

From Environment to Accidents : Understanding Pedestrian Safety through Spatial Analysis in Taipei

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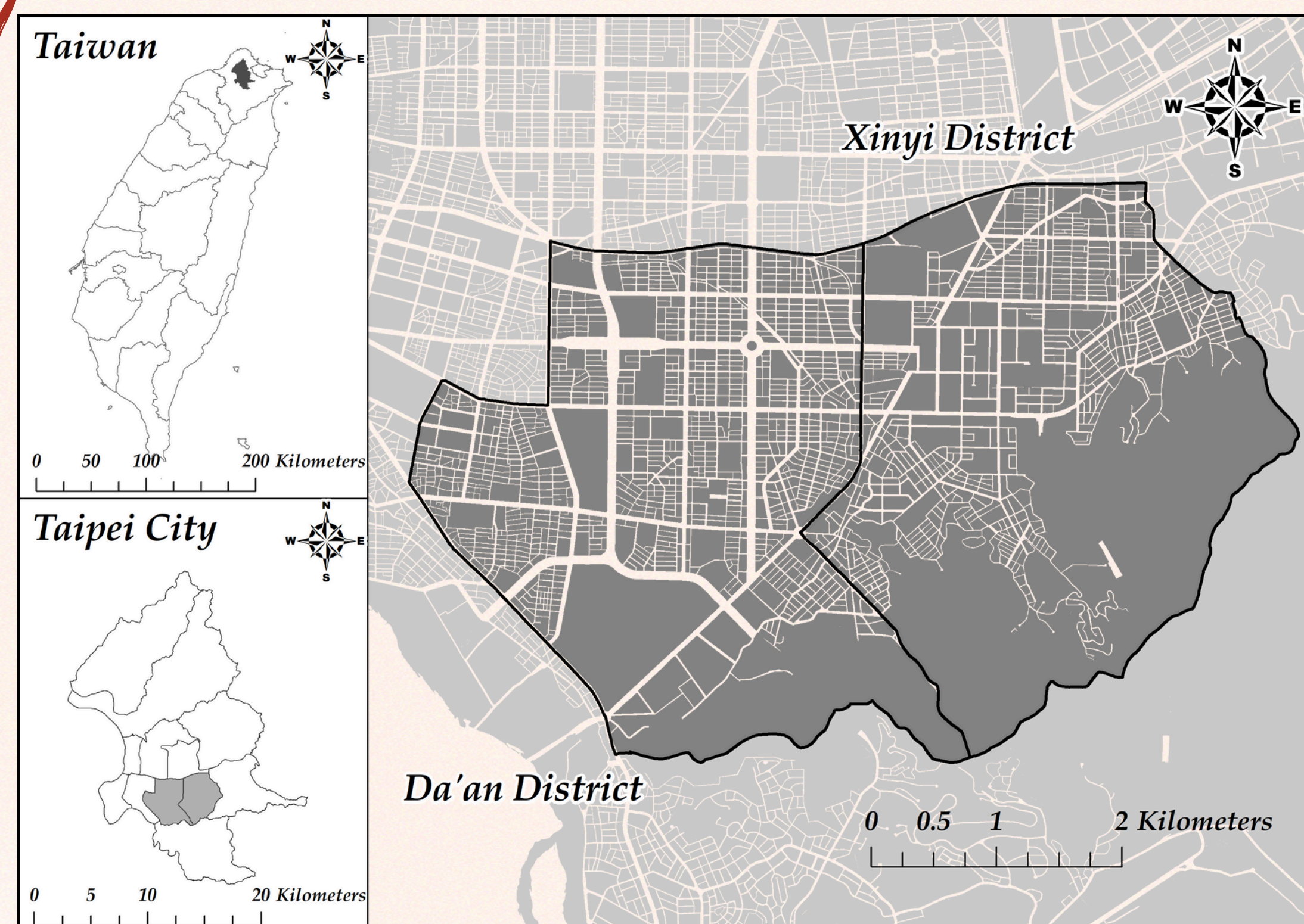


INTRODUCTION

Taiwan's walking environment is often criticized as a "living hell" due to historic vehicle-centric planning and narrow legacy roads. However, recent government priorities have shifted toward "**people-centric**" transportation to enhance pedestrian safety. To support this transition, this study integrates **spatial analysis** to examine the correlation between walking environments and pedestrian-vehicle accidents. The assessment focuses on four key dimensions: Passability, Safety, Convenience and Land Use, and Aesthetics, aiming to provide empirical evidence for sustainable and humanized urban design.

AREA OF STUDY

Da'an and Xinyi Districts in Taipei City, Taiwan

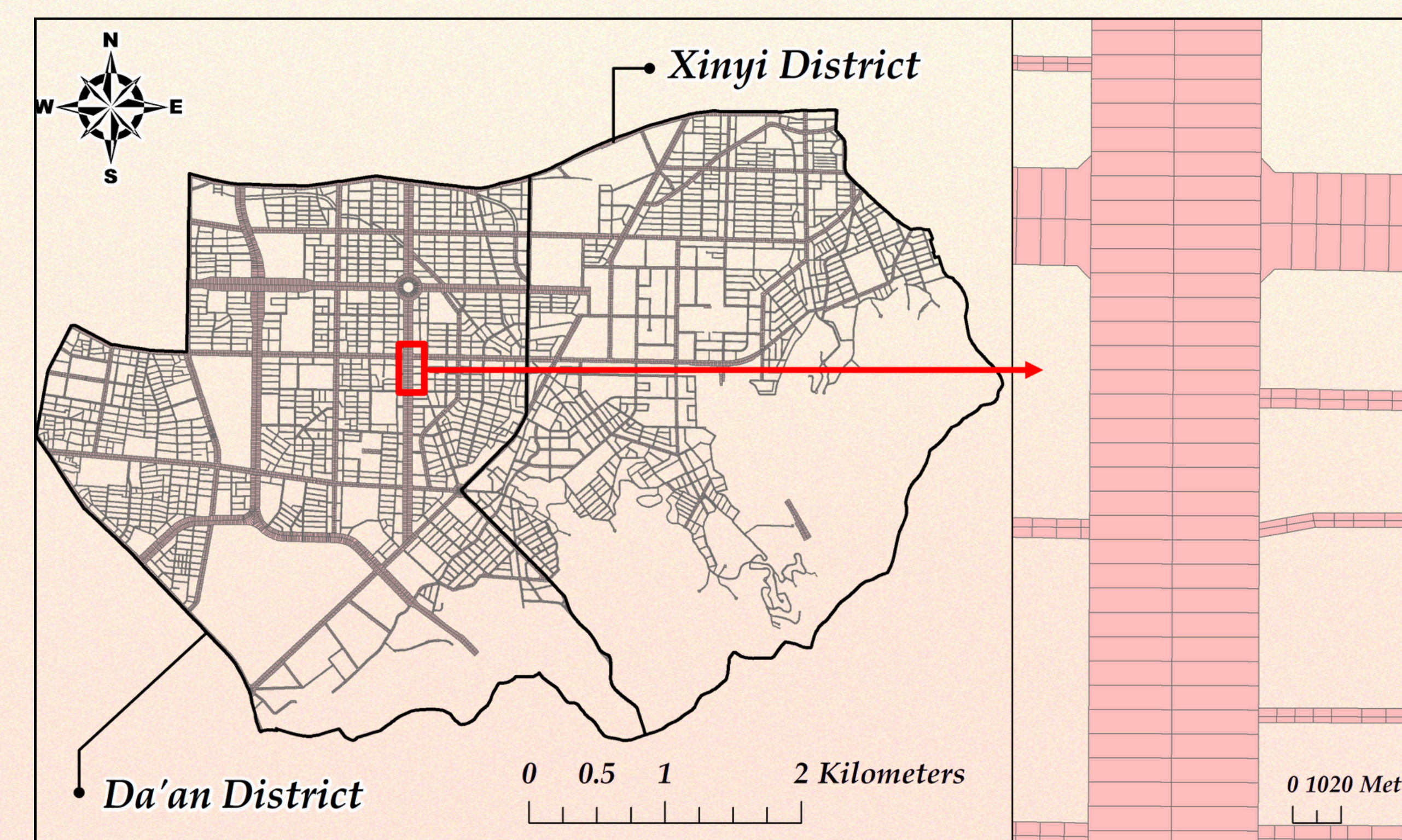


This study focuses on the Da'an and Xinyi Districts in Taipei City, Taiwan. As the **core administrative districts**, the area features **diverse land use** (residential, commercial, educational) and **high densities of pedestrian and vehicular traffic**. Its **diverse built environment** and **sufficient accident data** make it an ideal study area.

METHODOLOGY

- Definition of Spatial Units -

In this study, the spatial units were defined based on road centerlines. Roads were segmented at 10-meter intervals, with the left and right sides of each segment treated as independent units



- Construction of Walking Environment Indicators -

Drawing on literature emphasizing safety, comfort, built environment, and aesthetics, this study establishes an assessment framework comprising 15 sub-indicators across four key dimensions: Passability, Safety, Convenience & Land Use, and Aesthetics.

Dimension	Indicator
Passability	B1 Effective Sidewalk Width、 B2 Sidewalk Continuity、 B3 Road Connectivity、 B4 Sidewalk Ratio
Safety	B5 Pavement Quality、 B6 Street Lighting Level、 B7 Traffic Signal Facilities、 B8 Marked Pedestrian Lanes
Convenience and Land Use	B9 Sidewalk Connectivity、 B10 Access to Service Facilities、 B11 Land Use: Residential、 B12 Land Use: Commercial、 B13 Land Use: Mixed Residential、 B14 Availability of Resting Spaces
Aesthetics	B15 Street Trees

- Spatial Analysis Methods -

- Global Moran's I: Examines spatial autocorrelation of single variables.
- Bivariate LISA: Analyzes the spatial correlation between Dependent Variable (A): Pedestrian-Vehicle Accidents and Independent Variable (B): Walking Environment Indicators.

RESULTS

Global Moran's I & Bivariate LISA

Results show that all variables exhibit positive global spatial autocorrelation, particularly those with Global Moran's I values exceeding 0.8 (indicated in bold). Regarding the bivariate spatial association with traffic accidents (A1), indicators B1, B5, B12, and B13 display positive Mean Local Moran's I values, indicating a positive correlation. Conversely, B8 and B11 exhibit negative values, suggesting a negative spatial association.

Dimension	Code	Global Moran's I		Bivariate LISA	
		Moran's Index	p-value	Mean Local Moran's I	Significant Areas(%)
Accidents	A1	0.8641	< 0.001	-	-
Passability	B1	0.7368	< 0.001	0.092	51.34%
	B2	0.2775	< 0.001	0.038	17.80%
	B3	0.9969	< 0.001	0.002	42.82%
	B4	0.7682	< 0.001	0.000	21.08%
Safety	B5	0.8357	< 0.001	0.117	35.81%
	B6	0.6994	< 0.001	0.012	10.20%
	B7	0.9312	< 0.001	0.049	32.94%
	B8	0.8315	< 0.001	-0.039	25.57%
Convenience and Land Use	B9	0.7282	< 0.001	-0.010	40.19%
	B10	0.9752	< 0.001	0.040	25.55%
	B11	0.8547	< 0.001	-0.092	82.20%
	B12	0.8818	< 0.001	0.093	25.10%
Aesthetics	B13	0.8488	< 0.001	0.070	77.44%
	B14	0.2154	< 0.001	-0.009	99.01%
Aesthetics	B15	0.5499	< 0.001	-0.019	19.40%

CONCLUSION

- Protective Factors: **Marked Pedestrian Lanes (B8)** and **Residential Land Use (B11)** exhibit lower Mean Local Moran's I values, suggesting a potential protective effect on pedestrian safety.
- Widespread Influence: **Availability of Resting Spaces (B14)** shows an exceptionally high proportion of significant spatial clustering (**99.01%**).
- Implication: Enhancing these specific features (B8, B11, B14) serves as an effective strategy to **mitigate pedestrian-vehicle accidents**.