer, more accessible, and vibrant public realms centered around people rather than vehicles

VIII. ACKNOWLEDGMENT

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