ISSN 2717-4638

Study on the Quality of Walkable Streets in Dhapakhel Neighborhood, Lalitpur District, Nepal

Ganga Sagar Bhatt[1*], Kishan Datta Bhatta[2], Janardan Joshi[1]
[1]School of Engineering, Far Western University, Nepal
[2]Faculty of Engineering, Far Western University, Nepal
*Corresponding Author, Email: gsbhatt011@gmail.com

Abstract

Streets are vital public spaces that shape urban life and mobility, with sidewalks serving as essential yet often neglected pedestrian zones. Despite their importance, pedestrian facilities in many Nepali cities remain poorly designed and undervalued. This study examines the condition of streets in Dhapakhel, Lalitpur, emphasizing the need for pedestrian-friendly urban environments. Using field observation, spatial analysis, photographic documentation, and user surveys, the research evaluates accessibility, safety, and comfort for pedestrians. Findings reveal inadequate pedestrian infrastructure, obstructed walkways, and lack of supportive amenities. The study recommends adopting human-centered street design and implementing effective policies to create safer, more inclusive, and pedestrian-friendly urban environments.

Keywords: *Pedestrian Facilities, Sidewalk, Urban Sprawl, Urban Street Design, Walkability*

Introduction

An urban street refers to a public street or highway that typically includes a paved surface, curbs, piped storm sewer systems, sidewalks, street trees, and street lights. Streets constitute more than 80% of public space in cities, but despite this vast coverage, they often fail to provide communities with spaces where people can safely walk, cycle, drive, use public transport, and socialize. In urban street design, pedestrian spaces were long treated as unimportant, given only minor roles in movement and social life. However, in recent years, more people have become interested in walking and making streets better (Gehl, 2010; Mouratidis, 2021). Designing pedestrian facilities presents the challenge of accommodating two primary functions simultaneously. The first is the movement function, which ensures pedestrians can move safely and comfortably from one point to another. The second is the place function, which allows users to rest, communicate, shop, eat, and enjoy life within a pleasant street environment (Gehl, 2010; Mouratidis, 2021). The quality of urban life depends heavily on how well these functions are integrated into urban street design.

Kathmandu Valley, with an estimated population of 2.54 million, is one of the fastest-growing metropolitan areas in South Asia. The valley's urban population is growing at an annual rate of 6.5% (UN-Habitat, 2015). This rapid, mostly unplanned, and haphazard urbanization has deteriorated the urban environment, increased levels of urban poverty, and increased susceptibility to many risks, including earthquakes (MoUD, 2017). Unchecked urban sprawl has covered large portions of agricultural land, creating not only environmental but also social and infrastructural challenges. Government initiatives are currently attempting to control urban sprawl and direct growth through strategies such as satellite cities, smart city projects, the outer ring road, and the Kathmandu–Terai fast-track. The National Urban Policy of 2007 acknowledges that "Kathmandu-centric urbanization is a major cause for the imbalance in national urban structures" (MoPPW/DUDBC, 2007, p. 1). The valley's original urban cores were compact communities with small streets, but they are almost nonexistent in newly growing metropolitan districts. Instead, new communities frequently see ribbon development along highways. While smaller cities may have a single core, metropolitan centers develop multiple cores. Expansion trends typically radiate outward from central areas toward the periphery, spreading along connector roads branching from highways (MoUD, 2017).

A consistent demographic shift is also visible. Residents of the traditional core are relocating to the periphery, often settling in detached, single-family residential units. The reasons for this transfer vary: in some situations, properties in the core are sold due to family separation, while in others, they are rented or sold because of the high economic value of central districts. Many middle-class families prefer detached housing in less congested areas, leading to rapid suburbanization and conversion of

agricultural land for real estate projects. While some residents retain property in the core for rental income, most prefer to move to the periphery. Unfortunately, this expansion is often irregular, and essential services such as waste management and clean water supply remain limited in these new residential areas (MoUD, 2017).

Dhapakhel is a transitional zone in the Kathmandu Valley, located between the traditional urban core of Lalitpur and its surrounding agricultural hinterlands. Over recent years, it has undergone rapid transformation from farmland to residential land, often in an unplanned and fragmented manner. This area reflects the broader phenomenon of urban sprawl, with changing land use patterns and a shift from rural to urban characteristics.

Objective

To examine the current street network and pedestrian infrastructure in Dhapakhel, Lalitpur, and identify deficiencies in walkability, accessibility, safety, and related facilities such as sidewalks, footpaths, and crossings.

Study Area

For the selection of the study area, the urban structure of Lalitpur City was first analyzed. The core area of Lalitpur and its satellite developments were also examined.It was found that there were many new settlements around the outskirts of Lalitpur core area, all of which were found to have urban sprawl characteristics. Then five settlements nearest to the core city were selected which were Bhaisepati, Nakhipot, Dhapakhel, Harisiddhi and Imadol. From this settlements Dhapakhel was selected as the study area for this article. The neighborhood for the study is highlighted by green colour in figure 1. The major collector roads associated with the study area were analyzed. The local street structure was analyzed. It was found that the neighborhood was mostly compromised to low-density, single family dwellings. There was a high dependency on automobiles even for short trips. The pattern of development was found to be dispersed and haphazard. The development was found to be in a strip along historical agricultural rural streets. Due to the urbanization of previous agricultural land there was an undefined edge between urban and rural areas as there were still settlements remaining which had rural and vernacular characteristics which ethnically comprised local Maharjans. The local streets and urban structure were found to have a lack of identity, a lack of character, unsustainable development and visually unattractive.

Research Methodology

The research methodology is mainly based on the qualitative research type. It includes the in-depth interviews with stakeholders and observations of the components related to the road and supporting infrastructure. The researcher first visited the study area and examined the street layout, its amenities, and infrastructure. The physical properties of the site were studied. Then an interview with the local stakeholder, Chairman of Tole Sudar Samiti. During the interview many topics were discussed related to the history of the neighborhood, structure of the local community and its development process, state of the local infrastructure, maintenance of the infrastructure. Besides other factors like political issues of the local area, the cooperation between the local community, ward and municipalities were also discussed. Other specific topics like drainage system management, land use process, control of heavy vehicle, road width and maintenance were also discussed. Through this interview it was found that the local community was involved in some maintenance work of the local streets and also acted as the voice of the local people to collaborate with the governing bodies. Next the local government authorities from the Ward office were interviewed. The chairman of Ward-23 and the Ward Engineer were interviewed. Topics regarding local byelaws, setbacks, road widening, etc were discussed. Budget allocation and usage were also discussed. It was found that 60%, approximately four crore rupees were allocated every year for the ward for Infrastructure development. Diverse topics like conservation of temples, drinking water, sewage problem and real estate development were discussed. The researcher then asked about more relevant topics related to this article which are the state of the streets and the urban structure, encroachment of agricultural land, control of urban sprawl and haphazard development, lack of public open spaces etc. It was found from this interview that

there were no guiding policies and guidelines regarding control of urban sprawl, distribution of open spaces and greenery spaces, vitality of the local streets and future plans for more sustainable development. Then the researcher studied the available data, maps and studied relevant articles and literature regarding the topics and further analysis were made.

Literature Review

International best practices, such as the Chula Vista Pedestrian Design Guidelines, highlight the importance of designing streets to encourage walking by providing safe, comfortable, and appealing experiences (City of Chula Vista, 2005). These standards emphasize that sidewalks, walkways, and crossings must be safe and built to avoid conflicts with automobile traffic, noise, and architectural barriers. They must also be widely accessible, catering to people of all ages and abilities.

A well-connected pedestrian network is essential for connecting residences, schools, shopping centers, public services, recreational places, and transportation hubs. To minimize delays, sidewalks and crossings should provide direct, uninterrupted routes. Additionally, the pedestrian environment should foster a strong sense of place through the integration of plazas, courtyards, building facades, seating, art, greenery, and historical references. Importantly, commercial activities such as dining and vending can be allowed, provided they do not compromise pedestrian safety and accessibility. Sidewalk corridors are the most important component of pedestrian circulation, and they are determined by available roadway width, motor vehicle traffic, neighboring land uses, and pedestrian activity levels. Chula Vista's guidelines divide sidewalk corridors into distinct zones: curb, furnishing, through pedestrian, and frontage (City of Chula Vista, 2005). The curb zone keeps runoff from encroaching on pedestrian areas and discourages automobiles from crossing them.

Straight curbs are recommended over rolled curbs to prevent cars from obstructing sidewalks. The furnishing zone accommodates public utilities, signage, and street trees. This buffer separates pedestrians from traffic and enhances safety. For tree-lined roadways, furnishing zones should be at least four feet wide, preferably six to eight feet. The through pedestrian zone is the unobstructed area for safe pedestrian travel. Its minimum clear width should be four feet, though commercial and school zones may require wider corridors. This space must remain free of obstructions. The frontage zone, located between the through pedestrian zone and property lines, allows space between pedestrians and adjacent buildings or fences. A minimum of 12 inches is required, however in residential areas with open landscapes, the frontage zone may be removed.

Residential Settings

Although residential sidewalks are typically narrower than commercial sidewalks, the through pedestrian zone should always be prioritized. Sidewalks should have a minimum width of five feet. When sidewalks fall short of this width, the frontage zone may be sacrificed in order to maintain safe pedestrian mobility (U.S. Access Board, 2005). A through passage should be at least 48 inches wide, but it can be 44 inches wide if there are vertical obstacles. Sidewalks must be well-maintained, without cracks or debris. To ensure accessibility, a cross slope of no more than 2% is recommended. This consideration is particularly significant for wheelchair users and individuals with mobility impairments (FHWA, 2010).

Curb Ramps

Curb ramps are vital for wheelchair users and others who need step-free access between sidewalks and crosswalks. Two common types are perpendicular curb ramps and diagonal curb ramps. Perpendicular ramps are preferred because they align directly with crosswalks and reduce pedestrian travel distances. They should be 48 inches or more in width. (FHWA, 2010). Diagonal ramps require less space and cost less but often force users to travel longer, less direct paths, exposing them to more traffic risks. Street lighting enhances safety by deterring criminal activity and encouraging nighttime use of pedestrian spaces. Low-height, frequent lighting is preferred over tall, widely spaced lights. Lighting design can also reinforce neighborhood identity or preserve historic character (City of Chula Vista, 2005). Bicycle parking helps people use different modes of transport. It should be placed away

ISSN 2717-4638

from main walking paths, alongside sidewalks in narrow areas or at a right angle in wider streets. Properly integrated bicycle facilities encourage cycling over short trips that might otherwise rely on private vehicles. Crosswalks legally extend walkways across highways, making them essential for pedestrian safety. They exist at all crossroads, whether marked or unmarked, unless specifically forbidden. Crosswalk markings help guide pedestrian paths and alert motorists to potential crossings. Standard transverse markings are suitable for low-volume, controlled intersections, while ladder or zebra crossings are preferable in high-volume areas, particularly near schools and mid-block crossings (California MUTCD, 2014). High-visibility crosswalks should be used in school zones, marked with yellow stripes instead of white. Curb extensions, pedestrian refuge islands, and raised crosswalks are some other characteristics that improve visibility and shorten crossing distances (FHWA, 2010).

Warning and school zone signage play a vital role in pedestrian safety. Warning signs may be integrated into existing posts to reduce confusion, while in-pavement paddles can be used at uncontrolled intersections. In school zones, fluorescent yellow-green signs are recommended to enhance visibility (Califo rnia MUTCD, 2014).

Observation and analysis

Road Types

The road network in the area is primarily composed of two types of roads: the Main Collector Road and the Local Street Road. The Main Collector Road has an average width of 11 meters and is designed to accommodate higher activity levels with features such as commercial sub-zoning for adjacent parcels, availability of bus transit, a 2-meter setback from the road edge, a 1.5-meter-wide footpath, and a two-sided slope for effective drainage. In contrast, the Local Street Road is narrower, with a width of about 4 meters, and functions as a shared street space. These roads typically have a 1.5-meter setback from the road edge, a 1-meter right-of-way, and lack dedicated footpaths in most sections. Drainage on local streets is managed through a one-sided slope, reflecting their smaller scale and primarily residential or low-traffic character.

Fig 1: Local street

Land Use

In the figure 2, the areas highlighted in red indicate the residential zone, which constitutes the largest portion of the study area. This residential zone is predominantly occupied by housing developments such as Civil Homes and several downtown apartment complexes, both of which represent privately developed, high-density residential patterns. These developments not only provide accommodation for a large share of the local population but also illustrate the growing trend of compact urban living in the area. In contrast, the areas shown in purple correspond to the commercial sub-zone, which has

primarily evolved along the two major collector roads. This commercial strip accommodates various shops, services, and business establishments, creating a functional corridor that supports both the surrounding residential communities and the broader flow of people and goods across the locality. Together, these zones highlight the mixed-use character of the study area, where residential and commercial activities coexist and shape the urban fabric.

Walkability

A closer examination of walkability in the study area indicated that the street network evolved in an irregular pattern, lacking systematic planning or policies. Due to the randomness of the street layout, simple direction through streets was found to be very hard for someone new to the area and only possible for local inhabitants. Although certain places appeared close in distance, they were less walkable because the streets lacked direct connections, making the actual travel distance much longer.

Transit Network

The transit network of the study area was also analyzed. It was observed that the transit network is inadequate to cater for the growing population of the area. The street design and urban topography is rather provided to private vehicle usage. For the locals it is much safer, and easier to use private vehicles than to use public transportation or walk. There was a dead Zone for pedestrians between Core area and Neighborhood as seen in figure 5, the road that is of 2.5km length highlighted in the diagram shown to be not walkable, and heavily favor usage of vehicles. Also due to availability of only two collector roads there was a obstacle effect at key intersections during peak traffic hours. Beside this there were also inadequate public transit to cater to the local passengers as only bus service was available in the main collector roads.

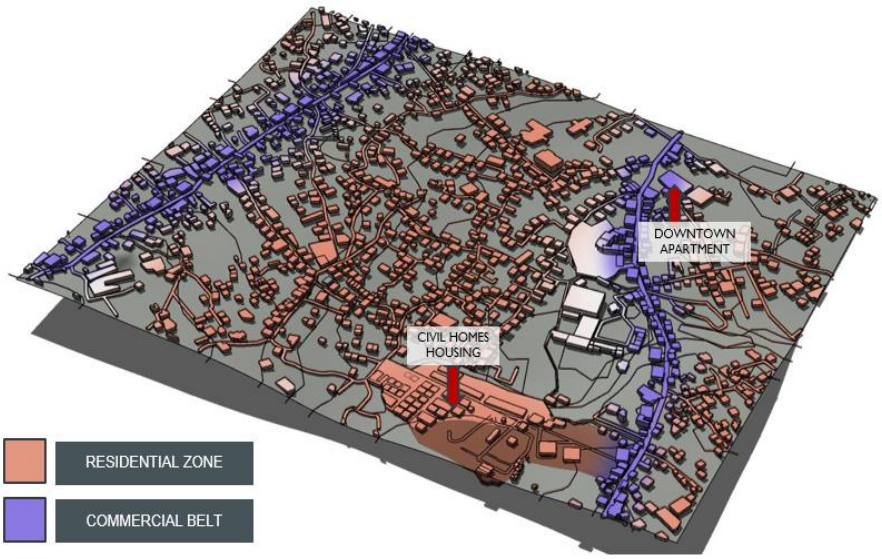

Fig 2: Land use in Dhapakhel area

Fig 3: Road network in dhapakhel area

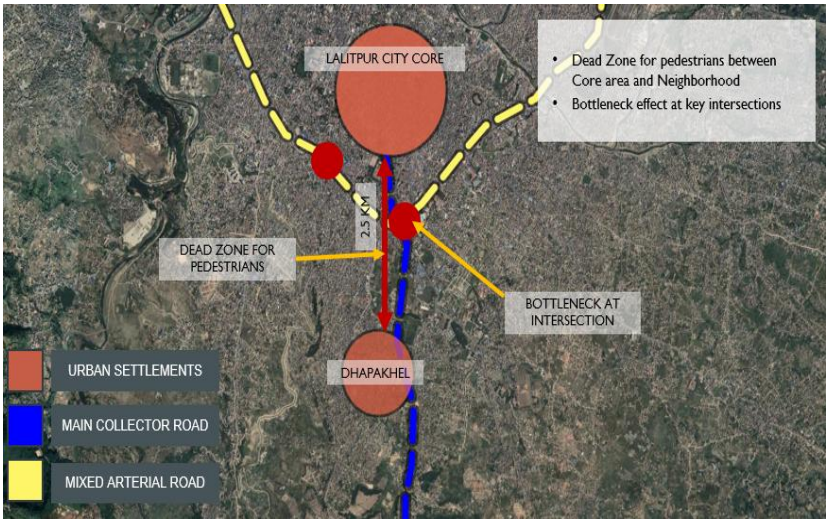

Fig 4: Transit network

Footpaths

A comprehensive analysis of the footpaths in the study area revealed multiple deficiencies in their design and construction. Many footpaths were found to be poorly constructed, with uneven surfaces and structural issues that hinder pedestrian movement. In addition, the width of several footpaths was insufficient to accommodate pedestrian flow comfortably, particularly during peak hours. Greenery, street furniture, and other infrastructure elements often encroached upon the walking space, further limiting usability. Moreover, a significant number of footpaths were not designed to be accessible for people with disabilities, lacking ramps, tactile indicators, and other necessary features.These findings underscore the urgent need for a holistic redesign of the pedestrian network, prioritizing safety, accessibility, and overall functionality for all users.

Availability of Amenities

An inspection of the available amenities revealed several shortcomings that directly affect the comfort, safety, and overall convenience of pedestrians in the area. It was observed that there is a lack of adequate seating arrangements and shaded spots, which makes it difficult for people, especially the elderly, children, or those with mobility challenges, to rest or find relief during hot or harsh weather conditions. The situation is further aggravated by a poorly designed and insufficient drainage system, which not only leads to frequent waterlogging during rainfall but also creates unhygienic and slippery conditions that pose health and safety risks. In addition, the absence of essential public facilities such

ISSN 2717-4638

as toilets and dustbins significantly reduces the usability of the space, forcing residents and visitors to deal with inconvenience while simultaneously contributing to littering, open dumping, and overall environmental degradation. Collectively, these issues underline not just minor flaws but a fundamental gap in basic urban infrastructure, making it clear that immediate attention and improvement are necessary. Strengthening these facilities would not only support a cleaner and healthier environment but also encourage walking, social interaction, and the creation of a more vibrant and pedestrian-friendly urban space.

Fig 5: Narrow footpath

Fig 6: Electric pole in the middle of footpath

Comfort and Safety Analysis

It was observed that there was a high level of noise near the main collector road due to high movement of vehicles on these roads. The local residential areas were found to have lower levels of noise due to low movement of vehicles. The local streets were used as shared open space and were also used by the local people and children for leisure activities as there were no open spaces for community use.

Alternative course of action

Local streets within residential neighborhoods are often underutilized as spaces for play, leisure, and community interaction. These streets should be designed to provide safe and welcoming environments for walking, with direct access to nearby shops, schools, and other local amenities. The inclusion of speed-control measures, such as traffic calming devices, can help regulate vehicle speeds and create more pedestrian-friendly streets. Additionally, cities should collaborate closely with local agencies to ensure regular street maintenance and upkeep. Clear signage should be installed to inform and guide both pedestrians and drivers, promoting safety and enhancing the overall street experience.

Conclusions and Recommendations

Safe and accessible pedestrian infrastructure is extremely important to improve the mobility system of cities. There are no comprehensive policies, plans and infrastructure development programs that ensure the pedestrian's right for safe and easy mobility. Focusing on vehicular mobility while ignoring the needs of pedestrians achieves the opposite of development. Integrated road design that includes standard footpaths, cycling lanes and dedicated public transit routes is more sustainable. It is important to change the trend towards focusing on pedestrian mobility rather than vehicular mobility. This will cause an increase in traffic congestion and also increases in air and noise pollution. The Dhapakhel area can be improved as a pedestrian friendly street only if the strict policy is made and implemented prioritizing pedestrians first and vehicles second. There is also the need for Improvement of infrastructures as the streets are not pedestrian friendly enough and can be improved a lot. As for the new development projects, urban planning, the authorities are recommend to plan as per compact planning. Building a compact city which is more connected and inclusive is far better than the urban sprawl that is continuing in the Dhapakhel area. It will emphasize streets for pedestrians and control the city within. The layout and accessibility of the city should be changed into integrated and inclusive neighborhood planning. This will encourage "Higher Density Multi Family Housing" which will solve the problem of land for housing and population growth. It will also incorporate the Community Open Space/Greenery Parks in the Neighborhood Center of the Dhapakhel area. Improved street networks make areas more walkable and pedestrian-oriented, simultaneously enhancing the physical health and well-being of residents. Another good trend of Compact Development will bring the neighborhood close and healthy and also put all the infrastructures within walking distance within the city.

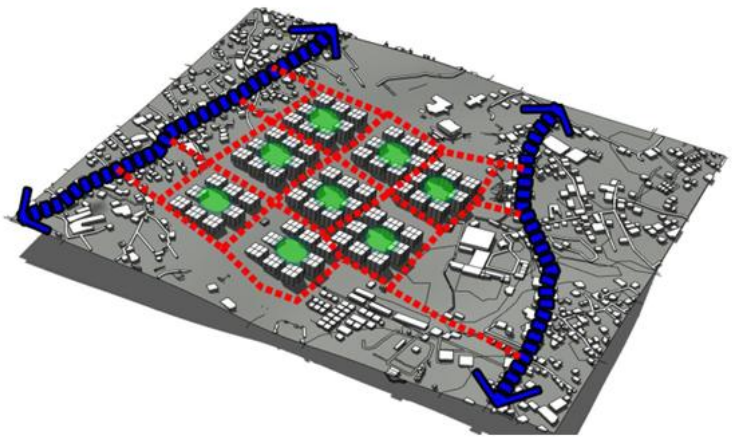

Fig 7: Illustration of Dhapakhel area with compact settlement

Conflict of interest

Author declares no conflict of interest.

References

California Manual on Uniform Traffic Control Devices (MUTCD). (2014). *California MUTCD, 2014 edition*. California Department of Transportation.

City of Chula Vista. (2005). *Pedestrian Master Plan and Design Guidelines*. Chula Vista, CA.

Federal Highway Administration (FHWA). (2010). *Accessible Public Rights-of-Way: Planning and Design for Alterations*. Washington, DC.

Gehl, J. (2010). *Cities for People*. Island Press.

Global Designing Cities Initiative. (n.d.). *Design guidance: Sidewalks*. In *Global Street Design Guide*. Retrieved September 4, 2025, from https://globaldesigningcities.org/publication/global-street-design-guide/designing-streets-people/designing-for-pedestrians/sidewalks/design-guidance/

Haack, B., & Rafter, A. (2006). Urban growth analysis and modeling in the Kathmandu Valley, Nepal. *Habitat International*, 30(2), 412–420. https://doi.org/10.1016/j.habitatint.2004.12.002

Hossain, A., Sun, X., Thapa, R., & Codjoe, J. (2022). Applying association rules mining to investigate pedestrian fatal and injury crash patterns under different lighting conditions. *arXiv*. https://arxiv.org/abs/2211.03187

Intelligent street lighting. (2025, August). In *Wikipedia*. Retrieved September 4, 2025, from https://en.wikipedia.org/wiki/Intelligent_street_lighting

Karna, B. K., Mandal, U. K., & Bhardwaj, A. (2013). Urban sprawl modeling using RS and GIS technique in Kirtipur Municipality. *Nepalese Journal on Geoinformatics*, 12, 50–56. https://doi.org/10.3126/njg.v12i0.9073

Liu, S., Higgs, C., Arundel, J., Boeing, G., Cerdera, N., Moctezuma, D., Cerin, E., Adlakha, D., Lowe, M., & Giles-Corti, B. (2021). A generalized framework for measuring pedestrian accessibility around the world using open data. *arXiv*. https://arxiv.org/abs/2105.08814

Living street. (2025, July). In *Wikipedia*. Retrieved September 4, 2025, from https://en.wikipedia.org/wiki/Living_street

Ministry of Physical Planning and Works, Department of Urban Development and Building Construction (MoPPW/DUDBC). (2007). *National Urban Policy 2007*. Government of Nepal.

Ministry of Urban Development (MoUD). (2017). *National Urban Development Strategy 2017*. Government of Nepal.

Mouratidis, K. (2021). Urban planning and quality of life: A review of pathways linking the built environment to subjective well-being. Cities, 115, 103229.

National Academies of Sciences, Engineering, and Medicine. (2022). *Design guide for low-speed multimodal roadways*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25248

National Association of City Transportation Officials (NACTO). (2013). *Urban street design guide: Sidewalk design*. Retrieved September 4, 2025, from https://nacto.org/publication/urban-street-design-guide/street-design-elements/sidewalks/sidewalk-design/

National Complete Streets Coalition. (2010). *Complete Streets policy FAQ*. Retrieved September 4, 2025, from https://en.wikipedia.org/wiki/Complete_streets

Pantha, K., Aryal, B., & Shrestha, A. (2022). Urban climate change in populated Kathmandu Valley, Nepal: A case study. *Himalayan Review*, 45(1), 41–55. https://doi.org/10.3126/hr.v45i1.68172

Poudel, K. P. (2012). Urban sprawl and socioeconomic change in the Kathmandu Valley, Nepal. In A. K. Dutt, V. Wadhwa, B. Thakur, & F. J. Costa (Eds.), *Facets of Social Geography* (pp. 236–251). Cambridge University Press. https://doi.org/10.1017/UPO9788175969360.015

Rimal, B., Zhang, L., Kunwar, R., & Zhai, Y. (2017). Monitoring urban growth and the Nepal Earthquake 2015 for sustainability of Kathmandu Valley, Nepal. *Land*, 6(2), 42. https://doi.org/10.3390/land6020042

Shrestha, M., Ishtiaque, A., & Chhetri, N. (2018). Rapid urban growth in the Kathmandu Valley, Nepal: Monitoring land use and land-cover dynamics of a Himalayan city with Landsat imageries. *Environments*, 5(4), 72. https://doi.org/10.3390/environments5040072

Traffic calming. (2025, August). In *Wikipedia*. Retrieved September 4, 2025, from https://en.wikipedia.org/wiki/Traffic_calming

UN-Habitat. (2015). *The state of Asian and Pacific cities 2015: Urban transformations*. United Nations Human Settlements Programme.

U.S. Access Board. (2005). *Revised Draft Guidelines for Accessible Public Rights-of-Way*. Washington, DC.