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Improvement of Walkability in CBD Area of Bathinda City

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Abstract
The concept of walkability is increasingly recognized as a critical component in urban planning, influencing not only the quality of life for residents but also the economic vitality of city centers. In the Central Business District (CBD) of Bathinda, a vibrant and growing hub, improving walkability can significantly enhance both the attractiveness and functionality of the area. Walkability refers to how friendly an area is to walking, encompassing factors such as pedestrian infrastructure, safety, accessibility, and overall environment. In Bathinda's CBD, the need for enhanced walkability is becoming more apparent as the city experiences growth and urbanization. Despite its economic significance, the current pedestrian infrastructure and urban design may not fully support the needs of residents and visitors, potentially limiting the area's potential for economic development and reducing quality of life. This project aims to address these challenges by evaluating and improving the walkability within Bathinda's CBD. Through a comprehensive analysis of existing conditions and the implementation of strategic improvements, we seek to create a more pedestrian-friendly environment. This initiative not only aims to boost the economic vitality of the CBD but also to foster a more inclusive and sustainable urban space that enhances the overall experience for all users.

Keywords: walkability, Infrastructure, Traffic volume study, sidewalks, planning, services,

Introduction (Heading 1)

The first street to be " walkability " appears to have happened "around 1929" in Essen, Germany. walkability is a step toward more environmentally friendly modes of transportation. Every year on September 2, "Car Free Day" is observed. This event is recognized as a powerful tool for promoting car-free streets and pedestrian "malls" around the world. walkability is thought to be a successful strategy for bringing the commercial district's lost life and charm back.

Walking was the main form of transportation before the invention of the automobile, but as cities have grown, so too have the distances between homes and workplaces. The car has emerged as the preferred means of transportation. Even though walking is the most affordable, straightforward, and popular form of transportation, pedestrian-related infrastructure is still underdeveloped. However, the amount of non-motorized traffic is also rising in the current situation. A third of the 200 million people in the workforce commute on foot **(Registrar General of India, 2016).** Sidewalks are an essential public resource for children and older adults who are unable to drive, as they allow them to engage with people their own age and stay active.

Because there are insufficient facilities for pedestrians, there is a high risk of pedestrian fatalities. Delhi has a fatality rate of 45% and Mumbai has a fatality rate of 40% for pedestrians. (**Annual Report on Traffic Accidents Prepared by Delhi and Mumbai Traffic Police).** Every year, about 4 lakh pedestrians in India are struck by cars, resulting in about 10,000 fatalities. Research Institute on Central Road, 2012). In India, pedestrian-related features like crosswalks, pedestrian signals, and signage are found on fewer than 30% of urban roads. Policies and strategies related to traffic and transportation in urban India, MoUD). The Global Walkability Index method has been used to calculate the walkability index of thirty Indian cities. However, due to a dearth of safety and policy support, Bathinda City has the lowest walkability index of any North Indian city, at just 31, after Shimla. India's Chandigarh (Walk score: 92) was dubbed a "walker's paradise." Engineering and Technology International Research Journal, 2017. Bathinda has been selected for this research topic because it offers pedestrian facilities with suitable design in its core and commercial area. The research topic is Planning Strategies for Bathinda City's Core Area.

LITERATURE SURVEY

Economic	Social	Environment
Improved accessibility Particularly for non-drivers. Reduces external transportation costs.	Increases social interactions and fitness is a bonus.	Reduced energy consumption and pollution emissions
Minimized conflict points with vehicles.	Improved opportunities to preserve cultural resources (historic buildings)	Improved aesthetics.
Increase local business activity and employment.	High rates of walking and cycling.	They enhance liveliness of urban environment
Health cost saving from improved exercise.	Improved accessibility for people who are transport disadvantaged.	Less air pollution. Better for health of shopkeepers and shoppers

Environmental benefits

Bicycling and walking are the two major non-fuel-consuming, non-polluting forms of transportation. They enable the society to reduce consumption of fossil fuels and the associated pollution and other environmental damage **(U.S. Department of Transportation, 1993).**

Transportation benefits

More than half the trips less than 5 km that could be commuted through walking or cycling are made by car. Walking is an easier mode of travel and it would gradually reduce the traffic congestion on the streets, when more people adopt walking.

Economic Benefits

1. Walking is an affordable form of transport. Vehicle ownership is expensive and consumes a large part of the income. Waling would result in reduces consumption of fuel. This would lead to savings and reduced energy dependence as urban transport consumes some 30% of fuel consumption.

2. Walking would also subsequently affect the health expenses and reduce them in the long run **(walking info. org, 2010).**

Social benefits

1. Walking can be done by people from all age-groups and genders.
2. Walking helps in maintaining the spiritual and mental well-being of people.

Quality of life benefits

Increased vehicular traffic has reduced the quality of life on the streets. Walking helps in instilling back the lost vibrant character of streets, where people can meet, socialize, interact and appreciate the overall urban environment.

Visual benefits

1. It is on foot that one can observe people's faces and expressions, observe the visual environment around in detail, which is not possible when one is driving. Eyes respond well when one walks through light, darkness, shadows and changes in color **(Watson. 2003).**
2. The use of walking space is an experience by itself, through the application of well-planned sensory gradients of colors, light, sound, surface texture, ground slope and other interested features **(Pawan Kumar, 2009).**

Pedestrian characteristics

Four important walking characteristics namely, walking speed, walking space requirements, pedestrian volume and the comfortable walking distances need to be studied to help in pedestrian planning and design in cities and these are discussed below.

Pedestrian Space requirements

A walking forms a simplified body ellipse of 50cm X 60cm for standing areas occupying in area of only 0.3 sq.m. A body buffer zone of 0.75 sq.m. For walking is recommended **(N. Rouphail, 2005).** In contrast, a bicycle occupies 1-1.2 sq.m. A two-wheeler occupies 1.25 sq.m. and a car occupies 13.75 sq.m. Space.

Pedestrian Walking Speeds

Walking speeds have been found to vary over a wide range depending on personal physical condition, age and gender, including such factors as trip purpose, environmental conditions, and traffic density. Normal walking speeds unrestrained by pedestrian crowding vary between 46m/min. to 107m/min. with an average of 82m/min. **(Watson. 2003).** A male walks at an average speed of 80m/min. and the average walking speed of a female is 77m/min. The walking speed of elderly people reduces to 60m/min.

Pedestrian Volume

walking volume, or the number of persons passing a given point in a unit of time, is the most important walkway design parameter. The maximum average peak flow volumes range from 23-26 persons per foot of walkway width per minute (PFM) **(J.Fruin, Planning and Design for Pedestrians, 2003).**

Concept of Streets

Streets rank amongst the most valuable assets of a city besides being the most important public spaces **(Shreya Gadepalli, ET. All, 2010).** The street and the square remain the main elements of the city and its centre the street is the place of passage and the square is the point of rest and as far as possible both should be given over to pedestrian movement **(Epstein, 1995).** Streets are not merely conduits of traffic, the comprise of well-designed pedestrian facilities and have a vibrant character. Streets are places where one meets different people from different socio-economic backgrounds and various walks of life. It is a very basic public space and a part of what is called as the urban realm. Streets define cities; they have individual characters and qualities and are distinguishable from each other **(Commission of Architecture and Built Environment, 2001),** its main functions are-

a) Circulation for vehicles as well as pedestrians.
b) Access to buildings and the provision of light and ventilation for the buildings.
c) A route for utilities.
d) Storage space especially for vehicles.
e) Public space for interaction.

Residential Street. The recommended width for various zones, especially in a commercial node must be

a) Curd Zone -0.15m minimum
b) Furniture Zone -0.9m to 2.5m
c) Walking Zone -1.8 to 2m
d) Frontage Zone -0.9m minimum

Cities like Copenhagen, Munich and Manhattan have very wide sidewalks to accommodate large number of pedestrians

Summary of standards suggested under IRC (Indian Road Congress) code

<table>
<tr><th>Sr. no.</th><th>Name of Component/Facility</th><th>Description</th></tr>
<tr><td>1.</td><td>Sidewalks</td><td>Minimum width must be 1.5m, though it is related with pedestrian flows.
Capacity of persons vs. width of sidewalk as prescribed in Indian Road Congress Manual
<table>
<tr><th rowspan="2">Width of sidewalk (in meters)</th><th>Capacity in number of perons per hour</th><th></th></tr>
<tr><th>All in one direction</th><th>In both directions</th></tr>
<tr><td>1.5 m</td><td>1200</td><td>800</td></tr>
<tr><td>2.0 m</td><td>2400</td><td>1600</td></tr>
<tr><td>2.5 m</td><td>3600</td><td>2400</td></tr>
</table>
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HERITAGE WALK (AMRITSAR)

Furthermore, the case study aims to address the challenges and strategies related to heritage conservation in Amritsar, evaluating the efforts of local authorities, communities, and organizations in preserving its historical sites and promoting cultural tourism. By providing a detailed analysis of Amritsar's heritage,

this case study aspires to contribute to the discourse on cultural preservation, offering insights and recommendations that could be applied to similar heritage cities globally, thus emphasizing the importance of safeguarding cultural identities while embracing modernity.

THE CHANDNI CHOWK HERITAGE WALK (DELHI)

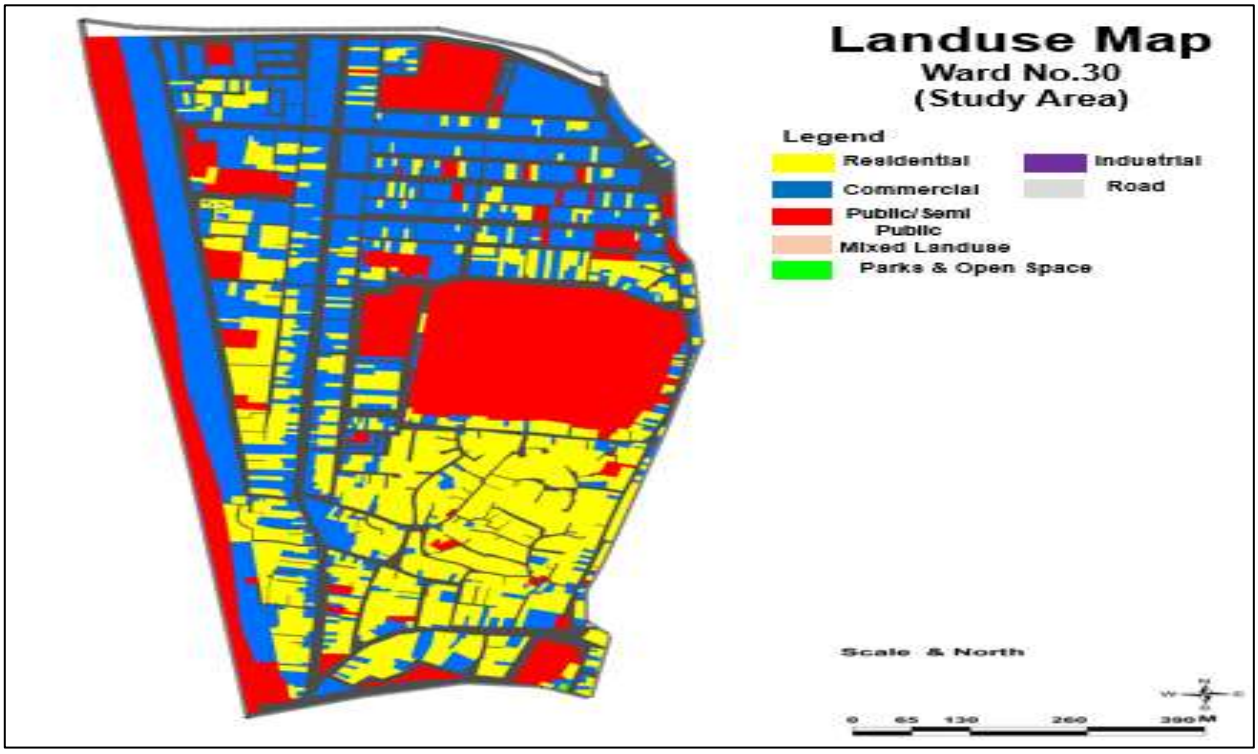
The aim of the Chandni Chowk Delhi heritage walk, as explored in this case study, is to provide participants with an enriching, educational, and immersive experience that unveils the profound historical, cultural, and architectural significance of one of Delhi's oldest and most vibrant neighborhoods. This heritage walk seeks to deepen understanding and appreciation of Chandni Chowk's unique heritage, tracing its evolution from a 17th-century Mughal commercial center to its current status as a bustling, multicultural hub. By navigating through the narrow lanes and bustling bazaars, participants gain insights into the rich tapestry of Mughal, colonial, and contemporary influences that have shaped the area. The walk aims to highlight the architectural splendor of iconic landmarks such as the Red Fort and Jama Masjid, while also bringing attention to lesser-known yet historically significant sites like traditional havelis and ancient temples. A key objective is to showcase the vibrant street life and culinary heritage, emphasizing how these elements contribute to the living culture of Chandni Chowk. Additionally, the heritage walk aims to foster an appreciation for the area's religious diversity by visiting various spiritual sites, thereby promoting a message of communal harmony and coexistence. The walk also seeks to raise awareness about the challenges and opportunities related to heritage conservation in an urban context, encouraging participants to reflect on the balance between preserving historical integrity and accommodating modern development needs.

Study and Analysis

EXISTING LAND USE

Residential

The land use map makes it abundantly evident that a greater portion of the city area is used for residential purposes. About 2178.08 hectares (32.09%) of the 6800 hectares total municipal area—which includes both planned and unplanned development—are used for residential purposes. The town has a gross density of 32.01 people per hectare. Compared to outer areas (less than 50 people per hectare), inner areas have a higher population density (>200 people/hectare). Under the Punjab Apartment and Property Regulation Act of 1995, there are twelve urban estates, seventeen T.P. schemes, twelve development schemes, and seven colonies that are licensed for planned residential development.The majority of these regulated and planned developments are found in the town's eastern region, while the other side is home to haphazard and unplanned residential development. The majority of the city's population lives in its central region.



Study Area Landuse Distribution

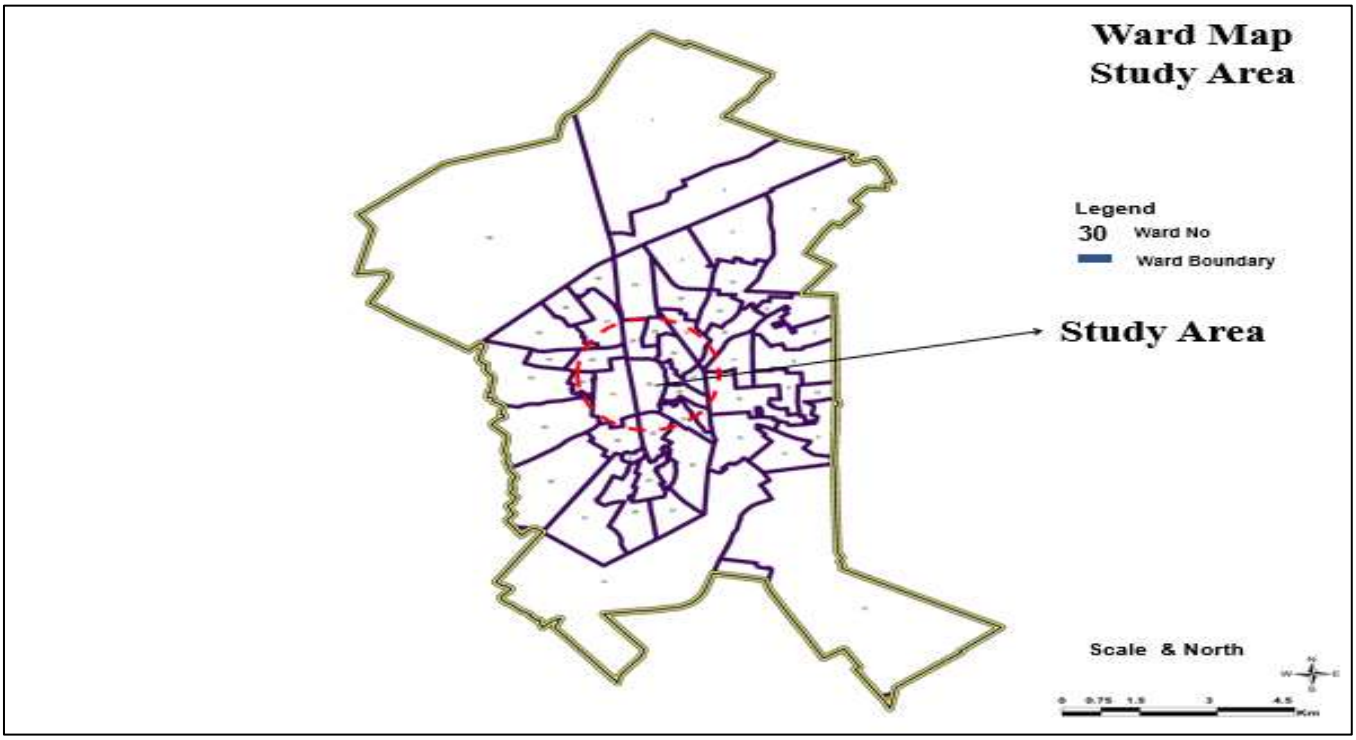
Land Use	Study Area (Ha.)	Area- MC (Ha.)	Developed Area Percentage (study area)
Residential	80.19	1033	33.43%
Commercial	42.05	385	17.53%
Mixed	15.09	108	6.29%
Industrial	1.01	342	0.42%
Public & Semi-Public	46.77	776	19.50%
Open Spaces	0.6	150	0.25%
Circulation	54.1	779	22.55%
Total	239.84	3573	100%

Ward Map Bathinda City

Tucked away in the central region of Punjab, Bathinda is a symbol of the state's vibrant modernity and rich cultural legacy. Bathinda, Punjab's 50th ward, is the state's fifth-largest city with a sizable population. Its lively marketplaces and busy streets convey the impression of a metropolis that is always changing and where progress and tradition coexist peacefully. Bathinda's strategic significance, however, is greater than its demographic significance; this is demonstrated by the fact that it is home to the largest army cantonment area in Punjab. This vast military installation highlights the city's importance to the region's defense infrastructure in addition to attesting to its historical significance.

Since ancient times, when it acted as a significant crossroads for traders and travelers, Bathinda has been a vital hub for trade and commerce due to its advantageous location. This legacy of connectedness continues to this day, with Bathinda acting as a center for a number of sectors, including manufacturing,

services, and agriculture. Because of the fertile lands surrounding it, agriculture plays a significant role in the city's economy, which is thriving due to its diverse economic base. In addition, Bathinda's industrial sector has grown significantly in recent years, drawing investment and advancing the general development of the city. Bathinda preserves its cultural identity despite the bustle of the city, as evidenced by the many historical sites, places of worship, and festivals it hosts. The people of the city celebrate their heritage through a variety of customs and cultural events because they are proud of it. Bathinda's architectural wonders, which include the venerable Gurdwara Sahib and the famous Qila Mubarak fort, are testaments to the city's rich history and enduring legacy. In addition, the city's culinary scene showcases the variety of Punjabi cuisine with a mouthwatering array of flavors. Whether dining at fancy restaurants or indulging in street stall specialties, guests visiting Bathinda are guaranteed to have an amazing culinary experience. Bathinda is essentially the essence of Punjab, where history blends with progress and tradition meets modernity. Bathinda, Punjab's 50th ward with the fifth-largest population, is significant not just within its physical borders but also in shaping the cultural, economic, and geopolitical environment of the area.

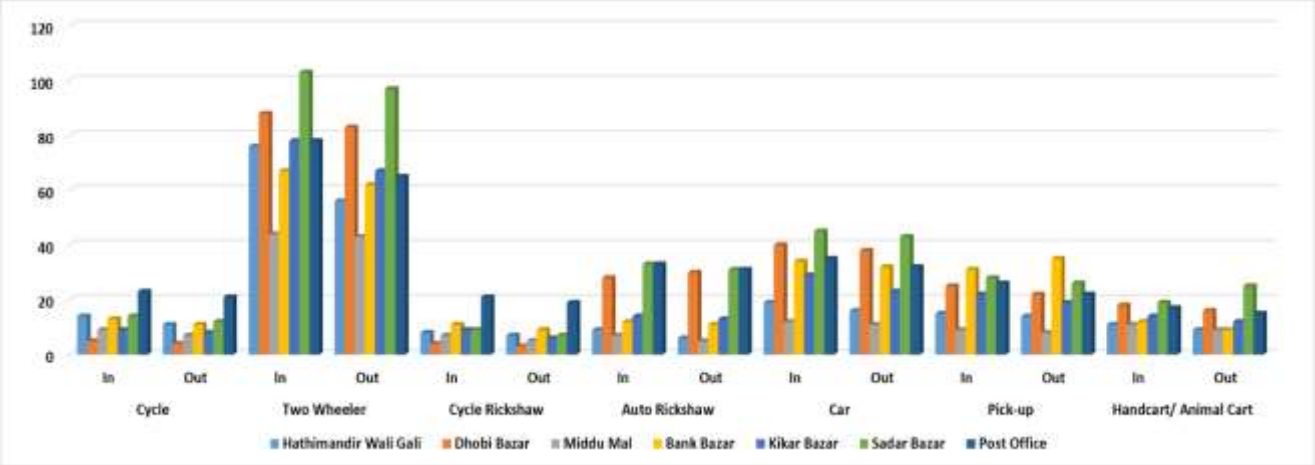


TRAFFIC VOLUME

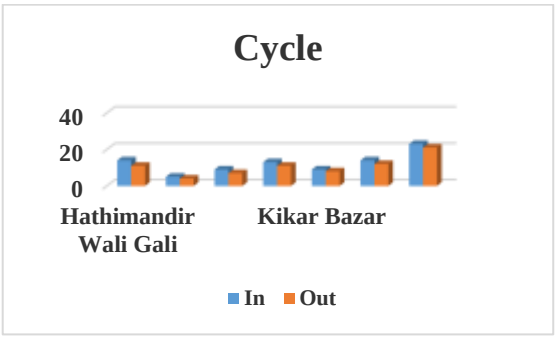
Along the arterial streets where traffic volume was at its highest, different cordon points were set up for the traffic volume study. The survey was administered between 11:00 a.m. and 4:00 p.m. Seven cordon points in total were chosen. The volume was recorded according to the mode, such as truck, bus, 4-WLR, 2-WLR, 3-WLR, cycles, rickshaws, and other vehicles (such as hand carts, horse carts, and bullock carts).

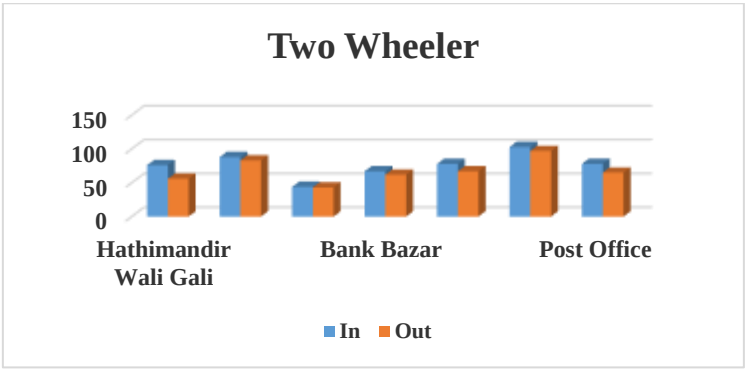
Composition of Traffic

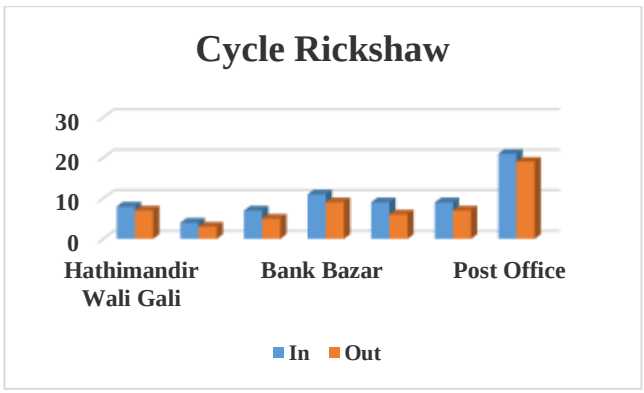
Depending on the location, two-wheelers make up 65% of all traffic. Approximately 40% of the traffic at the cordon points is made up of cars and vans. whereas 20% and 20%, respectively, go to trucks and tractors.

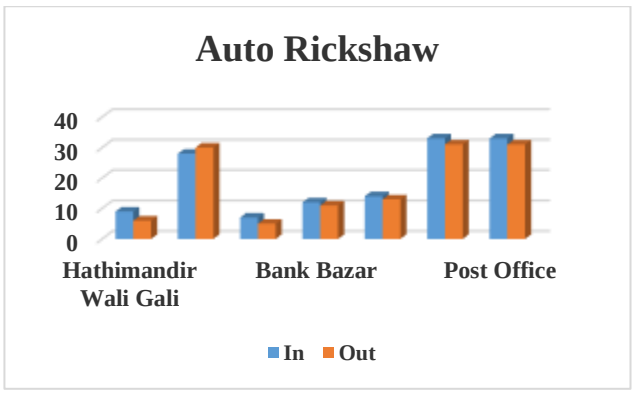


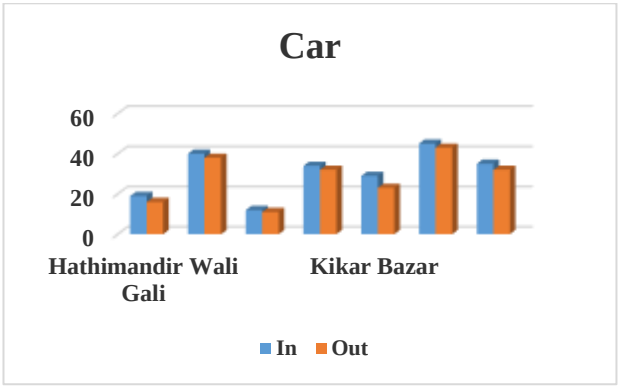
Vehicle Wise Traffic Composition

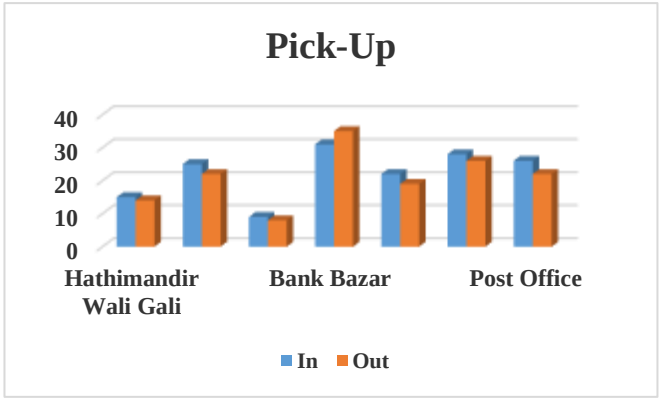


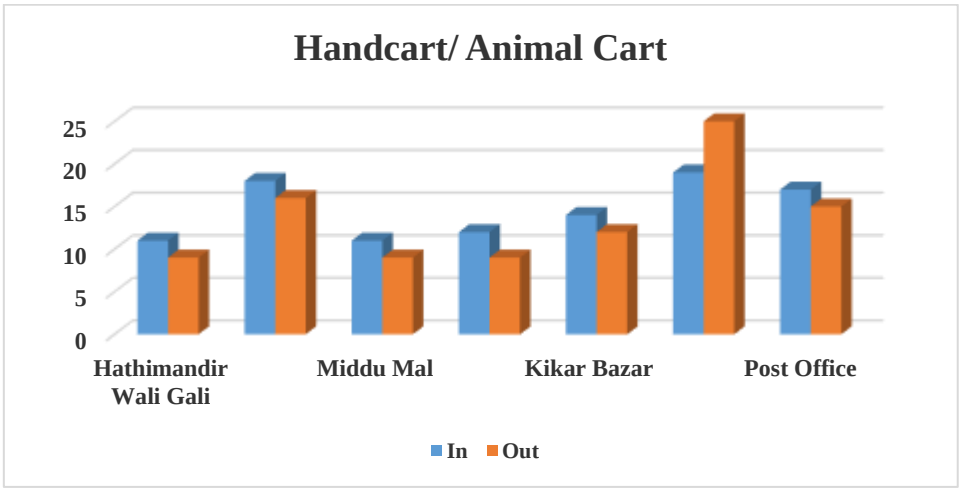












PROPOSAL AND RECOMMENDATIONS

The bustling bazaar road at the heart of Bathinda city has a comprehensive pedestrian infrastructure proposal, which demonstrates the city's commitment to improving the urban experience while putting the safety and convenience of its visitors and residents first. The primary focus of this initiative is the placement of blue and green trash cans in key locations along the pathways used by pedestrians. These unique bins support recycling efforts in addition to responsible waste disposal, which advances the city's sustainability objectives and creates a cleaner, greener environment for everybody. In addition to waste management initiatives, energy-efficient streetlights have been installed to provide a welcoming and warm glow to the main thoroughfare. These contemporary lighting fixtures provide a well-lit and safe

atmosphere for night-time strolls and shopping outings, while also improving visibility during the evening hours and pedestrian safety in general.

Along the bazaar road, benches have been thoughtfully positioned as part of the proposal to give pedestrians a comfortable place to rest and recharge in between busy days. In addition to being useful amenities, these benches help create hospitable public areas that promote social interaction and community involvement. Additionally, the bollards installed along the pedestrian pathways give the thoroughfare an additional layer of organization and safety. Bollards placed strategically aid in defining pedestrian zones, controlling traffic, and preventing illegal parking, all of which contribute to a smooth and uninterrupted flow of pedestrian traffic along the busy bazaar road.

Overall, the planned improvements to the pedestrian infrastructure along Bathinda City's bazaar road represent a comprehensive strategy for urban development that integrates sustainability, beauty, and utility. Through the use of energy-efficient streetlights, benches, bollards, green and blue dustbins, and other pedestrian-friendly features, the city hopes to create a lively, safe, and inviting pedestrian environment. Bathinda city aims to improve pedestrian experience by encouraging a feeling of community, well-being, and pride in its vibrant urban core through these deliberate interventions.

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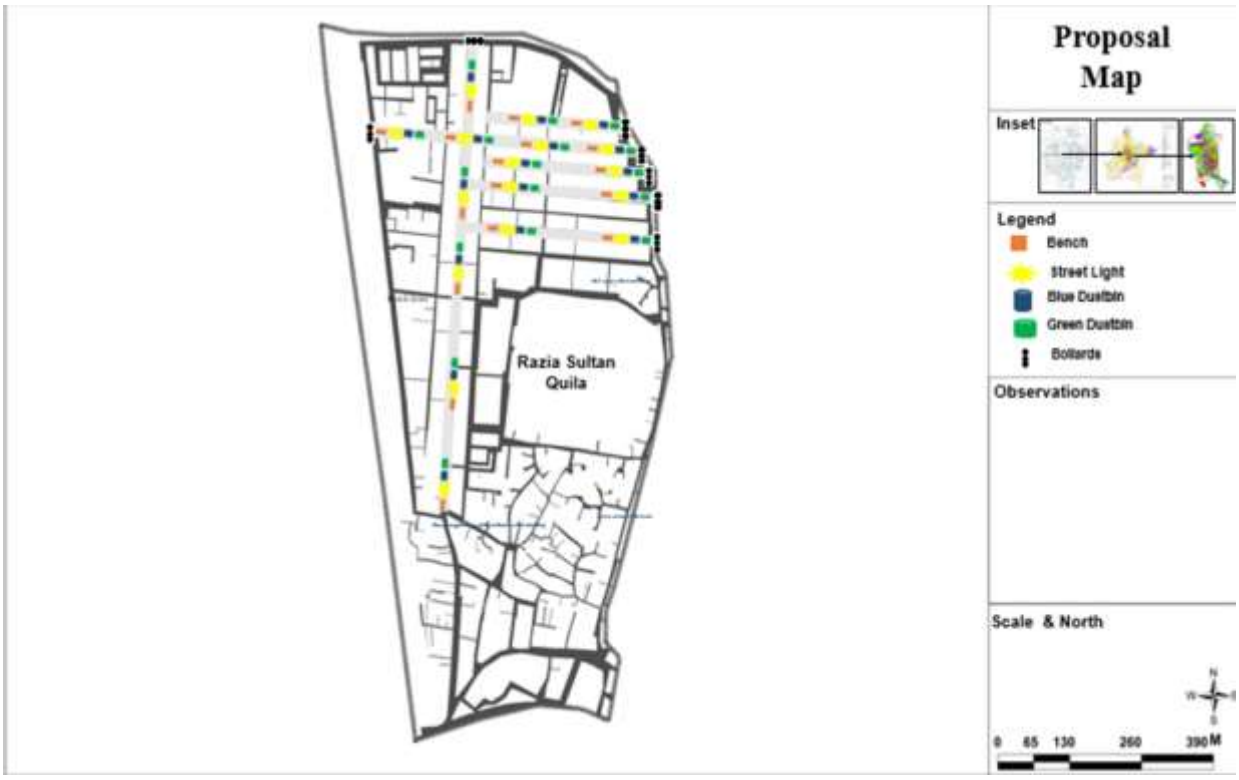

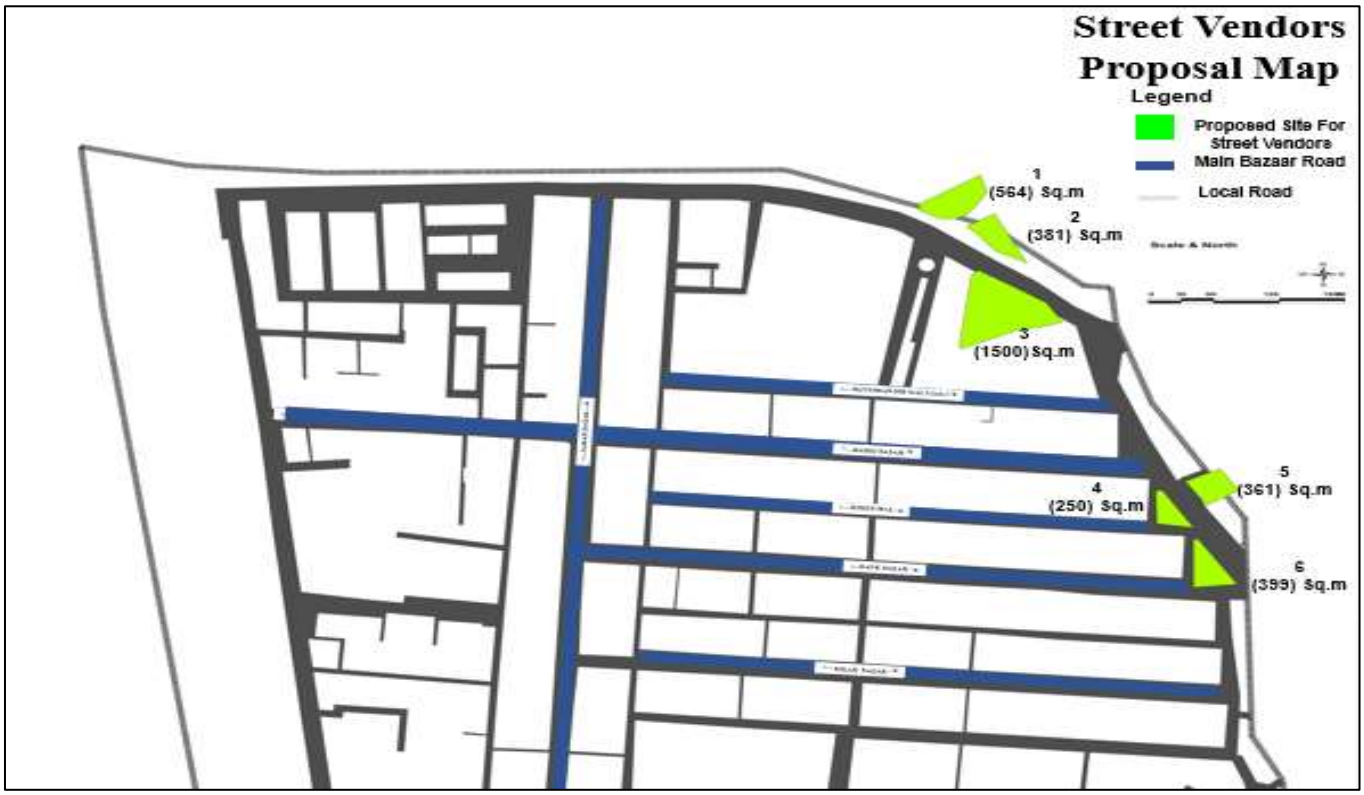

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