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AN ASSESSMENT OF PEDESTRIAN INFRASTRUCTURE AND WALKABILITY IN COMMERCIAL MARKET CORRIDORS OF DHAKA CITY: A CASE STUDY OF NILKHET TO SCIENCE LAB INTERSECTION

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Abstract

In Dhaka, where walking remains a primary mode of transport, pedestrian infrastructure is often overlooked in both design and policy. This study focuses on the high-footfall commercial market corridor between Nilkhet and the Science Lab Intersection, examining spatial conditions, governance issues, and pedestrian perceptions of key footpath features such as surface quality, width, safety, comfort, etc. Major concerns include vendor encroachment, inconsistent footpath dimensions, and lack of amenities, especially affecting women, children, and the elderly. A mixed-methods approach was applied, including drone survey, pedestrian flow counts, and on-site and online questionnaire surveys. Spatial data were analyzed using ArcGIS Pro, while statistical and perceptual responses were processed with Microsoft Excel. Results show that 27.85% of footpath space is encroached, reducing the effective average walkable width to 55.21%. The Quality of Service (QoS) score of 84.61 places the corridor in Grade C, indicating basic functionality but lacking comfort and safety. Pedestrian Level of Service (PLOS) ranges from Grades B to D in the morning and E to F during peak hours, pointing to critical congestion. The study highlights the need for integrated improvements combining design upgrades, vendor management, participatory governance, and data-informed urban planning.

Key words: Walkability, Pedestrian Level of Service (PLOS), Quality of Service (QoS), Footpath infrastructure, Vendor encroachment.

Introduction

Walking remains one of the most essential yet neglected modes of mobility in urban contexts, particularly in rapidly growing cities like Dhaka where spatial constraints, informal land use, and weak policy enforcement pose complex challenges to pedestrian infrastructure (Soni and Soni, 2016; Islam *et al*., 2019). In high-traffic corridors of Dhaka

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such as the Nilkhet to Science Lab intersection, the usability and safety of pedestrian environments are compromised not just by inadequate design, but also by behavioral patterns, vendor encroachment, and governance limitations (Tanvir *et al*., 2016; Rahman and Noman, 2016).

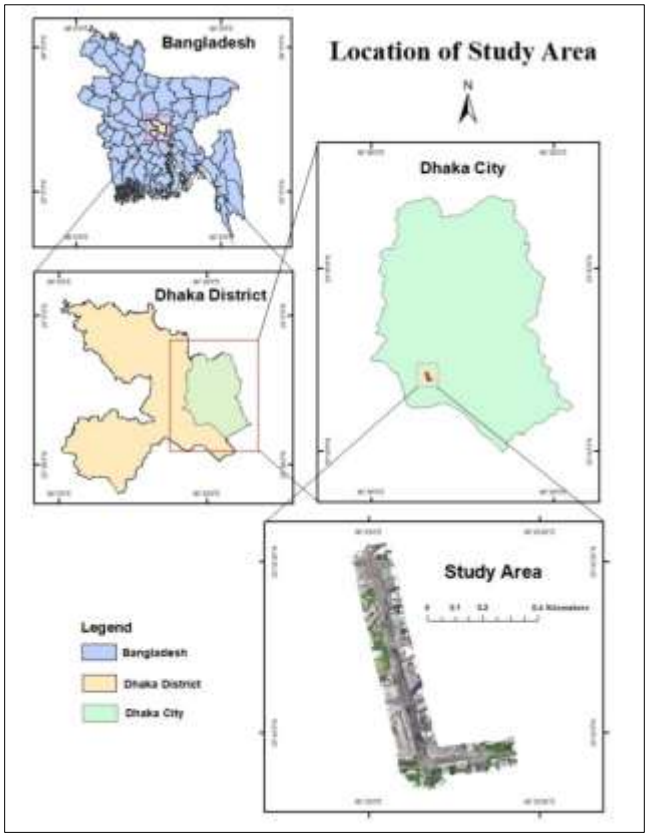


Fig. 1. Location of study area.

The academic discourse on pedestrianization increasingly emphasizes multi-dimensional analysis frameworks that move beyond static measures of footpath presence. Scholars have highlighted the importance of physical features such as width, continuity, and connectivity (Rahman *et al*., 2005; Kubat *et al*., 2013), but also argue for incorporating thermal comfort, safety perception, and user-specific vulnerability (Baobeid *et al*., 2021; Jahan *et al*., 2020). In line with this evolution, the current study adopts a conceptual framework that integrates physical infrastructure, socio-environmental comfort, informal

economy dynamics, and policy contexts. Following Bhuiya *et al*. (2018) and Bhadra *et al*. (2015), the study uses both spatial tools and perceptual surveys to analyze pedestrian mobility efficiency and user satisfaction. Despite this growing body of work, however, no study has simultaneously integrated UAV-based spatial mapping, Indo-HCM pedestrian flow assessment, and perception surveys to evaluate walkability in a commercial corridor of Dhaka. This study addresses that gap by providing a multi-method, evidence-based evaluation of the Nilkhet–Science Lab corridor — one of the most commercially dense and pedestrian-intensive stretches in the city.

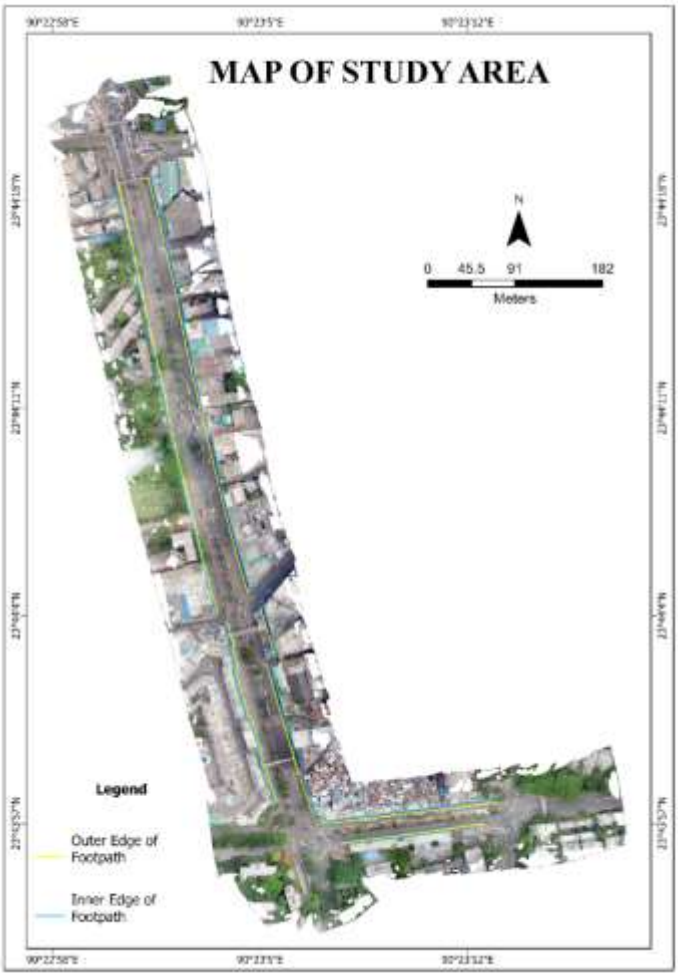


Fig. 2. Map of study area.

Drawing on this integrated approach, the Nilkhet–Science Lab corridor was selected as a case study to assess walkability conditions using drone-based spatial diagnostics (Debnath *et al*., 2021), Geographic Information System (GIS) analysis (Biswas and Roy, 2023), field surveys, flow counts, and stakeholder interviews. The Nilkhet–Science Lab corridor was selected for its unique concentration of urban stressors: it hosts one of the highest-density informal vendor clusters in Dhaka, serves a mixed population of students, commuters, and shoppers, and lies within a zone where Detailed Area Plan (DAP)-mandated footpath standards are demonstrably unimplemented. Its approximately 1.2 km length provides sufficient spatial extent for statistically valid sampling while remaining manageable for intensive drone and field survey. The corridor is representative of commercial arterials across Dhaka where pedestrian infrastructure deficits intersect with informal economic activity. The aim of the study was to understand how encroachment, infrastructure design, and behavioral factors intersect to affect Levels of Service (LOS) and perceived walkability. The findings are expected to contribute to evidence-based policy recommendations for equitable, inclusive, and livable pedestrian planning in dense urban centers like Dhaka.

Materials and Methods

Pedestrian Questionnaire Survey: The questionnaire survey was conducted in April and May in 2025. A structured questionnaire survey was administered to assess pedestrian experiences, perceived importance of various footpath features, challenges faced, and satisfaction with the pedestrian infrastructure along the corridor from Nilkhet to Science Lab Intersection. Data were collected through in-person surveys along the footpaths and an online Google Forms version targeting experienced pedestrians. A purposive sampling technique was adopted for both data collection modes. For in-person surveys, only pedestrians who were physically present and actively using the corridor at the time of survey, and who voluntarily consented to participate, were included. For the online survey, the Google Forms link was shared with college and university academic groups and on open social media platforms, with respondents explicitly encouraged to participate only if they were regular users of the Nilkhet–Science Lab footpath. This approach, applied consistently across both modes, ensured that responses reflected the perspectives of individuals with direct, lived experience of the corridor's walkability conditions, rather than a randomly selected general population unfamiliar with the site. Offline surveys were conducted at different times of day to ensure a representative sample of users.

The required sample size was determined using Cochran's formula for large populations, with a 95% confidence level and a 5% margin of error. The calculation yielded a minimum required sample size of 384 respondents:

$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2} = \frac{(1.96)^2 \cdot 0.5 \cdot (1-0.5)}{(0.05)^2} = \frac{3.8416 \cdot 0.25}{0.0025} = \frac{0.9604}{0.0025} = 384.16$$

In the formula, n_0 represents the estimated sample size, Z is the Z-score (1.96 for a 95% confidence level), p is the estimated population proportion (assumed to be 0.5 for maximum variability), and e is the margin of error (0.05, representing ±5%). The calculated sample size is 384.

A subset of the questionnaire responses was used specifically to compute the Walkability Index or Quality of Service (QoS), following the framework proposed in the Indian Highway Capacity Manual or Indo-HCM, published by the Council of Scientific and Industrial Research – Central Road Research Institute (CSIR-CRRI, 2017). The Indo-HCM framework was adopted for the Walkability Index and Pedestrian Level of Service (PLOS) assessment for three reasons. First, it was developed to reflect the mixed-traffic, high-density pedestrian conditions prevalent in India, closely resembling those in Dhaka's commercial corridors. Second, the core factors Indo-HCM emphasizes — path width, pedestrian volume, and buffer availability — align with those independently identified as the most influential PLOS determinants in Dhaka (Bhuiya et al., 2018; Rahman and Noman, 2016), supporting the contextual relevance of these parameters even though that study used a different (multi-criteria) method. Third, no Bangladesh-specific pedestrian capacity manual currently exists, making Indo-HCM the most contextually appropriate available standard.

The calculation of QoS involved ten selected indicators related to key physical and experiential features of the pedestrian environment. For each indicator, respondents rated importance and satisfaction using a 5-point Likert scale. Importance was rated from 1 (Not Important at all) to 5 (Extremely Important), and satisfaction from 1 (Very Dissatisfied) to 5 (Very Satisfied).

For each feature, the average importance and average satisfaction were calculated across all responses and denoted as A_i and B_i, respectively.

$$\text{Walkability Index (QoS)} = \sum_{i=1}^{10} A_i \cdot B_i$$

Where: A_i = Average importance weight for the i^{th} feature

B_i = Average satisfaction rating for the i^{th} feature

The final composite score was benchmarked against the QoS grading scale provided in Indo-HCM, 2017 allowing the corridor to be categorized into a walkability grade (A to F), reflecting the overall pedestrian experience.

Drone Survey: A drone survey using the DJI Phantom 4 Pro V2.0 was conducted to map footpath encroachment and measure usable pedestrian space along the Nilkhet to Science Lab corridor.



Fig. 3. Sample Drone Image Showing Vendor Encroachment (Source: Fieldwork, 2025).

Drone imagery was captured on April 28, 2025, between 8:13 am and 8:38 am. This window was selected to obtain clear, unobstructed aerial images of the footpath and road geometry before the onset of peak morning pedestrian activity, minimizing visual obstruction from pedestrian movement while maintaining suitable daylight conditions for image clarity.

A total of 21 high-resolution images were captured and mosaicked into a composite base map. The images were processed in ArcGIS Pro for detailed spatial analysis.

The digitization process included tracing the outer and inner edges of footpaths, individual vendor boundaries, and a common inner edge of vendors which reflects the linear pattern of encroachment along the corridor (Figure 3). This allowed precise calculation of encroached and walkable areas.

Polygons were created for total footpath segments and vendor-occupied zones. The encroached area was subtracted from the total to determine the remaining pedestrian space. Width measurements were taken at 25-meter intervals, totaling 62 sampling points (32 in east, 30 in west). At each point, the total footpath width, vendor-occupied width, and remaining walkable width were measured using digitized drone imagery.

This method enabled accurate spatial quantification of vendor encroachment and available pedestrian space, forming a critical component of the infrastructure analysis.

Pedestrian Count: Data collection was conducted on three separate days — April 30, May 5, and May 8, 2025 — on regular weekdays, avoiding rainy or inclement weather conditions to ensure consistent pedestrian behavior and survey accessibility. Pedestrian counts were conducted at four strategic points (start and end of footpaths on both east and west sides) along the Nilkhet–Science Lab corridor to assess flow patterns during peak hours. Data were collected during three time periods — 8–10 am, 1–2 pm, and 4–6 pm — representing the morning, midday, and evening peaks, when pedestrian activity is expected to vary most. At each period, counts were taken for three 5-minute intervals (beginning, middle, and end of the peak window) to capture intra-peak fluctuations in pedestrian volume. Count intervals for pedestrian flow data extraction have been reported in the literature to range between 1 and 5 minutes, depending on whether average or peak flow conditions are of interest (Kahali and Rastogi, 2021). The present study adopted 5-minute intervals at the upper end of this range, consistent with the goal of capturing representative average flow conditions during defined peak periods rather than instantaneous peaks. At each interval, simultaneous counts were recorded at all four locations to ensure spatial consistency across the corridor. The total count for each 5-minute slot was averaged across the four locations to compute the pedestrian flow rate, which was then used to determine PLOS for each time slot. Data collection was limited to regular, non-rainy weekdays; weekday–weekend and seasonal variations in pedestrian flow were not assessed and remain a scope for future research.

Flow rates were calculated using the Indo-HCM (CSIR-CRRI, 2017) methodology:

- Average pedestrians per minute were obtained by dividing the total 5-minute count by 5.

- This value was divided by the average effective footpath width to get flow in ped/min/m.
- This was multiplied by 60 to determine ped/hour/m.

Finally, the Pedestrian Level of Service (PLOS) was determined from the calculated flow rates using the Indo-HCM classification, which grades pedestrian conditions from A (free flow) to F (severely congested).

Results and Discussion

Walkability Score and QoS Interpretation: According to this classification, the score of 84.61 places the footpath corridor within QoS Grade C. This category reflects a moderate level of walkability, indicating that while certain essential infrastructure elements are present, the pedestrian experience is significantly constrained by gaps in service delivery, comfort, and safety provisions.

Table 1. Computation of Walkability Index of the study area.

Feature		Average Importance Weight (A_i)	Average Satisfaction Rating (B_i)	A_i x B_i
Physical Characteristics	Footpath Surface	4.0000	1.9245	7.6980
	Footpath Width	4.3125	1.7734	7.6478
	Obstructions	3.9401	2.0130	7.9314
	Potential for Vehicular Conflict	4.3932	2.8750	12.6305
	Continuity	3.9661	2.8125	11.1547
User Characteristics	Encroachment	4.4505	1.5755	7.0118
	Availability of Crossing Facilities	3.9714	2.1849	8.6771
	Security	4.1510	1.9870	8.2480
	Comfort	3.0000	1.7135	5.1405
	Walk Environment	4.0182	2.1068	8.4655
			Summation	84.6053

(Source: Fieldwork, 2025)

Usable and Effective Width of Footpath: In this study, usable width refers to the physically unobstructed portion of the footpath, while effective width accounts for both physical encroachment and the "shy distance" pedestrians maintain from obstacles like

vendors. Shy distance is the portion of space that pedestrians find psychologically unavailable, even if it is not physically occupied. Based on the Indo-HCM (2017), this distance is assumed to be 0.4 meters.

Table 2. Standard Walkability Index Range and Corresponding QoS Grades.

QoS Grade	Walkability Index Range
A	≥ 124
B	106-124
C	70-106
D	52-70
E	<52

(Source: CSIR-CRRI, 2017)

On the eastern side, the usable width is 1.94 meters, but drops to 1.54 meters when shy distance is considered. This means only 49.91% of the total footpath is perceived as walkable. The western side shows less encroachment, with a usable width of 1.77 meters and an effective width of 1.37 meters, or 63.25% of the total width. Overall, the average usable width across the corridor is 1.858 meters, but the effective width reduces to 1.458 meters, leaving only 55.21% of total footpath width realistically accessible for walking.

The eastern footpaths exhibit more encroachment due to both structural width and the economic attractiveness of adjacent land use. This side hosts a dense cluster of commercial markets such as Nilkhet Book Market, Chandni Chowk, Gausia, Nurjahan, Globe, Golden Gate, and Hawker's Market. These attract heavy footfall and informal vendors, increasing congestion and reducing walkable space. This emphasizes that improving walkability requires attention not just to physical obstructions but also to the psychological spatial behavior of pedestrians.

Encroached Area Analysis of Footpaths: High-resolution spatial analysis using GIS reveals a substantial reduction in functional pedestrian infrastructure due to informal vendor encroachment. Of the total 4,215 m² of surveyed footpath area along the Nilkhet–Science Lab corridor, approximately 1,174 m² (27.85%) is occupied by vendors, with 592 out of 657 vendors located directly on footpaths. This level of occupation considerably undermines pedestrian mobility and spatial equity.

Table 3. Calculation of effective footpath width.

Metric	Eastern Side (Meter)	Western Side (Meter)	Total (Meter)
Average Total Width of Footpath (W_T)	3.085	2.166	2.641
Average Width Occupied by Vendors (W_V)	1.145	0.396	0.783
Vendor Encroachment with Shy Distance (W_V+W_S) [Shy Distance for Hawkers, W_S= 0.4m] (Source: CSIR-CRRI, 2017)	1.545	0.796	1.183
Average Usable Width of Footpath (W_U=W_T-W_V)	1.94	1.77	1.858
Average Effective Width of Footpath (W_E=W_U-W_S)	1.54	1.37	1.458
Percentage of Usable Footpath Width [(W_U/W_T) × 100%]	62.88%	81.72%	70.35%
Percentage of Effective Footpath Width [(W_E/W_T) × 100%]	49.91%	63.25%	55.21%

(Source: Fieldwork, 2025)

The spatial distribution of encroachment is not uniform. Segments in proximity to high-footfall commercial hubs, notably Hotel Grand Galaxy to DBBL Road, Road to Science Lab and New Market exhibit the highest encroachment densities. These areas demonstrate a clear correlation between commercial attractiveness and informal spatial appropriation. In contrast, zones adjacent to institutional land uses—such as the Teachers' Training College, in front of Chandrima Market and Footpath of Western Road of Nilkhet —retain significantly more walkable space, with over 85% usability observed.

These findings emphasize the importance of spatially adaptive urban management strategies. Targeted vendor zoning, dynamic spatial audits, and policy interventions informed by geospatial evidence are essential to restoring pedestrian functionality and ensuring equitable access within dense commercial corridors.

Temporal Variation in Pedestrian Flow: Pedestrian flow patterns along the Nilkhet–Science Lab corridor exhibit significant temporal variability shaped by institutional, commercial, and commuting activity cycles. Based on nine five- minute observation intervals, peak pedestrian density was recorded during early afternoon and evening hours.

Table 4. Calculation of walkable footpath area.

Footpath Name	Footpath Area (m^2)	Space Occupied by Vendors (m^2)	Walkable Area on Footpath (m^2)	% of Walkable Area on Footpath
Nilkhet Road	616	195	421	68.34
Balaka Road	455	155	300	65.93
Chandni Chowk	153	57	96	62.75
Nurjahan Road	304	105	199	65.46
In front of Globe super Market	197	73	124	62.94
In front of Petrol Pump	35	10	25	71.43
Hotel Grand Galaxy to DBBL Road	511	194	317	62.04
Road to Science Lab	216	82	134	62.04
In front of Teachers' Training College	623	92	531	85.23
In front of Chandrima Market	397	15	382	96.22
New Market	502	196	306	60.96
Opposite Road Of Nilkhet	206	0	206	100.00
Total	4215	1174	3041	72.15

(Source: Fieldwork, 2025)

The lowest flow occurred between 8:00–8:05 AM, at 19 ped/min/m (PLOS B), coinciding with closed markets and minimal institutional activity. By contrast, the highest recorded flow—90 ped/min/m (PLOS F)—occurred between 5:55–6:00 PM, reflecting overlapping institutional dismissals, commuter return, and end-of-day shopping activity. Across all time periods, average pedestrian flow reached 61 ped/min/m, classified as PLOS E per Indo-HCM (CSIR-CRRI, 2017), indicating suboptimal walking conditions and high crowding.

These findings confirm that afternoon and evening hours face critical congestion, requiring time-specific interventions like vendor regulation and dynamic footpath management. Additionally, unauthorized vehicle intrusions during peak periods further hinder pedestrian movement and compromise safety, underscoring the need for stricter footpath regulation.

Table 5. Pedestrian flow analysis.

Time Period	Total Pedestrians (5-min count) at 4 Locations	Ped/min/m	Ped/hour/m	PLOS Grade (Indo-HCM)	Time of Day	Notes
8:00–8:05 am	137	19	1128	B	Morning	Early morning, low demand
9:00–9:05 am	235	32	1934	D	Morning	Rising commuter activity
9:55–10:00 am	316	43	2601	D	Morning	Late morning peak
1:00–1:05 pm	516	71	4247	F	Midday	Lunch hour surge
1:30–1:35 pm	639	88	5259	F	Midday	Highest recorded flow★
1:55–2:00 pm	514	71	4230	F	Midday	Post-lunch sustained flow
4:00–4:05 pm	414	57	3407	E	Evening	Early evening activity
5:00–5:05 pm	562	77	4626	F	Evening	Evening peak builds
5:55–6:00 pm	653	90	5374	F	Evening	Highest evening flow★
Overall Average Flow (all 9 intervals)		**61**	–	**E**	–	**Corresponds to PLOS E overall, indicating systemic congestion along the corridor.**

(Source: Fieldwork, 2025)

PLOS Grade Legend — Indo-HCM (CSIR-CRRI, 2017) Thresholds:
A — Free flow (≤ 13 ped/min/m)
B — Free flow (>13–19 ped/min/m)
C — Stable flow (>19–30 ped/min/m)
D — Near capacity (>30–47 ped/min/m)
E — Congested (>47–69 ped/min/m)
F — Breakdown / forced flow (Variable, >69 ped/min/m)

Demographic-Sensitive Analysis of Footpath Safety and Comfort: The pedestrian experience along the Nilkhet–Science Lab corridor is marked by significant demographic disparities. The age distribution of respondents (Figure 4a) shows that the sample was predominantly composed of young adults, with 34.11% falling within the 21–25 age group and a further 27.08% within the 26–35 range, while children, adolescents, and older adults (11–20 and 51–65 years) together comprised less than 10% of respondents — a profile broadly consistent with the corridor's proximity to educational institutions. Among the counted pedestrians, 24.41% were women. However, survey findings reveal that 82.03% of respondents consider the footpaths unsafe for women at night, compared to 36.72% during the day.

Furthermore, 66.15% agreed that women are at higher risk of harassment, with 92.45% stating it occurs "always," "often," or "sometimes." Similarly, 71.36% of respondents rated the footpaths as uncomfortable or unsafe for children and elderly individuals — a

finding that warrants particular attention given that this group was comparatively underrepresented in the sample itself, suggesting their actual on-corridor experience may be even less visible in standard pedestrian counts.

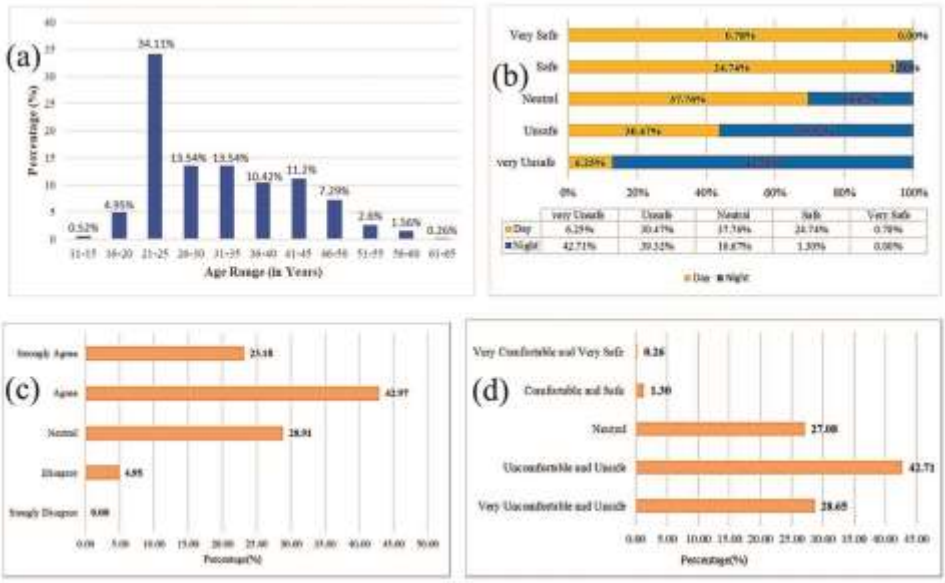


Fig 4. Demographic-Sensitive Analysis of Footpath Safety and Comfort: a) Age Distribution of Respondents; b) Perceived Day vs. Nighttime Safety of Women Walking Alone; c) Perceptions of Whether Women Face Higher Harassment Risk Than Men on Footpaths; d) Pedestrian Perception of Safety for Children and Elderly on Footpaths (Source: Fieldwork, 2025)

Comparative Analysis: The PLOS conditions recorded in this study — ranging from Grade B in the early morning to Grade F during evening peak hours, with an average of Grade E — align closely with prior assessments of Dhaka's footpath network. Rahman et al. (2005), in an evaluation of the roadside walking environment across five blocks of Dhaka City, identified illegal occupancy by hawkers as a recurring obstruction to walkway continuity in every studied block, and notably found that the lowest Level of Service (Grade F) occurred during off-peak hours rather than peak hours — indicating that structural and encroachment-related deficiencies, rather than pedestrian volume alone, were the dominant factor depressing service quality. Similarly, Bhuiya *et al.* (2018) determined PLOS for selected footpath stripes of Dhaka City using a multi-criteria decision-making approach and found that path width, pedestrian volume, and buffer availability were the most influential factors, with all studied sections rated as having poor PLOS. More recently, an assessment of walkability across Dhaka's Central Business

Districts identified narrow and discontinuous footpaths, multiple physical barriers, and haphazard hawker encroachment as the dominant challenges in its most congested wards (Khan and Tabassum, 2024). The convergence of these findings with the present study's 27.85% encroachment rate and PLOS E–F outcomes during peak hours suggests that vendor-driven footpath degradation is not localized to the Nilkhet–Science Lab corridor but reflects a systemic condition across Dhaka's commercial and institutional zones, persisting across nearly two decades of research.

This pattern of multi-dimensional walkability deficits recurs across South Asian cities with comparable informal economies and infrastructure constraints. A footpath-level accessibility assessment of 32 stretches in Central Kolkata, India, evaluated accessibility based on factors including footpath continuity, surface condition, and the presence of temporary and permanent vendor encroachment, finding that the overall accessibility score for the surveyed stretches was negative, reflecting poor walkability conditions overall (Mahapatra et al., 2023). At a broader regional scale, a study examining pedestrian-level-of-service perceptions across Indian cities found that almost all study areas required improvement across multiple dimensions, including footpath vendor management and footpath cleanliness, among other infrastructural deficiencies (Rahul and Manoj, 2020). Taken together, these studies indicate that poor PLOS in South Asian commercial corridors typically results from the compounding effect of inadequate footpath width, surface and continuity issues, and informal vendor activity, rather than any single factor in isolation. The recurrence of this multi-factor degradation pattern across Dhaka, Kolkata, and broader Indian urban contexts indicates that it is a structural feature of South Asian commercial corridors rather than a site-specific anomaly, reinforcing the appropriateness of Indo-HCM-based, multi-criteria PLOS thresholds — which similarly account for width, buffer, surface, and obstruction factors together — for evaluating corridors such as Nilkhet–Science Lab.

A useful contrast emerges when these findings are placed alongside pedestrian-space governance elsewhere. New York City mandates a minimum 12-foot clear path for sidewalk vending (NYC Administrative Code, §20-465), while London requires a minimum unobstructed footpath width of 1.8 meters for licensed street trading (London Borough of Hounslow, 2024). Bangkok regulates vending both spatially and temporally: under Bangkok Metropolitan Administration (BMA) policy, vendors must operate within designated zones at designated times, with each zone assigned its own schedule and a limited number of vendor slots (Batréau and Bonnet, 2016). These cases show that informal commerce is not eliminated but spatially and temporally bounded by enforceable limits. The 1.46 m effective footpath width recorded in this study falls below

both London's and New York's clear-path standards, despite no comparable standard existing along the Nilkhet–Science Lab corridor. This suggests the core issue is not vending itself, but the absence of defined, enforced space and time allocations — pointing to spatial and temporal formalization of vending zones as a more targeted policy response than removal.

Policy Gaps in Practice: In terms of spatial allocation, the DAP recommends a through route width of 2 to 2.5 meters for commercial areas outside the Central Business District (CBD), and 3 to 4 meters for pedestrian-dense institutional areas (Rajdhani Unnayan Kartripakkha, 2022). These through routes are intended to ensure uninterrupted, bi-directional pedestrian flow. In contrast, the findings from this study reveal that the average footpath width available for pedestrian movement before accounting for vendor encroachment is 2.64 meters. However, after factoring in vendor occupation, the usable through route width is reduced to 1.86 meters, and further declines to approximately 1.46 meters when considering shy distance. The effective width is significantly below the DAP's recommended minimum through route widths for both relevant land use categories, indicating a substantial shortfall in walkable space even before considering other obstructions or behavioral factors.

Table 6. Recommended footpath widths by DAP based on land use type.

Land Use Category	Peak Pedestrian Flow (ped/min)	Frontage Zone (m)	Through Route (m)	Utility Zone (m)	Total Width (m)
Central Business District (CBD)	80	1.0	3 to 4	1.5	5 to 6.5
Parks, Schools, and other Pedestrian-Dense Institutions					
Local Roads (Commercial)	60	1.0	2 to 2.5	1.5	4.5 to 5
Commercial Areas Outside Central Business Zone					
Residential Area	50	0.5 to 1.0	1.5 to 1.8	1.0	3 to 3.8
Collector Roads					

(Source: Rajdhani Unnayan Kartripakkha, 2022)

Policy Recommendations:

1. Vendor encroachment (spatial): DSCC should demarcate formal hawker zones along the corridor with GPS-tagged permits. The current 1.46 m effective footpath width falls well below the DAP minimum, making formal zone demarcation essential to recover usable pedestrian space.
2. Vendor encroachment (temporal): DSCC should pilot scheduled vending hours, regulating footpath vending, similar to Bangkok's time-based vending model — directly targeting the peak-hour PLOS F conditions found in this study without requiring complete displacement.
3. Footpath width: New or retrofitted footpaths must meet the DAP minimum through-route width for commercial areas, with a widening feasibility study.
4. Safety and accessibility: Install CCTV at 50 m intervals, prioritizing segments rated unsafe by women respondents; add tactile paving and dropped curbs at crossings for elderly and disabled pedestrians.
5. Monitoring: RAJUK and DSCC should establish an annual pedestrian flow monitoring protocol to track PLOS trends over time.
6. Coordination: A joint DSCC–RAJUK–vendor association task force should co-design hawker zones and schedules, ensuring compliance through negotiated participation rather than unilateral enforcement.

Conclusion

This study highlights the pressing challenges to pedestrian mobility within Dhaka's Nilkhet– Science Lab corridor, where 27.85% of the footpath space is encroached by vendors, reducing the usable width to 1.86 meters and the effective walkable width to just 1.46 meters, or 55.21% of the total. These dimensions fall significantly short of the DAP's recommended through-route width, underscoring a critical shortfall in functional pedestrian space. The corridor's QoS score of 84.61 (Grade C) and average PLOS grade of E during peak hours reflect a pedestrian environment under pressure, with overcrowding, inadequate design features, and psychological discomfort affecting user experience. Demographic-sensitive findings reveal that vulnerable groups, particularly women, children, and the elderly, face disproportionately unsafe and uncomfortable walking conditions. Over 82% of respondents felt unsafe walking at night, and 71% reported poor comfort levels for children and older pedestrians. These conditions

underscore the urgent need for integrated footpath design, vendor regulation, and targeted safety interventions to ensure equitable and safe pedestrian access in Dhaka's commercial zones.

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