



Participatory Urban Design for Informal Settlement Upgradation: A Case of Veer Chand Patel Marg near Patna Junction

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Abstract:

Informal settlements located near major transport corridors reflect the coexistence of socio-economic dependence and spatial marginalization within rapidly urbanizing cities. This study investigates a participatory urban design process undertaken at Veer Chand Patel Marg, adjacent to Patna Junction, India, within the framework of inclusive design and community-led urban development. The research examines how participatory approaches can facilitate the incremental upgrading of an informal settlement without displacement while strengthening social infrastructure, public spaces, and community participation. A qualitative, practice-based methodology was adopted, incorporating site observations, behavioural mapping, photographic documentation, land-use analysis, and structured interactions with residents, children, street vendors, NGO volunteers from Rise Up Community Foundation, and workers from neighbouring institutional premises. Comparative insights from internationally recognized participatory upgrading initiatives informed the contextual interpretation of findings while acknowledging the distinct socio-political conditions of Patna. The study identifies critical challenges, including inadequate sanitation, poor drainage, insufficient lighting, seasonal flooding, limited educational infrastructure, and the absence of safe recreational spaces for children. Participatory engagement enabled residents to identify locally relevant priorities, resulting in design proposals comprising multifunctional shade structures, modular seating and learning platforms, child-friendly play spaces, improved drainage, waste-derived paving materials, and adaptable public spaces for education and community activities. The findings demonstrate that small-scale, community-driven design interventions can substantially enhance everyday living conditions, strengthen social cohesion, and encourage collective stewardship of shared spaces. However, participatory design alone cannot address structural issues such as insecure land tenure, institutional fragmentation, and inadequate public investment. The study concludes that context-responsive, incremental urban design strategies provide a practical pathway for promoting inclusive, resilient, and socially sustainable development in transport-edge informal settlements while recognising local communities as active contributors to urban transformation.

Keywords: Informal settlements, Participatory urban design, Inclusive design, Community-led development, Incremental upgrading, Public space, Patna Junction.

1. Introduction

Rapid urbanization in Indian cities has accelerated economic growth and infrastructure development, but it has also intensified socio-spatial inequalities, particularly within areas surrounding major transportation hubs (World Bank, 2023; Roy, 2005). Railway stations frequently function as centres of mobility, commerce, and employment, attracting large numbers of migrants and informal workers. As a result, transit-adjacent informal settlements often emerge in close proximity to these economic nodes, creating complex urban environments where high accessibility coexists with inadequate infrastructure and environmental vulnerability (Asian Development Bank, 2023).

Patna Junction, one of the most significant railway stations in eastern India, serves as a major transportation gateway and employment centre for the region. However, the urban landscape surrounding the station reflects uneven development, where formal commercial and institutional establishments coexist with densely populated informal settlements. The Veer Chand Patel Marg settlement represents one such community whose residents depend on railway-linked livelihoods including street vending, transport assistance, and small-scale service activities. Despite their contribution to the local economy, residents experience inadequate sanitation, poor drainage, fragmented public spaces, and limited access to educational infrastructure (UN-Habitat, 2015; World Health Organization, 2023).

Addressing the reviewer's concern regarding socially inclusive redevelopment, this study investigates how participatory urban design can support the incremental upgrading of transit-edge informal settlements without displacement. Through participatory mapping, field observation, and stakeholder engagement, the research explores community-led strategies that strengthen public spaces, educational opportunities, environmental resilience, and livelihood retention. By examining Veer Chand Patel Marg as an interface between formal urban infrastructure and informal socio-economic networks, the study contributes to contemporary debates on inclusive urbanism, participatory planning, and sustainable settlement upgrading (Kumar & Banerjee, 2023; UN-Habitat, 2021).

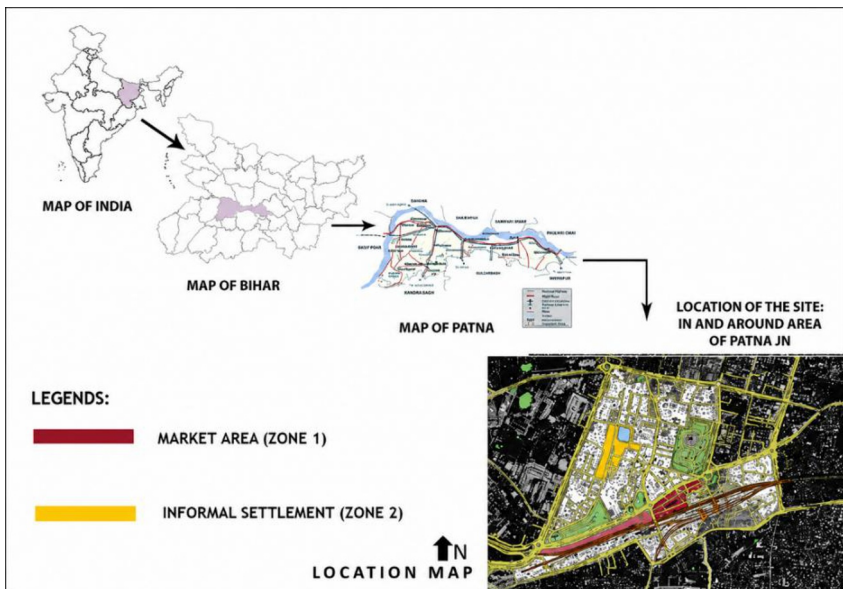


Fig.1. Location map.



Fig.2. Street school in Informal Settlement without basic infrastructure.

1.1 Research Aim

The primary aim of this study is to evaluate how participatory urban design can contribute to the incremental upgrading of transit-edge informal settlements while preserving existing livelihood systems and strengthening community infrastructure.

1.2 Research Questions

RQ1: What are the major spatial, environmental, and socio-economic challenges experienced by residents of the Veer Chand Patel Marg settlement?

RQ2: How can participatory planning processes contribute to the development of context-sensitive and community-supported upgrading strategies?

RQ3: To what extent can incremental urban design interventions improve living conditions while preserving livelihood opportunities and social networks?

1.3 Analytical Framework

The effectiveness of proposed interventions is evaluated using three interconnected criteria:

1. Spatial Improvement: circulation, sanitation, drainage, and public space quality.
2. Social Inclusion: accessibility, safety, education, and community participation.
3. Livelihood Retention: protection of informal economic activities and reduction of displacement risks.

These criteria's form the basis for the analytical framework used throughout the study.

2. Literature Review

2.1 Informality and Transit-Adjacent Urbanization

Informal settlements are increasingly recognized as essential components of urban development, contributing labour, services, and affordable housing within rapidly urbanizing cities (Roy, 2005). Their growth is particularly evident around transportation hubs, where access to employment opportunities attracts migrant and low-income populations despite infrastructural deficiencies (World Bank, 2023). Railway stations and transit corridors support diverse informal livelihoods, including vending, transport assistance, and small-scale enterprises (International Labour Organization, 2024). However, transit-oriented redevelopment often prioritizes infrastructure and commercial investment while overlooking adjacent communities, thereby increasing socio-spatial inequalities (UN-Habitat, 2015). The concept of transit-adjacent informality highlights this coexistence of economic opportunity and infrastructural vulnerability, providing an important framework for understanding settlements such as Veer Chand Patel Marg (Ahmed & Singh, 2024).

2.2 Participatory Urban Design and Community-Led Planning

Participatory urban design advocates the active involvement of communities in shaping decisions that affect their living environments, recognizing local residents as valuable

sources of knowledge and experience (Sanoff, 2000). Unlike conventional top-down planning approaches, participatory processes engage stakeholders throughout problem identification, design development, implementation, and evaluation stages (Arnstein, 1969). Studies indicate that such approaches enhance social inclusion, community ownership, and project effectiveness, particularly within informal settlements (Kumar & Banerjee, 2023). However, equitable participation requires supportive governance structures to address issues of representation and power imbalance (UN-Habitat, 2021; NIUA, 2023).

2.3 Incremental Upgrading and Inclusive Urban Transformation

Incremental upgrading offers a people-centred alternative to relocation-based redevelopment by improving existing settlements through phased and adaptable interventions. Rooted in the principles of community participation, this approach seeks to enhance infrastructure, environmental quality, and public spaces while preserving livelihoods and social networks (Turner, 1976). Such strategies reduce displacement risks, encourage local ownership, and support inclusive urban development objectives promoted by the World Bank (2023) and PMAY-U initiatives in India (Ministry of Housing & Urban Affairs, 2021; Ahmed & Singh, 2024).

2.4 Sustainable Materials and Circular Economy Approaches

Sustainable materials are increasingly incorporated into community-based upgrading projects to improve environmental performance and resource efficiency. Recycled plastic pavers, modular construction systems, and waste-derived products support circular economy principles by reducing waste generation and construction costs while enhancing durability (Smith et al., 2022). Additionally, agricultural by-products can be utilized in community infrastructure, contributing to environmentally responsible and locally adaptable urban development strategies (Jain & Chatterjee, 2024).

2.5 Case Study: Rani Kamlapati (Habibganj) Railway Station Redevelopment

The redevelopment of Rani Kamlapati (formerly Habibganj) Railway Station demonstrates how transportation infrastructure can stimulate urban regeneration through improved accessibility, passenger amenities, and commercial development (Times of India, 2021). While the project successfully modernized railway infrastructure, it also highlights the importance of integrating adjacent communities into redevelopment frameworks. The case underscores that sustainable transit-oriented development should balance physical modernization with social inclusion and community-sensitive planning objectives.

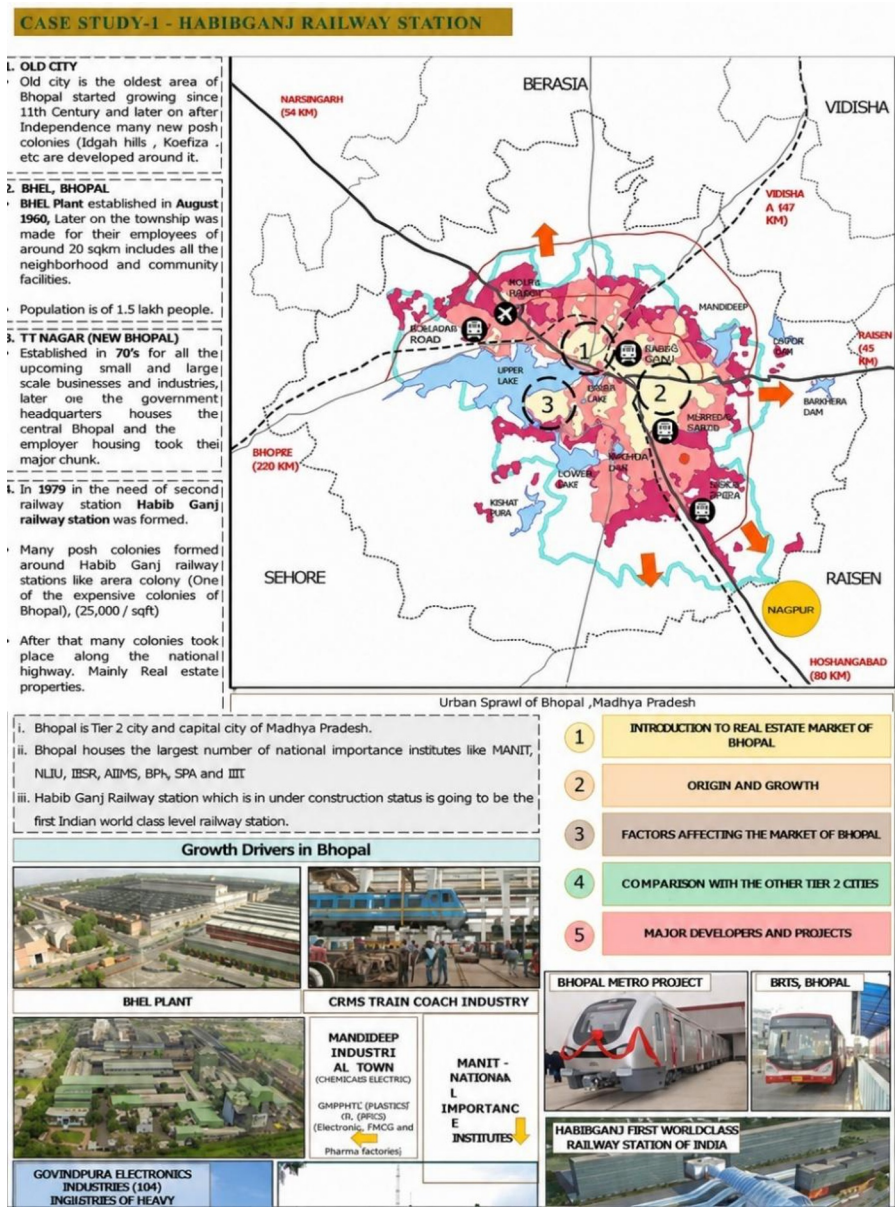


Fig.3. Case Study-1-Area in and around Habibganj Railway Station.
Source Bansal Pathways Habibganj Private Limited

2.6 Case Study: Surat Railway Station Redevelopment

The Surat Railway Station Redevelopment Project represents a major example of transit-oriented urban transformation in India. The project combines station modernization with multimodal transportation integration, public realm improvements, commercial development, and enhanced pedestrian infrastructure (Surat Municipal Corporation/SITCO, 2023–2024).

One of the project's key strengths lies in its emphasis on connectivity. Improved circulation networks, pedestrian-friendly environments, and integrated transportation systems contribute to a more accessible urban experience. The Surat project demonstrates the potential benefits of aligning transportation infrastructure with public space development. Nevertheless, researchers caution that transit-oriented redevelopment may inadvertently increase land values and displacement pressures if adjacent informal settlements are excluded from planning frameworks (Asian Development Bank, 2023).

The project therefore reinforces the importance of integrating social inclusion objectives into transportation-led redevelopment initiatives.

CASE STUDY- 2 - SURAT RAILWAY STATION

The Surat Railway Station area Redevelopment project focuses on transforming the area surrounding Surat Railway Station. The initiative aims to improve transportation links and enhance public spaces, pedestrian levels, and the design focus of commercial and residential spaces. The goal is to create a more efficient and inviting hub for all citizens.

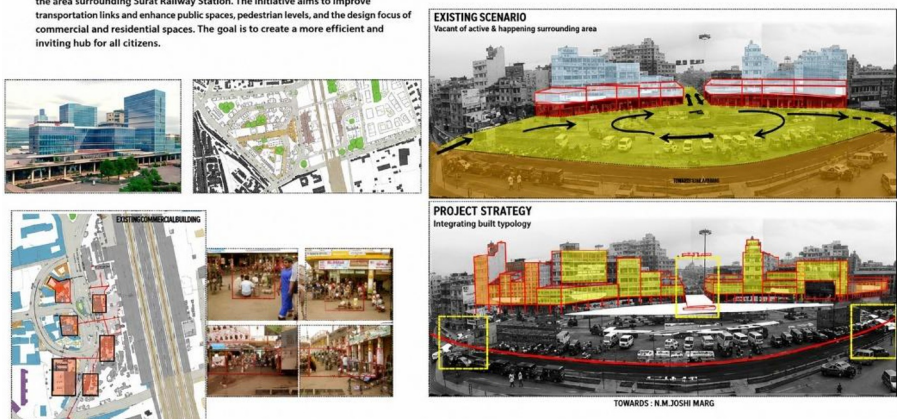


Fig. 4. Case Study-2- Surat Railway Station Redevelopment.

Source Soni, N.: The world through my 'visuals'. In: Cultural Cartographies of Media.

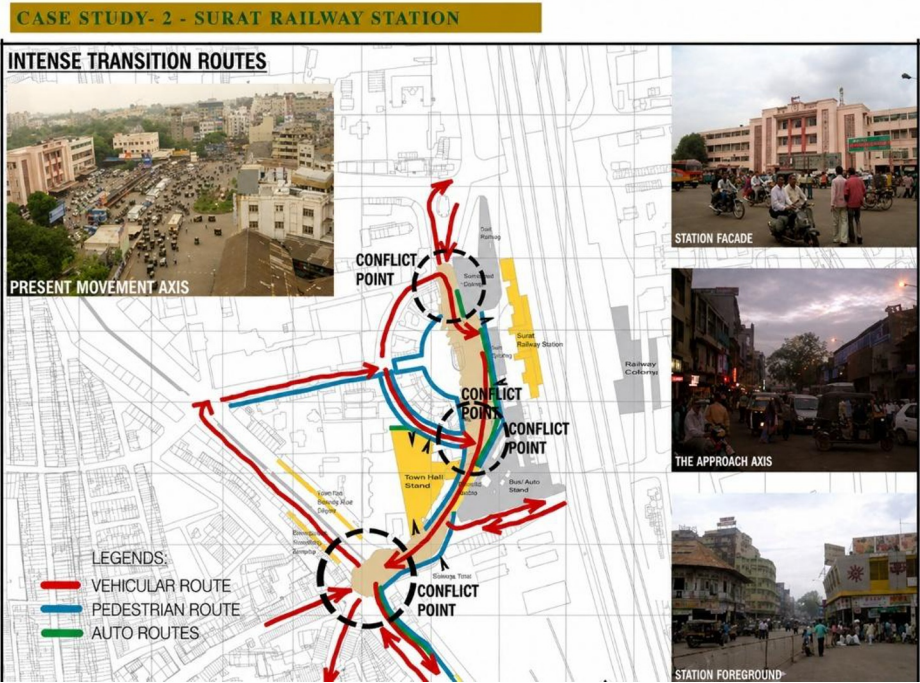


Fig. 5. Case Study-2- Surat Railway Station Redevelopment.
Source Soni, N.: The world through my ‘visuals’. In: Cultural Cartographies of Media.

Table 1. Comparative Analysis of Railway Station Redevelopment Case Studies and Design Inferences for Zone 2 (Veer Chand Patel Marg, Patna).

Criteria	Habibganj (Rani Kamlapati Railway Station, Bhopal)	Surat Railway Station Redevelopment	Inference for Zone 2 (Veer Chand Patel Marg Settlement)
Planning Approach	Infrastructure-led, public-private partnership (PPP)-based modernization model focused on station transformation and commercial integration.	Mobility-oriented redesign emphasizing plaza restructuring and circulation efficiency.	Adopt participatory, community-embedded planning to ensure inclusive and incremental upgradation.
Treatment of Informal Sector	Limited integration of existing informal settlements within redevelopment framework.	Focus primarily on pedestrian and vehicular movement with minimal structured engagement with informal vendors.	Livelihood-sensitive spatial reorganization required to retain and formalize existing economic networks.
Mobility Strategy	Strengthened multimodal connectivity and enhanced station accessibility.	Segregation of pedestrian, vehicular, and intermediate public transport flows to reduce conflict points.	Conflict-point reduction along settlement edges essential through defined pedestrian corridors and vending zones.
Public Realm Design	Creation of commercial concourses and formal public plazas.	Development of upper and lower plaza systems to structure commuter movement.	Provision of micro-plazas, shaded seating, and adaptable community spaces for informal settlements.
Socio-Spatial Impact	Triggered adjacent real estate growth and commercial intensification.	Improved commuter experience and enhanced spatial legibility.	Prioritize incremental in-situ upgradation without displacement to maintain socio-spatial continuity.
Environmental Measures	Incorporation of energy-efficient building systems and organized infrastructure.	Structured forecourt design and improved circulation layout.	Low-cost drainage systems, recycled paving materials, green buffers, and heat-mitigating shaded structures recommended.

2.7 International Precedent: Medellín, Colombia

Medellín is widely recognized for integrating transportation infrastructure with social and community development initiatives to address urban inequality. Through its Integral Urban Projects and the Metro cable system, the city combined mobility improvements with investments in public spaces, educational facilities, libraries, and community infrastructure, developed through active public participation (UN-Habitat, 2021). The Medellín experience demonstrates that transportation-led development can promote social inclusion when supported by accessible public spaces and community-oriented interventions, offering valuable lessons for the upgrading of transit-adjacent informal settlements.

2.8 International Precedent: Baan Mankong Programme, Bangkok

The Baan Mankong Programme in Thailand is widely recognized for demonstrating the effectiveness of community-led informal settlement upgrading. The programme empowers residents to participate directly in planning, financing, implementation, and long-term management of neighborhoods improvements, fostering collective ownership and institutional collaboration (UN-Habitat, 2021). Its success highlights the importance of participatory governance and incremental development strategies in achieving socially inclusive and sustainable urban transformation.

2.9 Research Gap

Existing scholarship increasingly acknowledges the value of participatory planning, incremental upgrading, and inclusive urban development; however, limited research has examined their application within informal settlements located adjacent to major railway infrastructure in India (Kumar & Banerjee, 2023; Ahmed & Singh, 2024). Current studies predominantly emphasize housing and infrastructure provision, with comparatively less attention given to public spaces, educational facilities, and community-led design processes. This study addresses this gap by exploring participatory urban design as a framework for integrating livelihood protection, social infrastructure, and public realm improvements within transit-oriented informal settlement upgrading (UN-Habitat, 2021).

3. Conceptual Framework and Research Methodology

3.1 Conceptual Framework: This study adopts a participatory urban design methodology that integrates community knowledge with spatial analysis to develop context-sensitive upgrading strategies for informal settlements (Roy, 2005; UN-Habitat, 2021). The framework comprises four interconnected stages:

Stage 1 – Spatial and Social Diagnosis, involving site surveys, behavioural mapping, and stakeholder analysis

Stage 2 – Community Participation, using interviews, focus groups, and participatory mapping;

Stage 3 – Co-Design and Design Translation, where community priorities are transformed into spatial interventions;

Stage 4 – Incremental Upgrading and Community Stewardship, focusing on implementable, low-cost solutions and long-term management. This process positions participation as a continuous mechanism linking diagnosis, design, implementation, and sustainable urban transformation (Kumar & Banerjee, 2023; NIUA, 2023).

Conceptual framework: Diagnosis → Participation → Co-Design → Incremental Upgrading → Community Stewardship

3.2 Research Design

This research employs a qualitative, case-study-based methodology to examine the relationship between participatory planning and urban design outcomes within a transit-adjacent informal settlement. Veer Chand Patel Marg was selected due to its strategic location and socio-spatial complexity. Multiple methods, including spatial analysis, behavioral mapping, stakeholder engagement, and design exploration, were integrated to ensure comprehensive and context-responsive findings (Kumar & Banerjee, 2023; UN-Habitat, 2021).

3.3 Research Questions

The methodology was structured to address the following research questions:

1. **RQ1:** What are the major spatial, environmental, and socio-economic challenges experienced by residents of the Veer Chand Patel Marg settlement?
2. **RQ2:** How can participatory planning processes contribute to the development of context-sensitive and community-supported upgrading strategies?
3. **RQ3:** To what extent can incremental urban design interventions improve living conditions while preserving livelihood opportunities and social networks?

3.4 Analytical Framework: To evaluate the effectiveness of proposed interventions, the research adopts three analytical criteria:

Spatial Improvement: This criterion evaluates the ability of interventions to enhance circulation, sanitation, drainage, environmental quality, and public space provision.

Social Inclusion: This criterion assesses accessibility, educational opportunities, safety, community participation, and the creation of inclusive public environments.

Livelihood Retention: This criterion examines the extent to which interventions support existing economic activities and reduce displacement risks.

Table 2. Analytical Framework

Evaluation dimension	Indicators
Spatial improvement	Drainage, sanitation, circulation, public spaces
Social inclusion	Education, participation, safety, accessibility
Livelihood retention	Vendor support, employment continuity, reduced displacement

3.5 Data Collection Methods: A combination of primary and secondary data sources was utilized.

3.5.1 Site Observation: Direct observations were conducted to document physical conditions, circulation patterns, environmental challenges, and public space usage. Particular attention was given to Pedestrian movement, Waste accumulation, Drainage conditions, public space availability, Informal economic activities, Field observations provided essential contextual information regarding everyday spatial practices within the settlement.

3.5.2 Spatial Mapping and Land-Use Analysis: Spatial mapping was undertaken to understand relationships between the settlement and its broader urban context. The analysis included Land-use and land-cover assessment, Transportation infrastructure mapping, Road hierarchy analysis, Open space identification, Circulation network assessment, Land-use data obtained from the Municipal Corporation of Patna (2022) provided insights into urban growth patterns and development pressures affecting the study area.

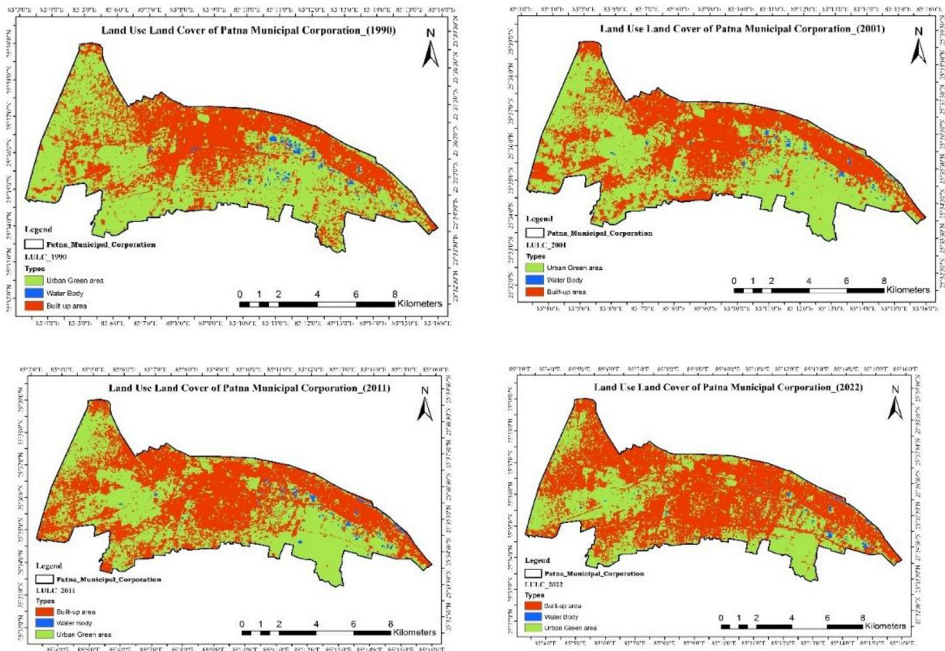


Fig.6. PMC (1990-2022)-LULC Analysis
Source Author based on Municipal Corporation of Patna (2022)

Table 3. PMC (1990-2022)-LULC Analysis

LULC FEATURES	1990		2001		2011		2022	
	Area (Km)	%	Area (Km)	%	Area (Km)	%	Area (Km)	%
URBAN GREEN AREA	58.82	58.35	56.13	55.68	48.68	48.29	39.61	39.29
BUILT-UP AREA	40.86	40.54	43.77	43.43	51.09	50.68	60.44	59.96
WATERBODI ES	1.12	1.11	0.9	0.89	1.03	1.02	0.75	0.74
TOTAL	100.8	100	100.8	100	100.8	100	100.8	100

Source Author based on Municipal Corporation of Patna (2022)

- ✓ **The built-up area**, which was 40.86 sq. km in 1990, has increased to nearly **47.92%** in 2022 to 60.44 sq. km

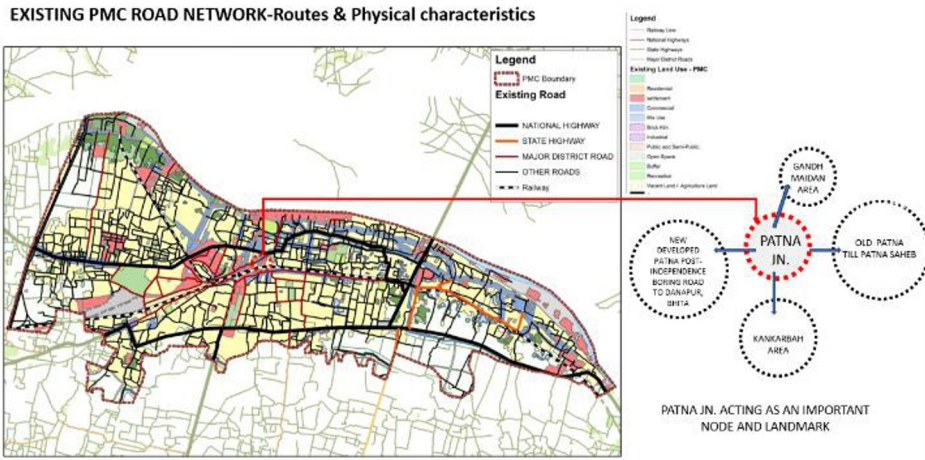


Fig.7. Existing Patna Municipal Corporation Road Network-Routes & Physical characteristics.
Source Author based on Municipal Corporation of Patna (2022)

3.5.3 Behavioural Mapping: Behavioural mapping was conducted to examine every day spatial activities and patterns of space utilization within the settlement. Observations focused on educational activities, street vending, community interaction, children's recreation, and pedestrian movement. The method helped identify activity concentrations, movement patterns, and spatial conflicts among different user groups. This approach is widely recognized for understanding socio-spatial behavior and informing context-responsive urban interventions in informal settlements (Kumar & Banerjee, 2023; UN-Habitat, 2021).

3.5.4 Semi-Structured Interviews: Semi-structured interviews were conducted with key stakeholders, including residents, street vendors, NGO volunteers, community leaders, and railway-linked workers. Discussions focused on living conditions, infrastructure challenges, educational needs, public-space requirements, livelihood concerns, and future aspirations. The method enabled the collection of qualitative insights regarding community perceptions and locally relevant development priorities. Semi-structured interviews are widely used in participatory planning research to understand stakeholder perspectives and support evidence-based decision-making (UN-Habitat, 2021; Kumar & Banerjee, 2023).

3.5.5 Focus Group Discussions: Focus group discussions were conducted with women, youth, vendors, and community volunteers to encourage collective dialogue on settlement conditions. The sessions helped identify priority interventions, shared concerns, and community aspirations while ensuring broader stakeholder representation and inclusive participation in the planning process (UN-Habitat, 2021; NIUA, 2023).

3.5.6 Participatory Mapping Workshops: Participatory mapping workshops were undertaken to capture community perspectives on spatial challenges and development opportunities. Participants identified problem areas, flood-prone locations, unsafe spaces, community assets, and potential intervention sites. The exercise generated location-specific information that informed the design development process and helped establish community priorities. Participatory mapping is widely recognized as an effective approach for integrating local knowledge into planning and decision-making processes, thereby enhancing the relevance and inclusivity of urban interventions (UN-Habitat, 2021; NIUA, 2023).

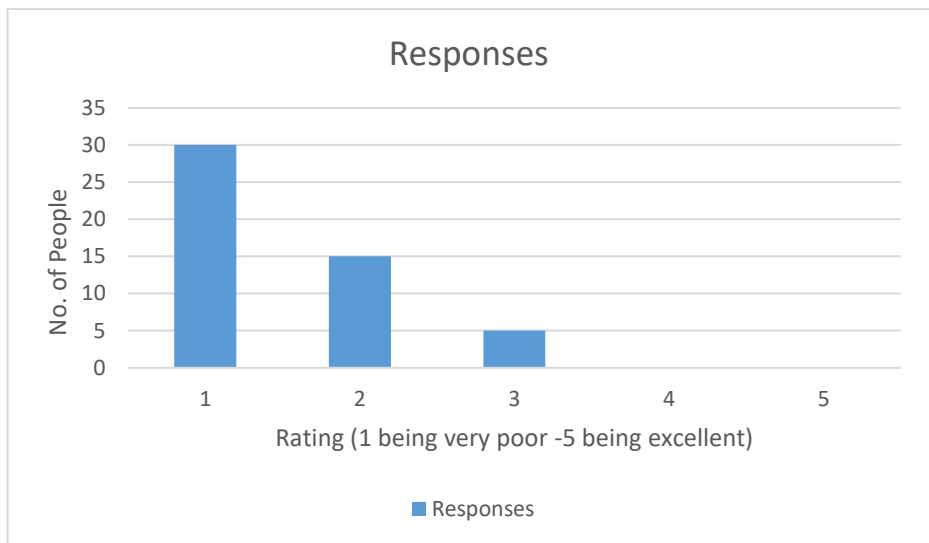


Fig. 8: Bar Graph showing the rating of current living conditions in Informal settlement near Veer Chand Patel Marg (Survey report was taken of 50 people).

Source Author.

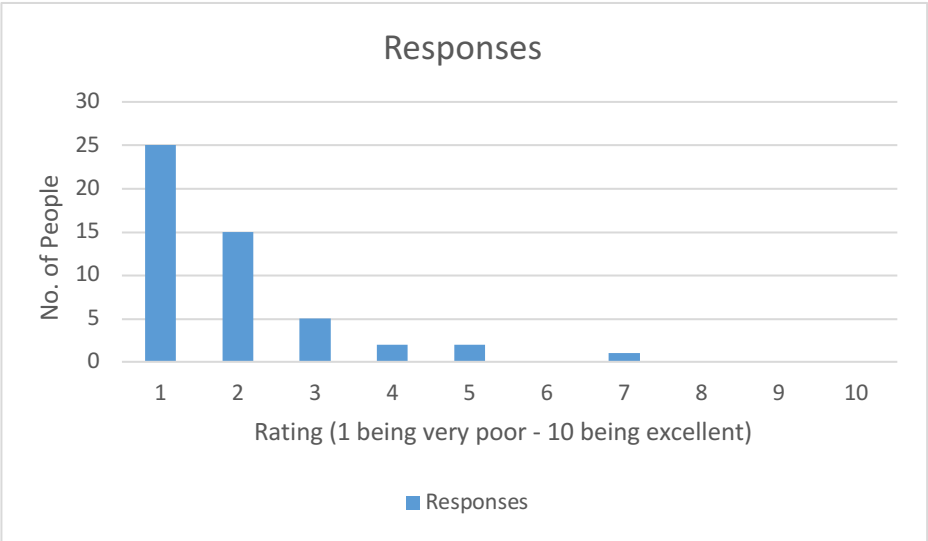


Fig. 9: Bar Graph showing the rating of hygiene and the sewage facility in Informal settlement, Veer Chand Patel Marg (Survey report was taken of 50 people).
Source Author

What improvements would you like to see in the Veer Chand Patel Marg slum area during redevelopment?

-

Cleanses

-

To clean this area

Investing in improved infrastructure such as wider roads, proper drainage systems, and access to clean water and sanitation facilities can significantly enhance living conditions and public health.

Infrastructure, cleanliness, dustbin installation

-

-

Hygiene

Fig. 10. Suggestions given by local people during the survey.
Source Author

3.6 Secondary Data Sources: Secondary data were collected from Municipal Corporation of Patna reports, Government of Bihar planning documents, railway redevelopment project records, NGO publications, academic literature, and relevant policy frameworks. These sources provided contextual information on urban growth patterns, transportation infrastructure, governance mechanisms, and redevelopment initiatives, enabling a comprehensive understanding of the study area and supporting the triangulation of primary findings (Municipal Corporation of Patna, 2022; Government of Bihar, 2022; World Bank, 2023).

3.7 Participation-to-Design Translation Process: One of the key objectives of the methodology was to establish a clear relationship between community inputs and design outcomes. To address reviewer concerns regarding methodological transparency, a Participation-to-Design Matrix was developed.

Table 4. Participation-to-Design Matrix.

Community Priority	Evidence Source	Design Response	
Educational Infrastructure	Interviews, Workshops	Community Pavilion	
Lack of Play Areas	Parent Consultations	Learning Landscape	
Drainage Problems	Participatory Mapping	Drainage Network	Improvement
Vendor Congestion	Vendor Interviews	Vendor Micro-Plazas	
Limited Public Spaces	Community Discussions	Public Space Network	
Poor Environmental Quality	Site Analysis	Green Infrastructure Strategy	

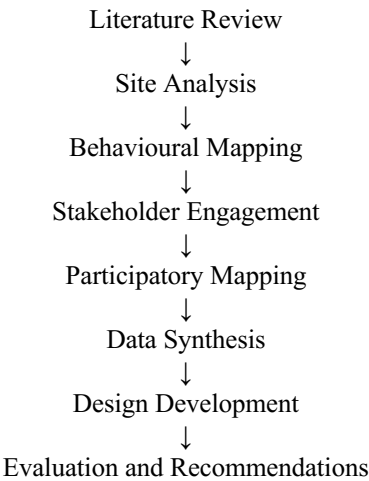
The matrix demonstrates that proposed interventions emerged directly from community engagement processes rather than externally imposed assumptions.

3.8 Ethical Considerations: The study was conducted in accordance with accepted ethical research practices and participatory planning principles. Participation in interviews, workshops, and field activities was voluntary, and informed consent was

obtained from all participants. Confidentiality and anonymity were maintained throughout the research process. Particular care was taken when engaging with children involved in community educational programs, ensuring ethical and responsible data collection procedures (UN-Habitat, 2021; NIUA, 2023).

3.9 Research Limitations: The study is based on a single case-study approach and therefore does not aim for statistical generalization. Proposed design interventions have not yet been implemented, limiting assessment of long-term outcomes. Variations in stakeholder participation may have influenced the representation of community priorities. Issues such as land tenure security and institutional governance extend beyond the scope of design-based interventions and require policy-level engagement. Despite these constraints, the methodology provides a robust framework for investigating participatory urban design within transit-adjacent informal settlements (UN-Habitat, 2021; Ahmed & Singh, 2024).

Methodological Framework



4. Site Analysis and Existing Conditions

4.1 Urban Context and Regional Setting: The Veer Chand Patel Marg informal settlement is located adjacent to Patna Junction, a major transportation and economic hub that significantly influences urban growth patterns within the city. The settlement occupies a transitional zone where formal commercial development intersects with informal residential activities, creating a complex socio-spatial environment. Owing to its proximity to the railway station, residents depend on railway-linked livelihoods and service-based occupations. Despite its economic relevance, the settlement continues to experience infrastructural deficiencies and limited planning attention, reflecting

broader challenges associated with transit-adjacent informal communities in rapidly urbanizing cities (Government of Bihar, 2022; Asian Development Bank, 2023; International Labour Organization, 2024).

4.2 Land Use and Land Cover Analysis: The Land Use and Land Cover (LULC) analysis presented in **Figure 6** and **Table 3** illustrates the rapid urban transformation of Patna between 1990 and 2022. The substantial increase in built-up areas reflects population growth, infrastructure expansion, and intensified development around major transportation corridors (Municipal Corporation of Patna, 2022). Increased accessibility has stimulated commercial investment near Patna Junction, while simultaneously reducing the availability of open and affordable land. These trends have contributed to the concentration of informal settlements within marginal urban spaces, highlighting the need for inclusive upgrading strategies that prioritize public spaces, environmental quality, and community resilience (Asian Development Bank, 2023; World Bank, 2023).

4.3 Transportation and Road Network Analysis: The transportation network illustrated in **Fig. 7** plays a significant role in shaping the spatial structure and economic activities of the study area. Veer Chand Patel Marg serves as an important connector between Patna Junction and surrounding commercial, institutional, and residential zones. Field observations revealed intense pedestrian and vehicular movement, resulting in circulation conflicts, limited accessibility, and safety concerns. Narrow internal pathways, inadequate pedestrian infrastructure, and restricted emergency access further exacerbate mobility challenges. These findings highlight the need for integrated circulation improvements that enhance accessibility while supporting existing livelihood activities within the settlement (Government of Bihar, 2022; Asian Development Bank, 2023).

4.4 Existing Physical Conditions

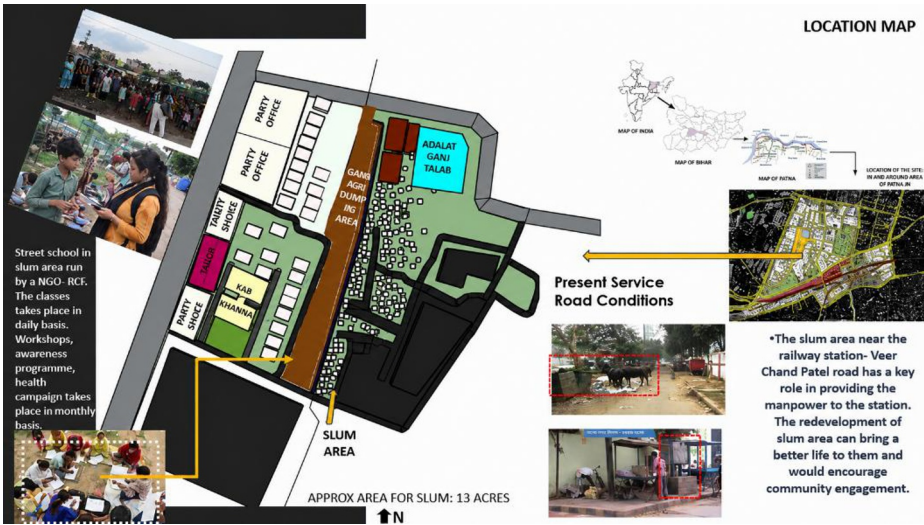


Fig. 11. Existing Conditions of the Informal Settlement and Street School Operated by Rise Up Community Foundation. (Source Author)

Field investigations reveal a highly compact settlement characterized by incremental development and limited public infrastructure. The built environment consists primarily of informal single-storey and double-storey structures constructed using a combination of permanent and semi-permanent materials. Housing units are organized along narrow circulation lanes that have evolved gradually in response to changing spatial requirements.

Several physical challenges were identified: Site observations identified significant infrastructural and environmental deficiencies within the settlement. Inadequate drainage systems frequently result in waterlogging during monsoon periods, affecting mobility and increasing health risks. Poor sanitation, irregular waste disposal, and blocked drains further degrade environmental quality. Additionally, the absence of dedicated public spaces limits opportunities for recreation, education, and community interaction. Limited vegetation cover and inadequate climate-responsive infrastructure increase vulnerability to flooding and thermal stress, highlighting the need for resilient and inclusive upgrading interventions (World Health Organization, 2023; UN-Habitat, 2021).

4.5 Socio-Economic Characteristics: The socio-economic structure of the settlement is closely associated with the transportation economy of Patna Junction. Residents primarily depend on informal occupations such as street vending, porter services, transport assistance, domestic work, waste recycling, and small-scale retail activities. Women and youth contribute significantly to household livelihoods through informal enterprises and service-based work. The settlement therefore functions as both a

residential community and an economic support system for the railway precinct, underscoring the importance of protecting livelihood networks within future upgrading and redevelopment initiatives (International Labour Organization, 2024; UN-Habitat, 2021).

4.6 Educational Infrastructure and Community Assets: A key community asset identified during the study is the informal street school operated by the Rise Up Community Foundation (RCF), which provides educational support to children with limited access to formal schooling. Despite operating in temporary and resource-constrained conditions, the initiative reflects strong community commitment towards education and social development. The absence of dedicated learning spaces, weather protection, seating, and basic infrastructure highlights the need for educational improvements. The importance of flexible and accessible learning environments in underserved communities has been widely recognized as a catalyst for child development and community empowerment (Shah & Mehta, 2023; UN-Habitat, 2021).

4.7 Community Perceptions and Survey Findings: The survey results presented in **Fig. 8 -10** indicate widespread concern regarding existing living conditions, environmental quality, and infrastructure provision within the settlement. Residents identified inadequate drainage, poor sanitation, limited educational facilities, insufficient public spaces, and safety concerns as major challenges. Community consultations further emphasized the need for improved drainage systems, dedicated learning environments, recreational areas, organized vending spaces, enhanced lighting, and better circulation networks. The consistency of these priorities across stakeholder groups demonstrates a strong collective demand for inclusive and community-oriented upgrading interventions (World Health Organization, 2023; UN-Habitat, 2021; NIUA, 2023).

4.8 Governance and Tenure Context: The governance framework surrounding the settlement involves multiple stakeholders, including municipal authorities, railway agencies, government departments, community organizations, and non-governmental institutions. While such institutional diversity can support resource mobilization and collaborative development, overlapping responsibilities often create implementation challenges. Additionally, insecure land tenure remains a significant concern, as many residents lack formal ownership documentation, limiting access to housing improvement programs and increasing vulnerability to displacement. These governance and tenure-related constraints represent critical barriers to sustainable and inclusive settlement upgrading (UN-Habitat, 2021; Government of Bihar, 2022).

4.9 Synthesis of Key Findings: The site analysis indicates that the Veer Chand Patel Marg settlement possesses strong socio-economic potential despite significant infrastructural deficiencies.

Key Challenges: inadequate drainage and sanitation, environmental vulnerability, limited educational facilities, lack of public spaces, pedestrian safety concerns, governance complexity, and tenure insecurity.

Key Opportunities: strategic location near Patna Junction, resilient livelihood networks, active community participation, existing educational initiatives, potential for incremental upgrading, and support from community organizations.

These findings provide the analytical foundation for participatory diagnosis and the development of context-sensitive urban design interventions (UN-Habitat, 2021; World Bank, 2023).

5. Participatory Diagnosis and Community Needs Assessment

5.1 Introduction: Participatory diagnosis formed a key component of the research methodology, enabling a comprehensive understanding of community needs, perceptions, and development priorities. Beyond physical site assessment, this approach captured local knowledge, lived experiences, and socio-spatial realities that are often overlooked in conventional planning processes. The findings established a direct linkage between community aspirations and proposed design interventions, ensuring that the upgrading strategy remained context-sensitive, inclusive, and responsive to local conditions (UN-Habitat, 2021; Kumar & Banerjee, 2023).

5.2 Stakeholder Identification and Analysis: A stakeholder analysis was conducted to identify individuals and institutions influencing the settlement's development process.

Primary stakeholders included residents, women-led households, street vendors, daily wage labourers, railway-linked workers, children, and youth groups, providing insights into local needs and challenges.

Secondary stakeholders comprised Rise Up Community Foundation (RCF), municipal and railway authorities, community volunteers, political representatives, and nearby business owners, contributing perspectives on governance, implementation, and institutional coordination. The inclusion of diverse stakeholder groups strengthened the participatory process and supported more inclusive planning outcomes (UN-Habitat, 2021; NIUA, 2023).

Secondary stakeholders provided perspectives regarding governance, implementation feasibility, and institutional coordination.

Table 5. Stakeholder Analysis.

Stakeholder Group	Role in Settlement	Relevance to Study
Residents	Daily users of the settlement	Identification of local needs
Street Vendors	Informal economic activity	Livelihood assessment
Women Groups	Household management and caregiving	Community priorities
Children	Users of educational spaces	Learning and recreation need.
NGOs	Community development support	Educational and social programs
Municipal Authorities	Infrastructure provision	Implementation support
Railway Authorities	Land and transport management	Redevelopment coordination

5.3 Behavioural Mapping Analysis: Behavioural mapping was undertaken to understand daily activity patterns, space utilization, movement networks, and spatial conflicts within the settlement. Educational activities were concentrated around the informal street school, highlighting the community's strong commitment to learning despite limited infrastructure. Street vending emerged as a key livelihood activity, although the lack of designated vending spaces contributed to circulation challenges. Informal gathering areas supported social interaction, community meetings, recreation, and learning activities, demonstrating the multifunctional use of available open spaces. The findings emphasize the need for educational facilities, organized livelihood spaces, and improved public realm infrastructure within future upgrading initiatives (Shah & Mehta, 2023; Kumar & Banerjee, 2023).

6. Design Strategy and Design Development

6.1 Introduction: The design strategy for Veer Chand Patel Marg was developed through the integration of site analysis, behavioural mapping, stakeholder consultations, participatory workshops, and comparative case-study findings. Unlike conventional redevelopment approaches that prioritize physical transformation through demolition and relocation, the proposed strategy adopts an incremental and community-led approach that seeks to improve environmental quality, strengthen social infrastructure, and support existing livelihood systems.

The design process was guided by three key principles:

1. **Social Inclusion** – ensuring that interventions respond to community needs and support vulnerable groups.
2. **Environmental Sustainability** – integrating climate-responsive and resource-efficient design strategies.
3. **Livelihood Retention** – preserving economic activities linked to Patna Junction and minimizing displacement risks.

The proposed interventions are intended to function as interconnected components of a broader upgrading framework rather than isolated physical projects.

6.2 Urban Design Vision: The vision for Veer Chand Patel Marg is to transform the settlement into a **safe, inclusive, environmentally resilient, and community-oriented urban environment** while maintaining its socio-economic connection with Patna Junction. The proposal envisions Improved educational opportunities, enhanced public spaces, better environmental conditions, Stronger community infrastructure, Organized livelihood-supportive spaces, Increased resilience to flooding and environmental stress. This vision aligns with international upgrading frameworks emphasizing participatory planning and community stewardship (UN-Habitat, 2021; World Bank, 2023).

6.3 Design Objectives: Based on participatory findings, six primary objectives were established.

Objective 1: Strengthen Educational Infrastructure

Provide safe and flexible learning environments capable of supporting educational activities currently conducted in temporary outdoor settings.

Objective 2: Improve Environmental Quality

Address drainage deficiencies, sanitation challenges, and environmental vulnerabilities through sustainable infrastructure.

Objective 3: Enhance Public Space Provision

Create multifunctional community spaces that support social interaction, recreation, and cultural activities.

Objective 4: Support Informal Livelihoods

Develop infrastructure that improves working conditions for vendors and other informal workers without disrupting economic networks.

Objective 5: Improve Connectivity and Accessibility

Enhance pedestrian circulation and improve accessibility throughout the settlement.

Objective 6: Encourage Community Stewardship

Promote long-term maintenance through community participation and collaborative governance.

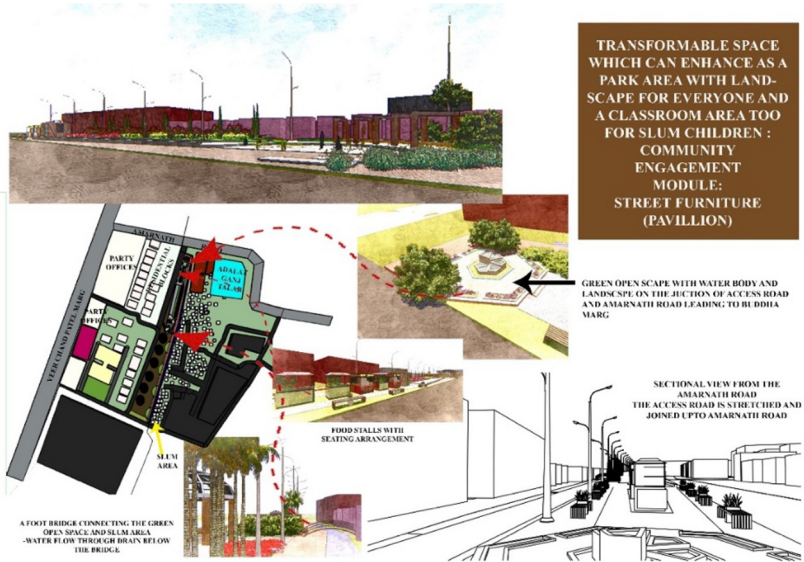


Fig. 12. Showing Design Intervention in Informal Settlement area.

Source Author

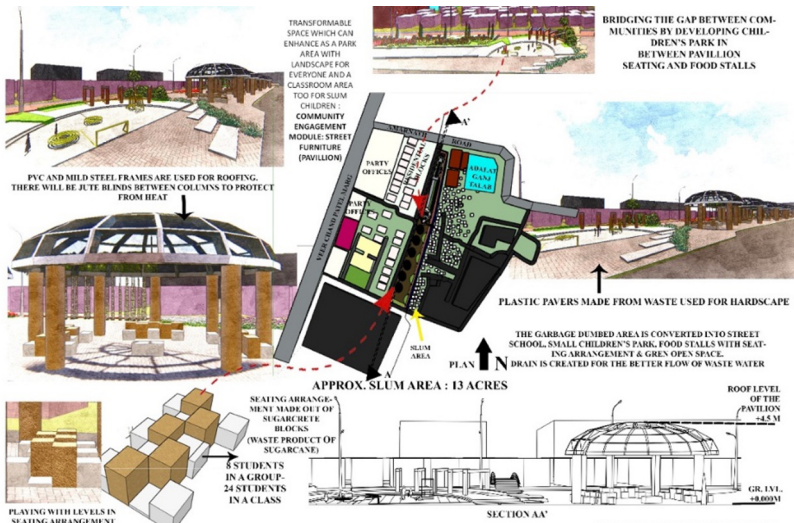


Fig. 13. Showing Design Intervention in Informal Settlement area.

Source Author

6.4 Overall Design Framework: In context of **Fig. 12:** Proposed Design Intervention Framework

The design intervention framework establishes relationships between identified community needs and proposed spatial responses.

The framework consists of five interconnected components:

1. Community Pavilion and Learning Centre.
2. Learning Landscape and Children's Recreation Zone.
3. Sustainable Drainage and Circulation Network.
4. Vendor Micro-Plazas.
5. Green Infrastructure and Public Realm Enhancement.

Collectively, these interventions create a network of educational, recreational, economic, and environmental infrastructure capable of supporting long-term community development.

6.5 Community Pavilion and Learning Centre

Design Rationale

One of the most significant findings of the participatory diagnosis was the absence of dedicated educational infrastructure. The informal street school currently functions in exposed outdoor conditions without permanent facilities.

Community consultations consistently identified education as a priority for future development.

To address this challenge, a multifunctional Community Pavilion and Learning Centre are proposed as the primary social infrastructure intervention within the settlement.

Functional Program: The pavilion is designed to accommodate:

- Educational activities.
- Community meetings.
- Skill-development workshops.
- Health awareness programs.
- NGO-led activities.
- Cultural events.

The multifunctional nature of the pavilion maximizes utilization while ensuring flexibility for changing community needs.

Material Strategy: The pavilion incorporates:

- Lightweight steel framing.
- Modular construction systems.
- Recycled plastic paving blocks.
- Jute-based shading elements.
- Solar-powered lighting.

The use of recycled materials aligns with circular economy principles and reduces environmental impact (Smith, Patel, & Gupta, 2022).

Social Benefits: The pavilion provides:

- Improved educational infrastructure.
- Enhanced community interaction.
- Increased safety.
- Opportunities for social development.

The intervention also reinforces the role of the existing street school as a community asset.

6.6 Learning Landscape and Children's Recreation Zone:

Need for Child-Friendly Infrastructure

Behavioural mapping revealed that children frequently use circulation corridors and residual spaces for play and learning activities.

The absence of dedicated recreational infrastructure limits opportunities for physical and social development.

Research indicates that play-based learning environments contribute significantly to child well-being and educational outcomes (Shah & Mehta, 2023).

Design Concept: The Learning Landscape integrates:

- Outdoor classrooms.
- Reading corners.
- Play areas.
- Interactive educational installations.
- Community seating zones.

The intervention combines recreation and education within a single multifunctional environment.

Landscape Strategy: The landscape incorporates:

- Native vegetation.
- Shade trees.
- Permeable paving.
- Low-maintenance planting systems.

These features improve environmental quality while creating a more comfortable microclimate.

Comparative Precedent: The Learning Landscape draws inspiration from Medellín's emphasis on educational and public infrastructure as catalysts for social inclusion.

Similar to Medellín's urban transformation initiatives, the intervention seeks to improve quality of life through accessible community facilities.

6.7 Sustainable Drainage and Circulation Network

Existing Conditions

Participatory consultations identified drainage deficiencies as the most urgent community concern. Seasonal flooding affects circulation, environmental quality, and public health. The lack of integrated stormwater management systems contributes to recurring waterlogging.

Design Approach: The proposal introduces a Sustainable Urban Drainage System (SUDS) consisting of:

- Surface drainage channels.
- Bioswales.
- Permeable paving.
- Rainwater infiltration zones.

Vegetated drainage edges.

These interventions improve stormwater management while enhancing environmental quality.

Circulation Improvements: The upgraded circulation network prioritizes:

- Pedestrian safety.
- Accessibility.
- Emergency access.
- Connectivity between community facilities.

Improved pathways support both daily mobility and long-term resilience.

Environmental Benefits: The drainage strategy contributes to:

- Reduced flooding.
- Improved sanitation.
- Better environmental performance.
- Increased climate resilience.

These benefits align with WHO (2023) recommendations regarding sanitation and public health in informal settlements.

6.8 Vendor Micro-Plazas

Supporting Informal Livelihoods

Street vending constitutes one of the settlement's most important economic activities. Conventional redevelopment projects often displace vendors in pursuit of formalization. However, participatory consultations revealed strong opposition to relocation-based strategies. Residents emphasized the importance of maintaining economic links with Patna Junction.

Design Concept: Vendor Micro-Plazas are proposed at key circulation nodes.

Each plaza includes:

- Shaded vending spaces.
- Seating areas.
- Lighting infrastructure.
- Waste collection facilities.
- Flexible market spaces.

The plazas improve working conditions while preserving existing economic networks.

Economic and Social Benefits: Vendor Micro-Plazas provide:

- Increased visibility.
- Improved customer access.
- Better spatial organization.
- Reduced circulation conflicts.

The intervention therefore supports both economic sustainability and public realm quality.

Lessons from Surat Railway Station: The intervention draws lessons from Surat's integrated approach to mobility and commercial activity.

Rather than separating economic activities from public spaces, the proposal seeks to improve coexistence between movement and commerce.

6.9 Public Space Network

Existing Conditions

The settlement currently lacks formal public spaces capable of supporting social interaction, recreation, and community events.

Available open spaces are fragmented and underutilized.

Proposed Hierarchy: The design establishes a hierarchy of public spaces:

1. Community Pavilion (Primary Community Space).
2. Learning Landscape (Educational and Recreational Space).
3. Vendor Micro-Plazas (Economic and Social Spaces).
4. Pocket Parks (Neighbourhood Spaces).

This hierarchy creates a connected network of community infrastructure.

Social Inclusion Outcomes: The public space network supports:

- Community interaction.
- Intergenerational engagement.
- Informal learning.
- Collective activities.

These outcomes contribute to broader goals of social inclusion and community development.

6.10 Green Infrastructure Strategy

Environmental Challenges: The settlement experiences:

- Limited vegetation cover.
- Heat stress.
- Poor environmental quality.
- Inadequate stormwater management.

Proposed Interventions: The Green Infrastructure Strategy includes:

- Native tree planting.
- Rain gardens.
- Community gardens.
- Green buffers.
- Vertical greening systems.

These interventions improve environmental performance while enhancing visual quality.

Climate Resilience: Green infrastructure contributes to:

- Reduced surface temperatures.
- Improved biodiversity.
- Enhanced stormwater management.
- Greater environmental resilience.

Such interventions are increasingly recognized as essential components of sustainable urban development (World Bank, 2023).

6.11 Interpretation of Final Design Proposal

Fig. 13. Final Urban Design Proposal: The final urban design proposal integrates educational, environmental, social, and economic interventions within a unified

framework. The proposal demonstrates how small-scale and incremental interventions can collectively generate significant improvements in quality of life.

The design prioritizes:

- Community participation.
- Educational opportunities.
- Environmental sustainability.
- Livelihood retention.
- Public space enhancement.

Importantly, the proposal avoids displacement and instead builds upon existing community assets and social networks.

6.12 Alignment with Research Objectives: The proposed interventions directly address the analytical framework established at the beginning of the study.

Spatial Improvement

- ✓ Improved drainage infrastructure
- ✓ Enhanced circulation systems
- ✓ Better public spaces

Social Inclusion

- ✓ Educational facilities
- ✓ Community participation
- ✓ Child-friendly environments

Livelihood Retention

- ✓ Vendor support infrastructure
- ✓ Protection of economic networks
- ✓ Reduced displacement risk

The design therefore demonstrates strong alignment with community priorities and research objectives.

6.13 Implementation Feasibility: The proposed interventions were intentionally designed as modular and incremental projects.

Advantages include:

- Lower implementation costs.
- Reduced disruption.
- Greater adaptability.
- Increased community participation.

This approach reflects lessons from the Baan Mankong Programme and other community-led upgrading initiatives where phased implementation contributed to long-term sustainability (UN-Habitat, 2021).

6.14 Chapter Summary: The proposed design strategy translates community priorities into a coherent framework for incremental upgrading. Rather than pursuing large-scale redevelopment, the proposal focuses on community infrastructure, environmental improvement, public space enhancement, and livelihood support. The interventions collectively demonstrate how participatory

urban design can contribute to socially inclusive and environmentally sustainable urban transformation within transit-adjacent informal settlements.

7. Participatory Implementation Framework, Monitoring and Evaluation

7.1 Introduction: The effectiveness of informal settlement upgrading depends not only on design quality but also on implementation strategies, institutional coordination, and community participation. Accordingly, the proposed framework emphasizes phased development, collaborative governance, and local stewardship to ensure socially inclusive, adaptable, and financially feasible interventions. This approach aligns with contemporary participatory upgrading principles that promote long-term sustainability and community ownership (UN-Habitat, 2021; World Bank, 2023).

7.2 Participatory Implementation Framework: The implementation strategy is structured into three sequential phases to ensure gradual, community-led transformation and minimize disruption.

Phase I (0–6 Months): Community Mobilization and Pilot Interventions – establishment of Community Management Committees, awareness programs, drainage improvement initiatives, temporary learning facilities, and pilot public-space projects.

Phase II (6–18 Months): Infrastructure Development – implementation of key interventions, including the Community Pavilion, Learning Landscape, Vendor Micro-Plazas, sustainable drainage systems, public lighting, and green infrastructure.

Phase III (18–36 Months): Consolidation and Community Stewardship – strengthening maintenance systems, monitoring and evaluation mechanisms, educational programs, and institutional partnerships to ensure long-term sustainability and local ownership (UN-Habitat, 2021; NIUA, 2023; World Bank, 2023).

7.3 Governance Structure: Effective implementation requires collaboration among community groups, government agencies, civil society organizations, and academic institutions.

The **Community Management Committee (CMC)** serves as the primary coordinating body, overseeing maintenance, stakeholder communication, and project monitoring, with representation from women, youth, vendors, and educational groups.

Municipal and railway authorities provide technical, regulatory, and infrastructural support, while NGOs and academic institutions contribute to capacity building, outreach, monitoring, and knowledge exchange.

This multi-stakeholder governance framework promotes inclusive decision-making, institutional coordination, and long-term sustainability of upgrading initiatives (UN-Habitat, 2021; NIUA, 2023).

8. Monitoring and Evaluation Framework

8.1 Need for Monitoring and Evaluation: Monitoring and evaluation are essential for assessing the effectiveness and long-term impact of proposed upgrading interventions.

The framework evaluates outcomes across four dimensions: **spatial quality, social inclusion, environmental performance, and livelihood retention.**

This multidimensional approach enables systematic assessment of both physical improvements and community well-being, ensuring that project objectives remain aligned with principles of inclusive and sustainable urban development (UN-Habitat, 2021; World Bank, 2023).

8.2 Key Performance Indicators

Table 6. Monitoring and Evaluation Indicators.

Evaluation Category	Indicator	Assessment Method
Spatial Quality	Public-space usage	Behavioural observation
Spatial Quality	Drainage performance	Flood monitoring
Social Inclusion	Educational participation	Attendance records
Social Inclusion	Community satisfaction	Surveys and interviews
Livelihood Retention	Vendor activity	Economic surveys
Environmental Quality	Waste management performance	Site inspections
Environmental Quality	Vegetation growth	Environmental audits

Source Author

8.3 Community-Based Monitoring: Community participation should continue beyond project implementation.

Residents can contribute through:

- Community audits.
- Maintenance reporting.
- Participatory evaluation workshops.
- Public feedback sessions.

Research indicates that community-based monitoring improves accountability and strengthens local ownership (UN-Habitat, 2021).

8.4 Adaptive Management: Urban environments evolve continuously.

Monitoring outcomes should therefore inform future modifications to:

- Public spaces.
- Educational facilities.
- Drainage systems.
- Vendor infrastructure.

Adaptive management enables interventions to remain responsive to changing community needs.

9. Discussion

9.1 Informal Settlements as Active Urban Systems: The findings challenge traditional planning perspectives that view informal settlements solely as manifestations of urban poverty. The Veer Chand Patel Marg settlement demonstrates strong integration with the economic ecosystem of Patna Junction. Residents provide services that support transportation infrastructure, commercial activity, and urban mobility.

Consequently, redevelopment strategies that focus exclusively on physical transformation risk overlooking the economic and social contributions of informal communities (Roy, 2005). The research therefore supports contemporary perspectives that advocate recognizing informal settlements as active urban stakeholders.

9.2 Participatory Urban Design as a Planning Tool: One of the most significant findings of the study is the effectiveness of participatory urban design in identifying locally relevant solutions. Community engagement contributed to:

- More accurate problem identification.
- Greater project acceptance.
- Enhanced social inclusion.
- Increased ownership of proposed interventions.

The participatory process revealed priorities such as educational infrastructure and public-space provision that may have received less attention through conventional planning approaches.

This finding supports previous research emphasizing the value of local knowledge in urban decision-making (Kumar & Banerjee, 2023).

9.3 Transit-Oriented Redevelopment and Social Inclusion: The comparative analysis highlights important lessons for transportation-led redevelopment.

Habibganj Railway Station

Demonstrates the transformative potential of infrastructure investment but also highlights the need for stronger integration between transportation projects and community development initiatives.

Surat Railway Station

Illustrates how mobility improvements and public-space investments can contribute to urban regeneration.

Medellín

Demonstrates the importance of combining transportation infrastructure with educational and social facilities.

Baan Mankong

Illustrates the effectiveness of community-led implementation and collaborative governance.

Collectively, these examples reinforce the importance of integrating social inclusion objectives within transportation redevelopment frameworks.

9.4 Sustainability and Environmental Resilience: The proposed interventions contribute to sustainability through:

- Green infrastructure.
- Sustainable drainage systems.
- Recycled construction materials.
- Community stewardship.

Research demonstrates that such approaches can improve environmental performance while supporting long-term resilience (Smith et al., 2022).

The integration of recycled plastic paving and locally sourced materials further aligns the project with circular economy principles.

9.5 Contribution to Knowledge: The study contributes to the growing body of literature on participatory urban design by:

- Extending participatory planning frameworks to transit-edge informal settlements.
- Demonstrating the relationship between participation and design outcomes.
- Integrating educational infrastructure into upgrading strategies.
- Developing a replicable framework for community-led upgrading.

The findings may therefore inform future redevelopment initiatives within similar urban contexts.

10. Study Limitations: Several limitations should be acknowledged.

Single Case Study Context: The research focuses on a single settlement and therefore does not seek statistical generalization.

Implementation Status: The proposed interventions remain at the design stage.

Future implementation may reveal operational challenges not identified during the research process.

Stakeholder Representation: Although multiple stakeholder groups participated, levels of engagement varied. Certain perspectives may therefore remain underrepresented.

Governance Complexity: Institutional fragmentation may affect implementation feasibility and project coordination.

Land Tenure Issues: Land ownership and tenure security remain unresolved and extend beyond the scope of design interventions.

Despite these limitations, the research provides a robust framework for participatory upgrading within transit-oriented informal settlements.

11. Policy Implications: The findings generate several important implications for policy and practice.

11.1 Integrating Informal Settlements into Transit Redevelopment: Transportation infrastructure projects should incorporate adjacent informal settlements within redevelopment frameworks rather than treating them as external entities.

Such integration can reduce displacement risks and improve social outcomes (Asian Development Bank, 2023).

11.2 Institutionalizing Participatory Planning: Municipal agencies should establish formal mechanisms for community participation during planning and implementation processes.

Participation should become a routine component of urban governance rather than a project-specific activity (NIUA, 2023).

11.3 Supporting Incremental Upgrading: Policy frameworks should prioritize incremental upgrading over displacement-oriented redevelopment. Incremental approaches preserve social networks while improving living conditions (Ahmed & Singh, 2024).

11.4 Strengthening Community Partnerships: Partnerships among communities, municipalities, NGOs, and academic institutions should be encouraged through dedicated funding and policy support.

11.5 Linking Education and Urban Development: Educational infrastructure should be recognized as a critical component of informal settlement upgrading. Investments in learning environments contribute to long-term social mobility and community development (Shah & Mehta, 2023).

12. Conclusion

This study investigated the role of participatory urban design in the upgrading of the informal settlement located along Veer Chand Patel Marg near Patna Junction. Through a combination of spatial analysis, behavioural mapping, stakeholder consultation, participatory engagement, and urban design exploration, the research examined how community-led approaches can contribute to inclusive and sustainable urban transformation.

The findings reveal that the settlement occupies a strategically important location within Patna's transportation network while experiencing significant infrastructural and environmental challenges. Major concerns include inadequate sanitation, poor drainage, limited public spaces, insufficient educational infrastructure, and vulnerability to redevelopment pressures.

Participatory diagnosis identified drainage improvement, educational facilities, public-space provision, and livelihood protection as the most significant community priorities. These findings directly informed the development of a comprehensive design strategy consisting of community pavilions, learning landscapes, sustainable drainage systems, vendor micro-plazas, and green infrastructure interventions.

The study demonstrates that participatory urban design can improve spatial quality, strengthen community ownership, and support livelihood retention while minimizing displacement risks. However, participation alone cannot address broader structural challenges such as tenure insecurity, governance fragmentation, and institutional constraints.

The principal contribution of the research lies in the development of a replicable framework for participatory upgrading within transit-adjacent informal settlements. By

positioning residents as active partners rather than passive beneficiaries, the study advances contemporary debates on inclusive urbanism, community-led planning, and socially sustainable urban futures.

Future research should evaluate post-implementation outcomes, investigate long-term governance mechanisms, and explore the applicability of participatory upgrading frameworks across diverse urban contexts in India and other rapidly urbanizing regions.

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