

PERCEPTION OF SPATIAL SAFETY IN RESIDUAL URBAN SPACES

A Case Study of Dehiwala Mount Lavinia Flyover

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Abstract: The spaces that remain in the cities under flyovers are usually overlooked in the expanding cities and, in most cases, are places of informality, former marginalization, and increased feelings of insecurity. To learn how physical qualities (lighting, visibility, form) and social activities (parking, vending, loitering, temporary shelter) affect ideas of safety and allocation of urban resources, this paper studies the Dehiwala-Mount Lavinia flyover in Colombo. Based on a mixed-method design, including field observations, photographic records, and a 20-responder pre-post-perception survey, the study under consideration reveals weak perceptions of daytime safety and significantly negative ones at night. The areas of preference, in terms of improvements, include cleanliness, lighting, vegetation, and seating. A small-scale post-design experiment means that specific environmental and lighting manipulations can help to increase perceived safety, although spatial justice transformations need redistributive and policy-level reaction. The paper ends by offering design and management recommendations in order to transform under-flyover spaces into safe, accessible, equitable urban commons of a new imagination.

Keywords: *Residual urban space, Spatial safety, Perception, Fly over, Colombo*

1. Introduction

The aim of infrastructural developments, like flyovers, in order to alleviate traffic jams, creates residual spaces on the underside of infrastructure networks, which cannot be well assimilated into street life and civic activities. The example of the residual space under the Dehiwala-Mount Lavinia flyover, Colombo, is reflective of a typical urban situation in which vague ownership, inadequate maintenance, and competing informal purposes interact to increase feelings of insecurity and cast doubts on spatial justice. This paper explores the interaction between physical qualities and social behaviours in this abandoned urban space and determines whether small-scale design and management interventions can change attitudes toward safety. The study will offer design-driven solutions that will honour the safety requirements and the principles of equal access.

2. Literature Review

This review summarizes the literature on the urban residual spaces around major transport systems are frequently characterized as unutilized by-products of planar mobility, and are in many cases without apparent ownership or civic purpose (Trancik, 1986; Madanipour, 1998). Subsequent research indicates that these remaining pockets often transform into informal micro-territories to park, vend, temporarily shelter, and other marginal practices, as indicators of spaces that have been neglected and signals of socio-economic strains (Loukaitou-Sideris, 2006; Berger, 2006; Hou, 2021; Mehrotra, 2022). These circumstances reveal that the residual spaces are not just pieces of physical space but a socially disputable space.

It is known that such spaces should be seen as safe places based on visibility, lighting, territorial behaviours, and maintenance as developed in classical urban theory (Jacobs, 1961; Newman, 1972; Crowe, 2000). Nevertheless, the current literature claims that safety is influenced by inclusivity, emotional comfort, and gendered vulnerability as well, with people under the flyovers having more fear due to shadows, blocked sight-lines, and unpredictable activity (Ceccato, 2022; Kim & Lee, 2023). This indicates that the perceptions of safety are developed as a result of a conglomeration of space form and social behaviour, and not as a result of environmental design.

The risk perception is also formed by design features such as access, functionality, and form. The presence of heavy structural elements, disconnecting pedestrian routes, and uncontrolled activities is predominantly supportive of the discomfort, and interventions such as lighting continuity, greenery, and organised use by the people can increase comfort and legitimacy, but only in the context of sensitively applied interventions (Low, 2006; Jamila & Wijayaningsih, n. d.). Exclusionary design or hostile design approaches that disproportionately displace vulnerable users are also discouraged by scholars (Petty, 2016; Rosenberger, n.d.)

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It has been demonstrated in the literature that the conditions of residual space, safety perception, and design qualities are mutually dependent. Nonetheless, very few empirical studies in Sri Lanka focus on understanding the effects of environmental design changes on perceived safety in flyover under crofts, the areas of informality, marginalisation, and poor surveillance. This paper fills this gap by assessing perception-based reactions to small-scale design improvements in the Dehiwala flyover at Mount Lavinia.

3. Methodology

The research adopted a mixed-method design comprising observation, photographic analysis, and a pre-/post-perception experiment. The choice of mixed methods was due to the fact that the spatial safety has both physical and subjective aspects to it, and triangulation of various types of data can enhance validity in small qualitative research (Creswell, 2018).

The study was conducted as a case study of the Dehiwala-Mount Lavinia flyover, in which its selection was based on the fact that this is a major suburban mobility hub that links rail, bus, and pedestrian movement. It has a high level of traffic on a daily basis, a variety of users, and long-term incremental developments occurring due to transport infrastructure, informal businesses, and unrestricted use of the space below the structure. The features render it a relevant and useful context in assessing the impact of the daily environmental conditions on perceptions of safety, comfort, and general spatial quality.

Initially, the lighting, visibility, accessibility, and informal activity were recorded by the observer and photographer at the site. Following these observations, there were two visual situations that were the photos of the current situations under the flyover, and the photos that were digitally enhanced, to display the light improvement, greenery, and cleaning. All images were digitally displayed in one order so that there was consistency.

The sample size of 20 subjects was obtained by using convenience sampling and were requested to rate perceived safety, comfort, and spatial justice on a Likert scale. The sample size, though small, is suitable for a paired sample t-test, as each respondent will give a matched pre-/post-score. Paired designs have sufficient statistical power even with a sample size of 15-20 (de Winter, 2013), and a sample size of approximately 20 is generally considered sufficient to detect the medium effects with regard to perception experiments when each participant is their own control (Field, 2018).

Quantitative analysis involved descriptive analysis and a paired-sample t-test to determine pre-post-difference. The simple descriptive thematic approach of coding observation notes was used in order to contextualise the numerical results patterns.

4. Results and Observation

4.1. OBSERVATION ANALYSIS

The case study of the Dehiwala-Mount Lavinia flyover is about 337 m in length and has a distinct trend of underutilization as compared to the possibilities. The results of the observations and of the survey are united by a collection of those problems that were repeated: unofficial vehicle parking, street vending, social loitering, uneven cleanliness, and insufficient lighting. The main findings of the research are summarized below.

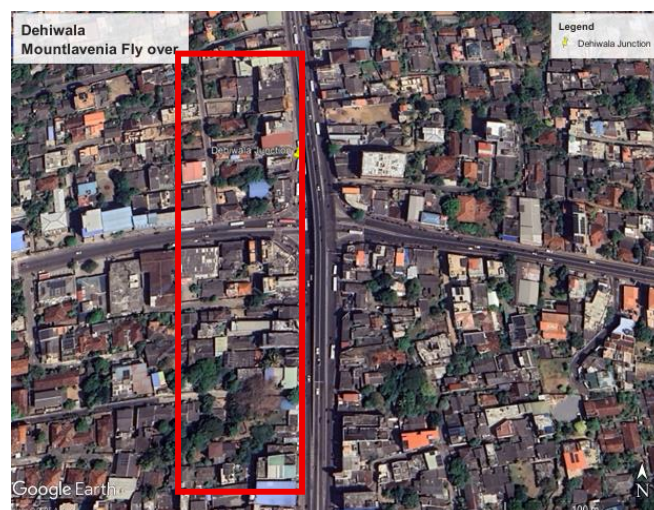


Figure 1 Location of the case study under the *Dehiwala – Mount Lavinia Flyover (Satellite Image)*



Figure 2: Existing images of Dehiwala Mount Lavenia flyover (*Satellite Image*)

The length of the Dehiwala -Mount Lavinia flyover. It will offer a vital infrastructure option to reduce the traffic situation on Galle Road, to make the day-to-day commute between the southern suburbs and Colombo less burdensome. Irrespective of these plans, there is persistent peak-hour congestion on a basis of high demand for vehicles. Judging by the area below the flyover, a vestigial urban emptiness has taken place- unpremeditated, unprotected, and largely unused. This space is casually transformed into vehicular parking and provides a habitation to marginalized groups, as well as passenger accommodations, with activities of sleeping, social loitering, and dumping of garbage being evident in the space. Such practices speak to a larger problem, namely that, in augmenting mobility in the sky, the flyover created complicated, underserved conditions on the ground, disclosing unintended spatial ramifications of transportation-oriented design.

4.1.1 Accessibility

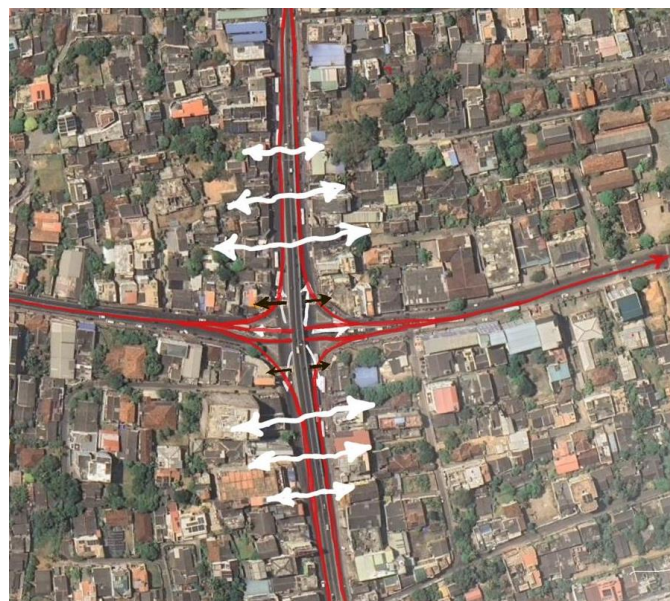


Figure 3 Accessibility (*Satellite Image of Dehiwala - Mount Lavinia Flyover*)

The Dehiwala Mount Lavinia flyover is situated in one of the busiest urban intersections that forms an important network to Hill Street, Marine Drive, and Galle Road. This intersection is considered to be one of the main points in terms of vehicular circulation as well as pedestrian circulation, and the traffic remains constant in the scheme of all directions. Where the

flyover passes over, it eases the movement of vehicular traffic, and where the ground-level passes under the flyover, it is highly intersected by pedestrian routes of the locals, and thus there arises concurrence between the vehicular passage, the people who engage in the informal activities, and the access that the people can have.

4.1.2 Fair Distribution of Resources

The remaining area under the Dehiwala Mount Lavinia flyover brings to the fore the deficiency of equitable distribution of resources. The space is occupied by vehicular parking, which prioritizes ownership and denies all other individuals, especially pedestrians and residents, a safe or meaningful use of space. Meanwhile, marginalized groups end up sleeping or finding a temporary refuge under the flyover, which indicates the flaws within the area of inclusive urban policy. This disparity leads to the problem of spatial exclusion, wherein some are shown convenience in the meantime, others are ignored or stigmatized, thus limiting the potential of the space to be a high street where people can enjoy the facility as a shared amenity.



Figure 4 Marginalized people using a shelter under flyovers (Author)



Figure 5 Vehicle parking located at the turning of the point (Author)

4.1.3 Functions

There is a residual quality under the Dehiwala Mount Lavinia flyover in the form of irregular activities and the unstructured patterns of the area. Planned as a part of the structural span of the flyover, this is actually used to park vehicles on an informal basis, with cars and three-wheelers using the areas on an arbitrary basis. In addition to this, it has also turned out to be a forgotten area where people dump garbage, alcohol is consumed, and there is social loitering. The fact that homeless people are utilizing the space as shelter also indicates its marginalization in the urban space. Rather than serving as a secure and non-exclusive shared space, the location is still an unused and stigmatized leftover space, which demonstrates the matters of poor management, lack of surveillance, and spatial abandonment in the city planning of the urban context.



Figure 6 Irregular Vehicle Parking (Author)



Figure 7 Dumping garbage and social loitering (Author)

4.1.4 Forms

The structural elements of the flyover are huge and play dominant roles as far as dividing spaces and providing shadowed

and encapsulated areas are concerned. Such shapes can provide weatherproofing as well as produce shadows, decreasing visibility. In regard to how pedestrians view safety depends on how a space is closed or open space is. Excess bulkiness can also restrict line of sight, whereas more balanced openness promotes the feeling of safety, comfort, and security.



Figure 8 Form and height (Author)



Figure 9 Narrow space Rigid lines (Author)

4.2. SAFETY PERCEPTIONS

4.2.1 How often do visits to the sites

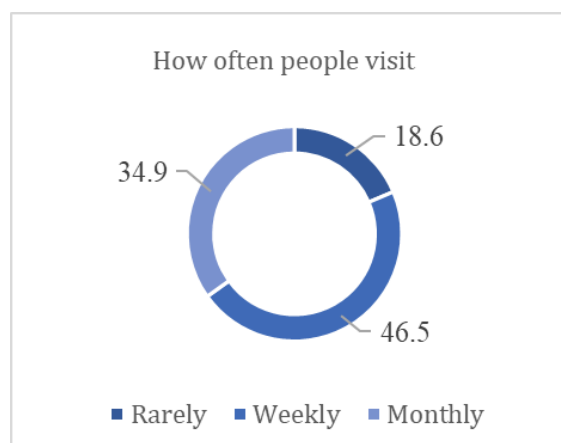


Figure 10 How often people visit the sites (Author)

The survey findings also indicate that the Dehiwala Flyover is the most visited space on a weekly basis (35%) and that 20% each reported going there or occasionally- a mixed but recurrent usage of the space. This is indicative of the fact that the flyover space is still an active component of daily and weekly urban life/routine in spite of being informalized and underutilized.

4.2.2 Perception of Safety at Dehiwala Flyover at Day-time (Day-time)

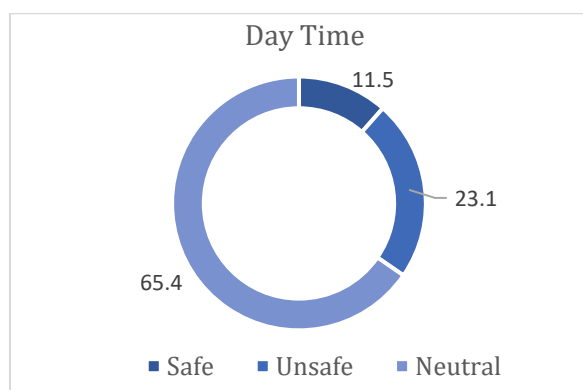


Figure 11 Safety at Dehiwala Flyover at Day-time (Author)

Based on the responses, 80 percent of the respondents gave a neutral answer, whereas only 12 percent expressed feelings of security, and eight percent felt unsafe under the Dehiwala Flyover in the daytime. This goes to show that most users are not sure about whether the space is safe or not, demonstrating weak positive and negative perceptions.

4.2.3 Perception of safety under the flyover at night.

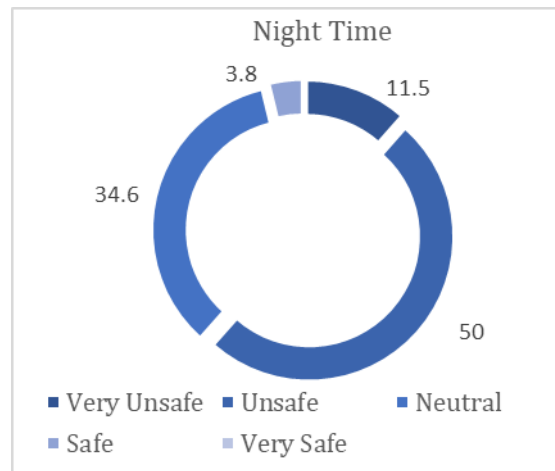


Figure 12 Safety at Dehiwala Flyover at nighttime (Author)

According to the survey findings, it was revealed that most people do not feel safe in the area under the flyover at night. Only 1 percent have felt that it was safe, whereas 51.5 percent have been found to be unsafe, 44 percent very unsafe, and 20 percent. Approximately 35.6 percent of the respondents averred a neutral stance. It indicates that the subjective experience in the hours of darkness under the flyover is that of a high degree of perceived unsafe. Therefore, it implies that there is a high degree of urgency to introduce measures that will enhance safety, lighting, and visibility in the said area.

4.2.4 Public Activities Observed Under the Flyovers.

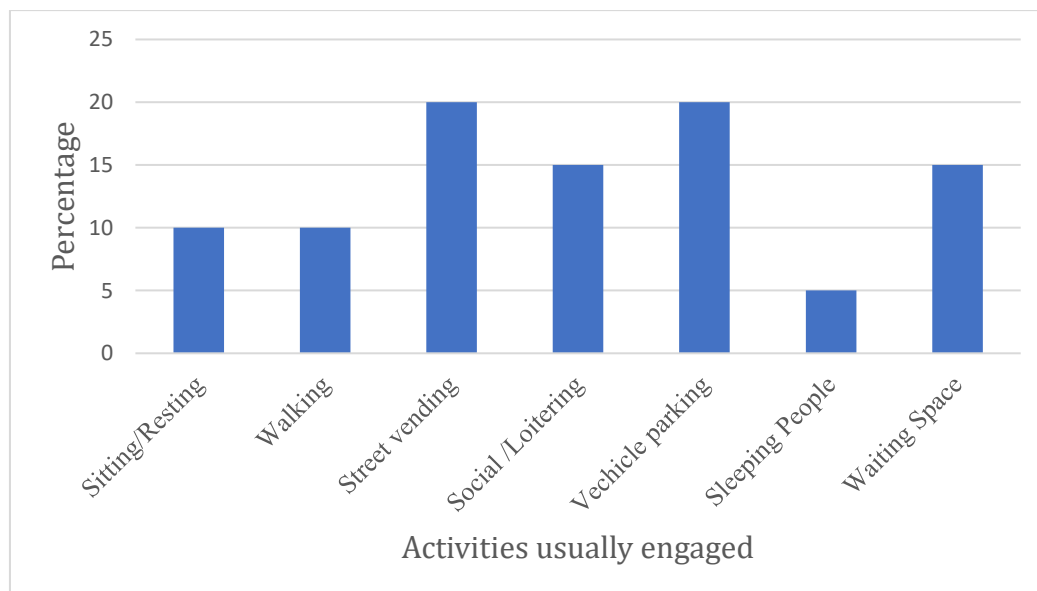


Figure 13 Activities usually engage Dehiwala Flyover (Author)

The bar chart represents the number of different activities that are observed or performed in particular spaces, and the most frequent are Socializing and Vehicle parking, with a frequency of about 18-20 frequency and the least frequent is Sleeping, with a frequency of about 5. This information indicates that people prefer social and mobility activities to resting or sleeping in such places.

4.2.5 Public preference for Improving Safety Under Flyover.

The questions put in the survey query included the way the space beneath the flyover can be made more comfortable for carrying out activities. The findings are that 35 percent of the respondents wanted cleaner surroundings, 30 percent wanted

better light, 25 percent wanted more greenery and shade, and 10 percent preferred having seats. This brings out the fact that the main contribution to increasing the usability and comfort of such urban residual spaces lies in environmental improvements, especially in cleanliness, light, and green features.

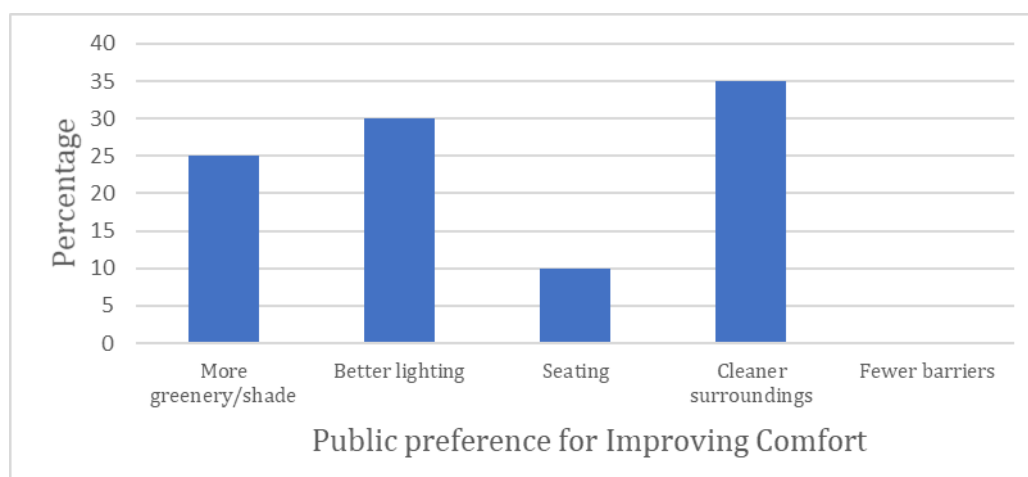


Figure 14: Preference for Improving Comfort Under Flyover (Author)

4.2.6 Pre-Test Post-Test Analysis



Existing Situation



Redesigned space for safety and comfort with design

The pre-test image reveals a dark, untidy, and disrepair residual spaces beneath the flyover, which create discomfort and poor perceived safety. The redesigned scenario brings in lighting, vegetation, and structured seating, making the environment cleaner and more hospitable. These images were presented to the participants, who were asked to rate the various conditions applying a 1-5 Likert scale in order to compare the perceived safety, comfort, and spatial fairness.

Table 1: Pre-Safety and Post-Safety

Paired Sample Statistics Pre Post Safety		
Dehiwala Mount Lavinia	Mean	Number
Pre Safety	1.7167	20
Post Safety	2.3833	20

Table 1 shows the comparison of the pre-intervention and post-intervention safety perceptions. The mean has risen by 1.72 to 2.38, which means that with better lighting, visibility and space organisation, users felt more secure. These findings indicate that fear and antisocial behaviour can be minimised by using basic environmental design techniques to make the environment look more organized and useful.

Table 2: Pre-Justice and Post-Justice

Paired Sample Statistics Pre Post Justice		
Dehiwala Mount Lavinia	Mean	Number
Pre Justice	1.6800	20
Post Justice	2.2714	20

As shown in Table 2, there is a moderate positive change in perceived spatial justice with the mean increasing by 0.59 at the end of the intervention. People perceived the redesigned space as more equal, open, and organised. Though, the improvements were aimed at control and order this did not deny the fact that improvements helped to create a better understanding of fair and orderly use of the space.

Table 3: Paired sample Test

Paired Sample Statistics: How comfortable after Post-test Design		
Dehiwala	Mean	Number
How comfortable is after post-test design	2.80	20

The moderate level of comfort after the intervention is seen in this table with a mean score of 2.80. Users liked the increased level of cleanliness and organization, but physical limitations and defensive design features limited the overall comfort. The feeling of comfort was mostly achieved by the increased organisation and less clutter, instead of emotions or sensual appeal.

5. Discussion

The results show that small environmental upgrades in the Dehiwala-Mount Lavinia under the flyover produced clear improvements in perceived safety, spatial justice, and comfort. Safety rose the most, which means that improved lighting, better sight-lines, and organised space would reduce the uncertainty and ensure that the users would feel safer, which is in line with the results of (Ceccato, 2022; Kim & Lee, 2023). These modifications directly respond to the typical problems of the Sri Lankan under crofts, where fear is increased by bad management and darkness.

The presence of improved movement routes and decreased levels of disorder likely enhanced one's ability to perceive these spaces as equal, fair, and accessible, which is consistent with recent research that has shown that increased spatial legibility and reduced ambiguity lead to a greater sense of fair and equitable use in residual urban areas (Hou, 2021; Mehrotra, 2022).

The comfort also increased moderately. The enhanced cleanliness and organisation were well received by users; however, the physical factors- heaviness of structure, its scant openness, etc. limited the ability to indulge in deeper sensory pleasure. This is an indication of literature that infrastructural spaces tend to need more human-centred aspects to bring about maximum comfort (Kim & Lee, 2023).

On the whole, the results indicate that inexpensive environmental interventions could be used to significantly improve the user experience under the flyover in urban areas of low priority. Although this sample and the use of visual stimuli restrict generalisation, the findings will be valuable to provide evidence that can be used to enhance similar residual spaces throughout Colombo.

6. Conclusion

This study set out to evaluate how small environmental design improvements influence perceived safety, spatial justice, and comfort in the Dehiwala-Mount Lavinia under the flyover. The results indicate that low-cost intervention measures that are focused on lighting, plants, cleaning of surfaces, and more transparent spatial arrangement are able to greatly increase user perception within the area, which is normally linked with low visibility, ambiguity, and informal use. The great change in safety perceptions and moderate changes in justice and comfort indicate that design cues are important in influencing behavioural expectations and emotional reaction in neglected infrastructural setups.

One of the contributions of this research is that it has shown that the reuse of residual spaces under flyovers in Sri Lanka is possible with minimal structural modifications. Grounded in a perception-based assessment, the study illuminates the direct impact of environmental cues on users' feelings of security and sense of fairness in the local setting, an area that has not been studied thoroughly. These lessons are the gap that is significant in the knowledge of how cities design can reclaim their peripheral spaces amidst the thick infrastructural scenery.

This case study of the Dehiwala-Mount Lavinia flyover shows that small-scale, context-sensitive interventions can improve perceived safety in residual urban spaces, particularly by addressing lighting, cleanliness, and opportunities for legitimate uses. However, true spatial justice requires policy-level attention to resource distribution and participatory governance to ensure that interventions do not simply hide or displace existing marginalized users.

The research has its drawbacks owing to a small sample size and the use of visual stimuli as opposed to complete on-site behavioural observation. Nevertheless, the findings form a solid base for further research with a bigger sample size, real-time mapping of activities, and, furthermore, immersive measurement methods. All in all, the research indicates that the flyover areas can be transformed into less dangerous, more understandable, and friendlier urban places through modest yet deliberate design measures that can be implemented in Sri Lanka.

Recommendations:

- Lighting upgrades focused on eliminating deep shadow pockets and improving continuity along pedestrian routes.
- Maintenance and cleaning protocols with municipal responsibility and clear performance indicators.
- Reallocation of space (controlled parking zones) to prioritize pedestrians and organized public uses.
- Soft landscape interventions (potted planting, low-maintenance greenery) to improve microclimate and perceived care.
- Community programming (markets, cultural events, wayfinding) to create predictable, legitimate activity and stewardship.

Future research should expand the sample, include direct observations of criminal incidents (if any), and test physical interventions through before-and-after field trials with larger and more diverse respondent groups

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