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Reclaiming The Void: Adaptive Reuse Of Spaces Beneath Metro Lines And Flyovers For Urban Vitality

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Abstract

In the context of rapid urbanization, Indian cities are increasingly dependent on elevated transport infrastructure like metro corridors and flyovers to meet growing mobility demands. However, the residual spaces beneath these structures often remain neglected, misused, or visually degraded. This paper explores the transformative potential of these voids through adaptive reuse, using case studies from Kochi, Nagpur, and Surat. These cities have demonstrated innovative approaches—ranging from vertical gardens to public art and recreational plazas—that reimagine underutilized spaces as community assets. The study integrates urban theories such as CPTED (Crime Prevention Through Environmental Design), Tactical Urbanism, and Urban Acupuncture, and proposes a zoning-based design strategy adaptable to different urban contexts. Comparative analysis and visual documentation support a scalable model for reclaiming infrastructure-adjacent spaces to improve safety, sustainability, and public engagement.

Keywords—Urban Voids, Adaptive Reuse, Metro Infrastructure, Public Spaces, Tactical Urbanism, CPTED, Urban Design

1. Introduction

The proliferation of elevated infrastructure—metro rail lines, flyovers, and skywalks—has reshaped the landscape of Indian cities. While these systems are essential for improving traffic circulation and urban mobility, they often result in lifeless spaces beneath them. These under-flyover and under-metro voids are typically ignored in master plans and left as dead zones, used for informal parking, waste dumping, or illegal encroachments. Despite their neglected state, these voids are centrally located, accessible, and visible—offering immense potential to serve the public through ecological, cultural, and recreational programming. Cities worldwide have begun reclaiming such spaces, with notable examples like the High Line in New York, Cheonggyecheon stream in Seoul, and Tokyo's under-viaduct markets. In the Indian context, a few pioneering projects have redefined these voids as valuable community assets.

2. Case Studies of Adaptive Reuse in India

Kochi – Vertical Gardens for Environmental Reuse

Kochi Metro, in collaboration with VKC Group and NGO Thanal, launched a vertical garden initiative in Ernakulam. Metro pillars were fitted with modular green walls made from recycled materials and planted with native vegetation. The initiative aimed to absorb dust, reduce heat, and visually soften the urban environment. The project was low-maintenance and low-cost, supported by a public-private-volunteer model. Residents reported a noticeable cooling effect in adjacent areas and greater civic pride. The intervention reflects the principles of urban acupuncture and aligns with the Smart Cities Mission by integrating green infrastructure into mobility corridors.

Figure 1: Conceptual Sketch of Vertical Gardens under Kochi Metro

Nagpur – Cultural Corridors through Public Art

Nagpur Metro transformed under-viaduct spaces into cultural hubs by integrating murals, sculptures, LED displays, and public seating. Partnering with artists and local institutions, MahaMetro used storytelling and symbolism to reflect Nagpur's heritage—ranging from tribal motifs to digital freedom murals. The interventions adhered to CPTED principles, increasing visibility, lighting, and pedestrian engagement to deter crime. The success of these projects is seen in rising footfall and citizen participation in art events hosted beneath the viaducts.

Figure 2: Conceptual Sketch of Public Art Activation in Nagpur

Surat – Recreational and Inclusive Zones

Surat's under-flyover zones were converted into recreational plazas with seating areas, shaded walkways, open gyms, food stalls, and smart lighting. Developed by the Surat Municipal Corporation, the design focused on usability, safety, and inclusivity—especially for women, senior citizens, and children. CCTV

surveillance, lighting design, and open sightlines created a sense of comfort at night. The success was evident in surveys showing a 40% increase in female use after redevelopment.

Figure 3: Recreational Zones under Flyovers in Surat

Table 1: Comparative Analysis of Adaptive Reuse Interventions

City	Strategy	Location Type	Stakeholders	Design Elements	Urban Goal	Key Outcomes
Kochi	Vertical Gardens	Metro Pillars	KMRL, Thanal, VKC	Green walls, recycling	Environmental	Air quality, cooling
Nagpur	Cultural Art	Metro Viaducts	MahaMetro, Artists	Murals, LED, sculptures	Cultural Identity	Footfall, CPTED visibility
Surat	Recreation Plazas	Flyover Nodes	SMC, Vendors	Gyms, seating, lighting	Safety, Inclusivity	Women's access, comfort

3. Zoning Strategy and Comparative Impact

The study proposes a zoning-based approach to structure underutilized metro or flyover areas. The modular framework includes:

- Green Zone: Pillar gardens, bioswales, native trees
- Activity Zone: Exercise areas, vending stalls
- Social Zone: Shaded seating, water stations
- Cultural Node: Art walls, digital boards
- Circulation Path: Footpaths, cycle lanes, tactile paving

This layout ensures functionality, safety, and inclusivity for a wide demographic. It can be adapted for narrow linear spaces or wider intersections.

Figure 4: Zoning Map for Adaptive Reuse Design

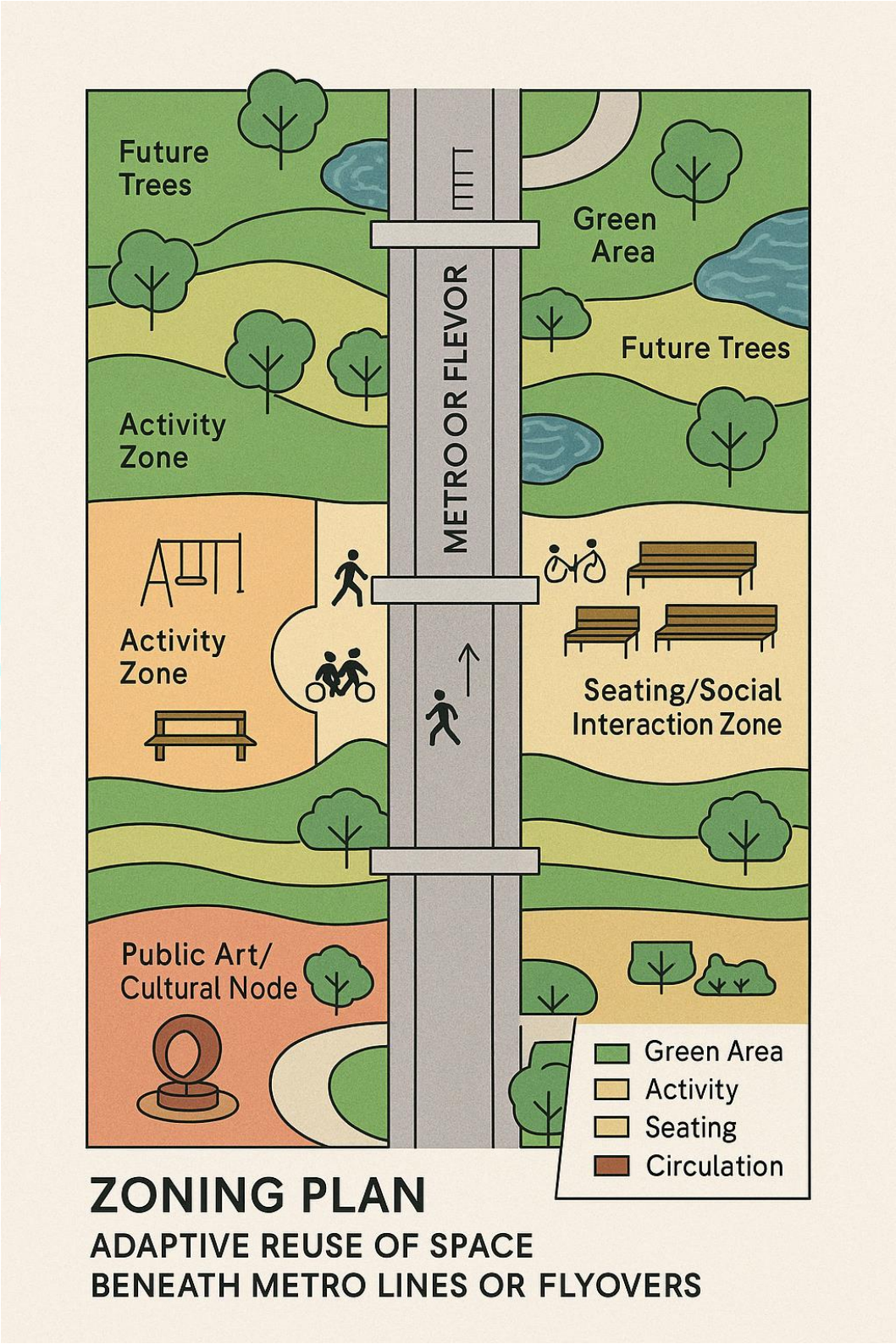
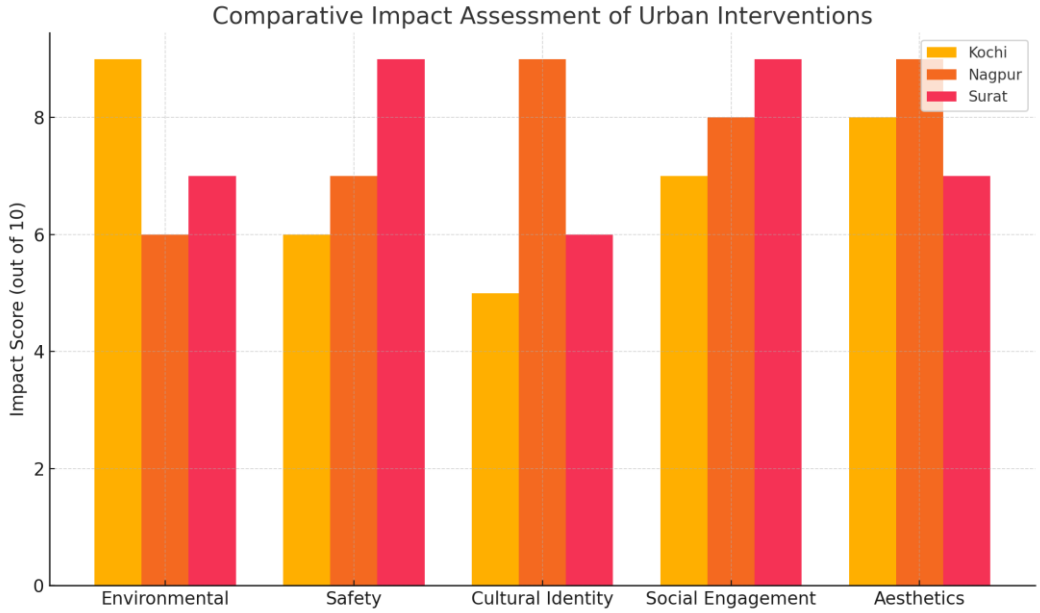


Figure 5: Comparative Impact Assessment of Urban Interventions



4. Results and Discussion

Results from the three city interventions show tangible benefits:

- Kochi: Local temperature reduction and improved air quality
- Nagpur: 35% pedestrian increase and reduced loitering complaints
- Surat: 40% rise in nighttime use by women, improved lighting perception

These confirm that well-planned reuse strategies enhance safety, aesthetics, and engagement.
Discussion: The design strategies reflect key planning theories—CPTED, Tactical Urbanism, and Urban Acupuncture—and validate the proposed zoning framework as a viable, scalable model for Indian urban contexts.

5. Challenges and Conclusion

Challenges include inter-agency coordination, lack of dedicated maintenance budgets, and gaps in inclusive design. Addressing these through PPP or DBMT models and community participation is vital. In conclusion, metro and flyover voids can be reimagined as functional urban assets. This paper presents a framework that balances design, safety, ecology, and culture to reclaim public space in dense Indian cities.

6. Proposal and Future Outlook

Proposal: Cities can adopt the five-zone adaptive reuse model under Smart Cities' ABD components, integrating it into Comprehensive Mobility Plans and TOD zones.
Future Outlook: Technological integration (smart lighting, surveillance), participatory design, and impact-based planning will ensure sustainability. Further research should assess economic and health metrics of these interventions to support long-term policy inclusion.

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