SUPTM 2026: 3rd Conference on Future Challenges in Sustainable Urban Planning & Territorial Management

Universidad Politécnica de Cartagena
sciforum

Proceedings

The Impact of Advertising Signage and Street Configurations on Traffic Safety

WAN-JU WU[1], CHIA-YING LU [2] and YUNG-CHUNG CHUANG

[1] Affiliation 1; luluwu0909353059@gmail.com
[2] Affiliation 2; htolah002323@gmail.com
* Correspondence: luluwu0909353059@gmail.com; Tel.:886-0909063302

Abstract: With the rapid pace of urbanization, the streetscapes of commercial districts have become increasingly complex. The dense presence of advertising signage, combined with diverse street network patterns, can potentially affect traffic safety and the overall visual quality of urban spaces. In Tainan's Central West District, where blocks are compact and intersections are frequent, the high density of commercial signage may distract drivers and increase the risk of accidents. This study aims to investigate the interplay between advertising signage and street configurations on traffic safety, with the goal of developing measurable indicators to inform future streetscape design and traffic planning.

Keywords: Advertising Signage,Street Morphology,Traffic Safety

Citation: Wu, WJ.; Lu, CY; Chuang,YC. The Impact of Advertising Signage and Street Configurations on Traffic Safety. *SUPTM 2026 conference proceedings* xx. https://doi.org/ 10.31428/xxxxx

Publisher's Note: UPCT and Sciforum stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Street configuration, as an essential component of urban space, influences not only the quality of the urban environment but also has a direct impact on traffic safety and public order. Among these elements, advertising signage has become a widely used type of streetscape feature due to the rapid growth of commercial activities. However, dense or poorly designed signage can create various problems, such as visual pollution, a sense of spatial congestion, and distractions for drivers and pedestrians, thereby increasing the potential risk of traffic accidents.

Therefore, this study examines how advertising signage and street configuration affect traffic safety. By establishing evaluation indicators and applying quantitative scoring methods, the study compares differences among various road segments and intersections within the research area. Both experts and the general public participate in the scoring process, and the results are spatially visualized to identify locations that may pose higher risks. These analytical findings serve as a basis for future improvement strategies.

2. Area of study

This study focuses on the West Central District of Tainan City as the research area, which features a complex street layout and a high density of advertising signage. The study targets the district's most commercially active sections and selects 20 representative street segments as the research road sections, along with 53 intersections formed by these segments as the research intersections. Through the three analytical dimensions of points, lines, and areas, this study examines the intersections, road segments, and road network within the research area, aiming to provide assessment indicators and recommendations regarding the impacts of advertising signage and road characteristics on traffic safety.

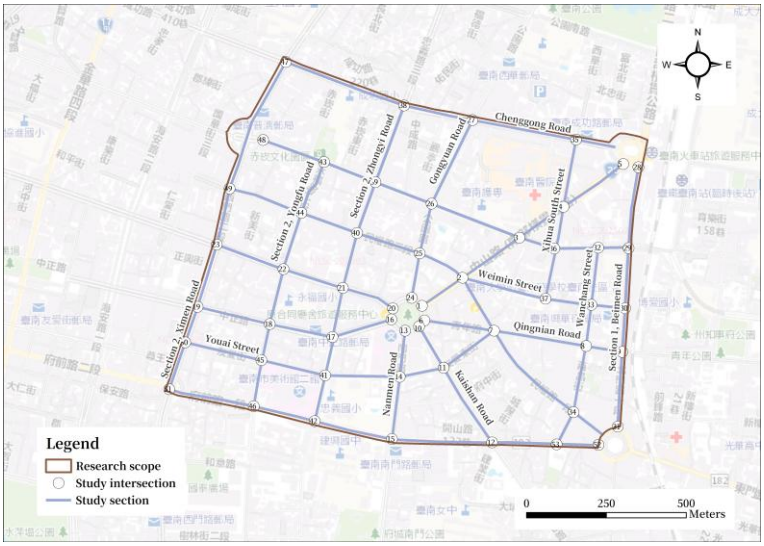

Figure 1. Area of study.

3. Methodology

Table 1. Research Process and Methods.

Steps	Research Process	Research Methods		
1	Establish Research Motivation and Objectives			
2	Define Research Area, Road Segments, and Intersections			
3	Literature Review and Theoretical Framework			
4	Data Collection	Road Network	Intersection Density	The designated road segments and intersections defined in this study are used as the basis for calculating intersection density.
			Traffic Efficiency	
		Road Segments	Signage Density	Field surveys are conducted to count the number of signs along each road segment, while ArcGIS is used to calculate the length of each segment.
			Visual Impact Ratio	Field surveys are conducted using a motorcycle dashcam, riding each road segment at 30–40 km/h and capturing one image per minute. Advertising signs are marked in red in Adobe Illustrator, and ImageJ is used to calculate their area ratio. The average value for each road segment is then used as the baseline for later analyses.
			Visual Variability	Using the images generated during the visual impact analysis, variance calculations are performed to assess the degree of variability in the distribution of advertising signage along each road segment.
			Road Markings	Field surveys are conducted to document and classify the different types of road markings.
			Road Width	ArcGIS is used to calculate the width of each research road segment.
		Intersections	Signalization Rate	Intersection signalization is classified into four types: fully signalized, time-restricted signalization, flashing yellow/red lights, and no signalization. Data from the

Steps	Research Process	Research Methods		
				"Tainan City Public Pipeline GIS – Traffic Signal System" are used to identify the signal types for each intersection.
			Accident Rate	Accident hotspot data from the "Traffic Safety Dashboard" are used to collect accident records for each intersection from 2021 to 2025, and their average value is calculated.
5	Questionnaire Survey	A questionnaire survey is conducted with experts, scholars, and the general public to obtain quantitative evaluations of each indicator, ranging from "very low impact" to "very high impact." These scores serve as reference data for the subsequent analysis.		
6	Indicator Classification and Mapping of Scores	The quantitative indicator scores provided by the researcher, experts, and the public are compiled and classified to evaluate the research area, road segments, and intersections. ArcGIS is then used to map the scoring results from each respondent group.		
7	Conclusion and Analysis	This study combines the scores from the researcher, experts, and the public, and uses ArcGIS to create total score maps for the study area, road segments, and intersections, showing the spatial distribution of overall results.		

4. Results

After integrating the evaluations from graduate students, experts, and the general public, clear differences in the distribution of risk within the study area can be observed.

For the road segments, Section 1 of Beimen Road received the highest score of 20.8, indicating that respondents generally perceived this segment as having higher potential risks, particularly in terms of signage density and visual distraction. In contrast, Nanmen Road scored only 11.6, making it the segment consistently regarded as the safest by all respondent groups. This reflects its relatively simple road environment and lower visual pressure.As for intersections, higher-risk evaluations are concentrated along Section 2 of Ximen Road, where many accidents have also occurred. Among them, the intersection of Section 1 of Beimen Road and Kaishan Road stands out with the strongest perceived risk, suggesting higher traffic volume or greater complexity at that location.

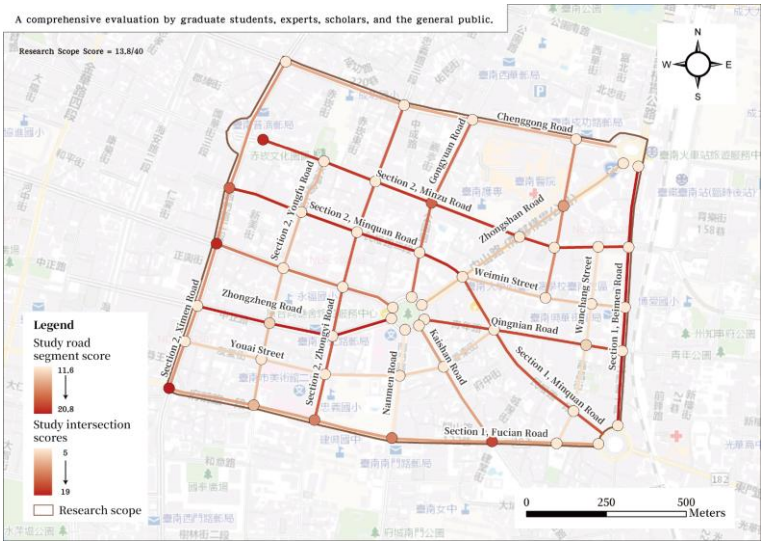

Figure 2. The combined evaluation results of graduate students, experts and scholars, and the general public.

5. Conclusions

Overall, the study area received a composite score of 13.8 out of 40. This value reflects the average of three indicator groups: road segments, road network, and intersections. Although many road segments exhibit high signage density and strong visual distraction, the overall score remains relatively low mainly because intersection scores were generally not high. This is due to the fact that the intersection indicators include signalization rate and accident occurrence. The study area has a well-developed signal system, with most intersections equipped with traffic lights, and the number of accidents in recent years is very low at most locations, with only a few intersections experiencing several cases annually.

As a result, the quantitative outcomes naturally pull down the overall risk score.In other words, the visual environment of the road segments contributes more to perceived risk, while the safety level of intersections is already relatively adequate, leading the overall score to fall within the low-to-mid range.

It is recommended that improvements prioritize road-segment-related issues, particularly signage management and road-marking enhancement. Measures may include restricting or adjusting signage density and size along high-scoring segments such as Section 1 of Beimen Road (e.g., setting setback requirements, standardizing signage height, or prohibiting certain large hanging signs) to reduce visual impact. Road-marking optimization—such as introducing clearer and more intuitive lane-separation lines—can further improve driving guidance.

For Section 2 of Ximen Road and the highest-risk intersection at Section 1 of Beimen Road and Kaishan Road, it is advisable to conduct targeted audits, including sight-line clearance checks, signal phase review, and evaluation of turning lanes and waiting spaces. Targeted measures such as signal timing adjustments may then be applied.

Finally, it is suggested that the composite scores produced in this study be used to determine improvement priorities, evaluate intervention effectiveness, and serve as a reference for further planning and maintenance.

References mdpi

1. Su, S.-H., Chen, Y.-W.Study on Drivers' Visual Perception and Preference toward Advertising Billboards and Planting Forms.Master's Thesis,Taiwan, **2006**.
2. Cheng, Y.-F.A Structural Analysis of Urban Visual Landscape Formed by Advertising Billboards: A Case Study of Taipei City.Master's Thesis, Tamkang University,Taiwan, **2008**.
3. Huang, K.-Y.; Lin, S.-T.A Study on Light Pollution from Lightbox Advertising Signs in Mixed Residential–Commercial Areas: A Case Study of Six Shopping Streets in Taiwan. JOURNAL OF ARCHITECTURE,**2014**, No. 88,35-46.
4. Yang, S.-H.; Chien, M.-C.; Yen, J.-T.; Nien, S.-M.A Study on the Evaluation of Dirty Exterior Wall Phenomena in Buildings: Hierarchical Analysis of Dirty Impacts and Trial Calculation of Dirty-Level Assessment Methods, Master's Thesis,Taiwan, **2008**.
5. Wu, Y.-J.A Study on Traffic Accident Analysis and Safety Improvement in Keelung City.Master's Thesis, National Yangming National Chiao Tung University, Taiwan, **2004**.
6. Wu, Y.; Liu, Q.; Hang, T.; Yang, Y.; Wang, Y.; Cao, L.Integrating Restorative Perception into Urban Street Planning: A Framework Using Street View Images, Deep Learning, and Space Syntax,Cities147,2024,104791.
7. Li, Y.; Yabuki, N.; Fukuda, T.Measuring Visual Walkability Perception Using Panoramic Street View Images, Virtual Reality, and Deep Learning,Sustainable Cities and Society 86,2022,104140.
8. Yang, Y.; Wang, Q.; Wu, D.; Hang, T.; Ding, H.; Wu, Y.; Liu, Q.Constructing Child-Friendly Cities: Comprehensive evaluation of street-levelchild-friendliness using the method of empathy-based stories, street viewimages, and deep learning, ,Cities154,2024,105385.