An Integrative Streetscape with Modular Design Guideline of the Spinal Streets of Sylhet City Corporation Area, Bangladesh

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Abstract: A street configuration and environment traced out from the local needs, culture, and available natural and manmade resources. A fruitful implementation of these criteria with a proper framework and guideline of street can bring a better pattern, fabric and vibration in a city area. This research finds those street guidelines in a modular pattern for the specific spinal streets of SCC area and proposed a design guideline of streetscape for the specific two major spinal streets of SCC area which can fasten the urban moveability, performance, and growth rate in a healthy manner through street use-policy, spatial morphology, green landscape, and integrated activities. A mixed method of primary data collected by self-observation, spatial sketches, trace findings, photograph collecting, random public interviews from field survey and the secondary data gathered by desktop survey, map survey, books, articles, magazine, newspaper and standards as literature survey. This study found, sorted and proposed a design guideline of the existing streetscape considering the existing limitations and resources. It has proposed a rational spatial and green streetscape to ensure better functioning, moveability and breathing city zone. It would also be helpful for further research on the street landscapes in urban areas.

Keyword: *Streetscape Guideline; Integrative Street-Median-Pedestrian Activity; Street Plantation; Street Pocket; Community Participation.*

I. INTRODUCTION

Streetscape means the natural and built fabric of the street. It is the spatial, functional and aesthetical quality of a street; especially how the street, median, paved and street-sides are treated. It includes buildings frontage, street pocket, street surface, street demarcation line, street signage, street furniture and street plantation that facilitate its use pattern (Charlwood, 2004). The unification and purpose of street elements enhance the value of user experience (San Luis Obispo, 2007). Sustainable streetscape, as a part of ecosystem, ensures a long-lasting and functional street spaces, manage stormwater runoff, and reduce carbon footprint employing technologies and green. A well streetscape approach ensures a better place for all its users for all time (IBI, 2009). So, a sustainable design approach of a street is one of the determining factors in the success of an urban area.

According to Carmona (Carmona, 2013) and Jacobs (Jacobs, 1961), the function and form of streets, in terms of qualities, can be diversified as visually dynamic or static, enclosed or open, long or short, wide or narrow, and straight or curved. It is mentionable that the public spaces are the most vital organs of an urban area (Carmona, 2013). It brings happiness to the busy city people like the soul to a body. And, the city streets are denoted as the widest and most accessible public space which gather more social activities and connections, (Oranratmanee, 2014). It generates several multifunctional spaces and live activities from various perspectives. Therefore, a street can be defined as a physical element, a channel of movement and a public realm, and lastly, as a place joyful public participation.

Jacobs mentioned that streets create a place of social interactions, vitality, and a sense of community (Jacobs, 1961). He also defined that street and pedestrian have possibilities for social interactions and cultural exchanges, for

example window shopping and a talk with a friend, although street movements are generally for circulation (Jacobs, 1961). Public spaces, like an urban square, provide a visual static attractiveness while streets are visually vibrant with a sense of movement. it is necessary to have quality spaces, rational buffer between functions, free flowing character, pause points in a regular interval, balanced street plants to provide shed, filter noise, purify air… to ensure the undebatable contribution of street mobility, walkability and integrative public interaction (Jacobs, 1961).

Streetscape urban design usually suffers from various issues facing urban quality. Pedestrian accessibility and inclusivity are among the key issues with poorly constructed sidewalks, narrow width paths, and missing curb ramps detracting from universal access, especially for the disabled (NACTO, 2012) (Loukaitou-Sideris, 2009). Pedestrian safety is also lost through inadequate illumination, unmarked crossings, and deficient barriers, which raise the chances of accidents (Gehl, Life between buildings: Using public space, (2011) (Appleyard, 1972). Absence of green spaces reduces ecological and psychological benefits, as trees and vegetation offer temperature control, air filtration, and visual attractiveness (Jim, 2008) (Jansson, 2014). Traffic density and pollution also rise where roads favor cars over they favor non-motorized traffic, thus aggravating the levels of noise and air pollution (Banister, 2008) (Litman, Evaluating Traffic Congestion Impacts for Transportation Planning, 2021). Most streetscapes also lack social interaction spaces, including seating areas or plazas, that communities and urban vitality depend upon (Whyte, The Social Life of Small Urban Spaces, 1980) (Gehl, Cities for people, (2010). Finally, neglect of cultural and aesthetic factors will diminish the sense of place among residents because design elements local to the area that incorporate public art and historical reference points make a place more recognizable and attached to.

Sylhet, Bangladesh's third fastest-growing city, is shaped by its natural and spiritual landmarks like tea gardens, Jaflong, and the 'mazars' (shrine) of Hazrat Shah Jalal (R.) and Shah Paran (R.), forming a unique urban identity (Arefin, 2021). Rapid urbanization—driven by migration—has increased pressure on infrastructure and key streets like Pathantula–Ambarkhana and Zindabazar, causing congestion and reduced spatial quality (Chowdhury, 1910) (Bijit Kumar Banik, 2009). Streets link 27 wards via Main and Link Roads but suffer from poor walkability, lack of accessibility, and overcrowded multifunctional uses (Hasan, 2016). Green elements are sparse, despite their role in cooling, air purification, and health, with Swietenia mahagoni being the most common species (Jiban Chandra Deb, 2013). Strategic guidelines are needed to enhance greenery and public interaction.High land values, private encroachment, and narrow setbacks hinder landscape integration (Sharma, 2022). Yet, vegetation—trees, grass, shrubs—can buffer noise, improve aesthetics, and support pedestrian flow (Jim, 2008). Brownfield zones (1–20 ft wide) often serve informal uses; integrating SL could formalize and upgrade them (Arefin, 2021). However, lack of policy and investment in arboriculture limits progress (Harris, 2004) (Beatley, 2011).

This paper proposes SL-focused solutions for a greener, accessible Sylhet.

The demographic dynamics of Sylhet's streetscape reveal critical patterns that impact infrastructure needs and urban planning. In the city's urban core areas such as Ambarkhana, Zindabazar, and Bandarbazar, high population density driven by intense commercial activity leads to constant pedestrian and vehicular congestion. These zones face immense pressure due to the lack of adequate breathing spaces. Conversely, peri-urban zones like Tukerbazar, Tilagarh, and Arambagh have lower population densities and wider streets, but often lack essential pedestrian infrastructure such as walkways and street lighting.

The age structure also shapes street use. Youth aged 15–30 heavily utilize areas near educational institutions such as the SUST gate and MC College, frequenting food stalls and informal gathering spaces. Their presence demands youth-oriented infrastructure like shaded walkways, bike lanes, and seating zones. Middle-aged adults (30–50 years), often engaged in commerce, prefer business corridors like Ambarkhana and Modina Market and prioritize road safety, parking, and walkability. The elderly (60+), due to poor pedestrian safety and limited resting facilities, are less visible in the streetscape and require shaded sitting areas and safe crossings.

Gender also plays a crucial role in street dynamics. Many roads—especially in commercial hubs like Bandarbazar and Chowhatta—remain male-dominated, with limited female activity in early morning and night hours due to safety concerns. However, areas like SUST Gate and Shah Poran Road show more balanced gender usage, pointing to the importance of better lighting, safety surveillance, and gender-sensitive design including toilets and rest zones.

Socio-economic diversity further influences street behavior. Low-income communities, reliant on walking and informal transport such as rickshaws, cluster around commercial hubs but suffer from poor pedestrian conditions. In contrast, middle to upper-middle-class users—particularly in Shahjalal suburbs and near Mount Adora—use private vehicles more, increasing pressure on parking and traffic systems. Occupational roles add another layer: street vendors and informal workers concentrate around major hubs, often encroaching on pedestrian zones due to the absence of designated vending spaces. Students dominate the SUST and MC College areas and require youth-friendly infrastructure, while professionals and daily commuters depend on corridors like Airport Road and Shah Poran Road for efficient travel and safer mobility.

Lastly, Sylhet's ethnic and cultural fabric—comprising local Sylhetis and returning diaspora from the UK and Middle East—also shapes street patterns, influencing commercial rhythms and the gender balance of street usage. These demographic insights highlight the need for inclusive, responsive urban street design—ensuring safety, functionality, and accessibility across all user groups.
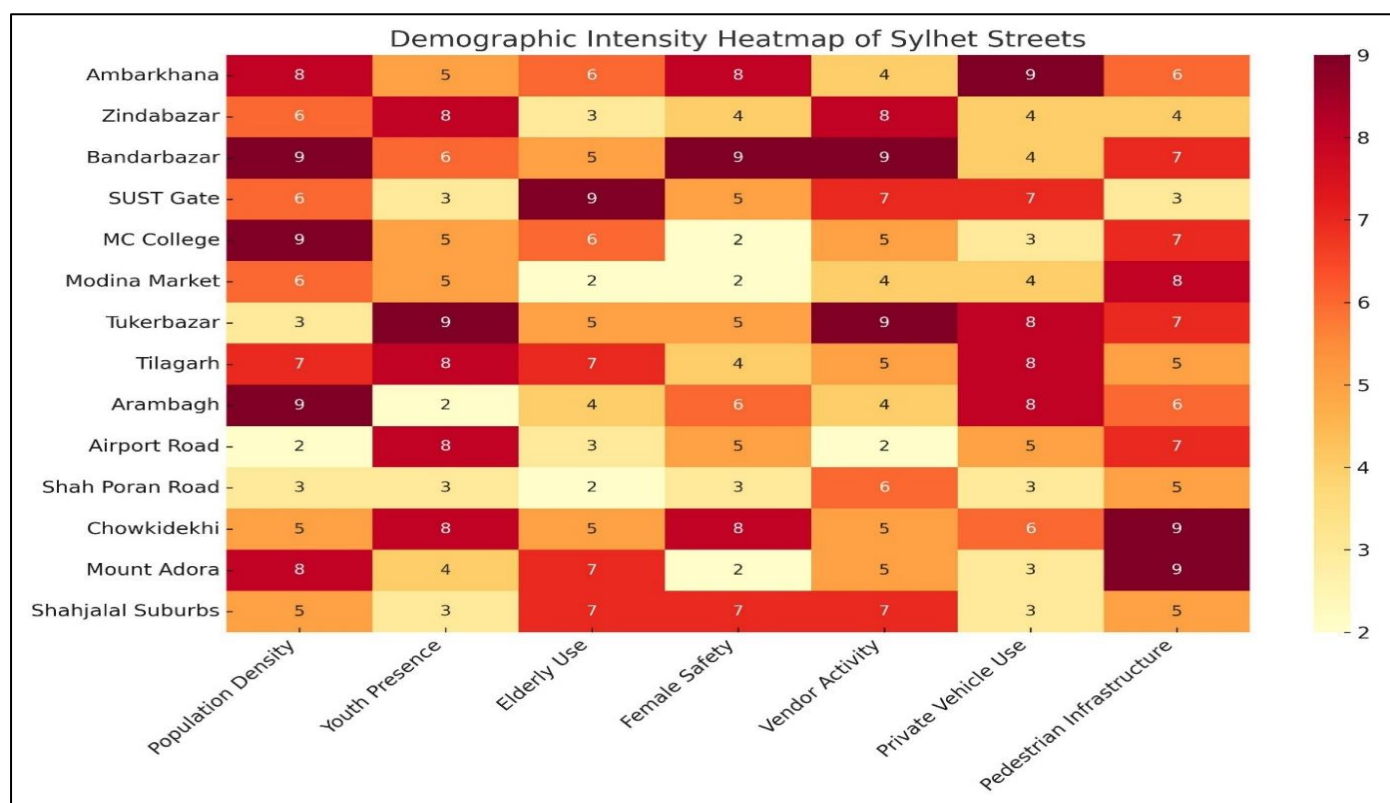
Fig 1 Demographic Intensity Heatmap of Sylhet Streets (Source: Author)

Sylhet lacks a formal intra-city bus service, a notable gap for any growing urban center. Instead, motorized mobility depends heavily on CNG auto-rickshaws (baby taxis), manual rickshaws, tempos, and pickup vehicles—often with informal registration and regulation.These paratransit modes are the backbone of daily commuting, clearly evidenced in academic transportation studies of the city (Tanay Datta Chowdhury, 2018).

A landmark traffic study by Shahjalal University of Science and Technology found that on the city's busiest corridor—from Ambarkhana to Chowhatta—the flow reached a staggering 9,111 PCU/hour during peak periods. Of those, nearly 47% were non-motorised vehicles such as

rickshaws and pushcarts, followed by tempos (15%) and private vehicles (14%). This imbalance confirmed severe traffic congestion, with a Roadway Congestion Index (RCI) value of 2.36, indicating that demand far exceeded roadway capacity (Bijit Kumar Banik, 2009).

The dominance of CNGs significantly contributes to erratic traffic behavior: they frequently stop mid-block to pick up or drop off passengers, often occupy multiple parking spots, and weave between lanes due to lack of designated stops or regulation. These dynamics disrupt overall traffic flow, particularly in commercial corridors like Zindabazar, Bandarbazar, and Ambarkhana.

Table 1 Mobility Analysis

Mode of Transport	Approx. Share of Road Use (%)	Role in Mobility	Key Issues	Source
Bus Service	0%	No formal intra-city bus system	Lack of mass transit causes dependence on informal and low-capacity mode	(Md Bashirul Haque, 2022)
CNG Auto-Rickshaw	28–32%	Primary paratransit option	Excessive volume, illegal operation, traffic disruption	(Nixon Deb Pritom, 2024)
Manual Rickshaw	30–35%	Affordable local travel	Slows down mixed-traffic corridors, high density in markets	(Md Bashirul Haque, 2022)
Motorcycles	15–18%	Fast, flexible personal travel	Risky driving, parking issues	(Rafi, 2023)
Private Cars	6–8%	Middle/upper-class mobility	Inefficient road space usage	(Rafi, 2023)
Bicycles	3–5%	Used in peripheral areas	Limited infrastructure, unsafe mixing with traffic	(Md Bashirul Haque, 2022)

The SCC area is distinguished by its unique urban landscape, situated at the base of the Khasia and Jayantia hills and along the Surma River. The natural beauty of its surrounding wetlands, low plains, waterfalls, canals, hills, and tea gardens has made Sylhet a prime tourist attraction. This appeal is further enhanced by religious sites like the shrine of Hazrat Shahjalal (R.), which also holds socio-political significance as a focal point for national election campaigns. Historically, Sylhet's prominence as a trade center dates back to ancient times, with the name "Sree-hatta" (meaning "rich marketplace") believed to reflect its status as a prosperous trade hub (Chowdhury, 1910). The city has long been recognized for its unique geographical positioning, diverse cultural demographics, and religious significance, earning it the title of "spiritual capital of Bangladesh". (Chowdhury S., (2019)The analysis of fifteen vital points along Sylhet's spinal roadways in the SCC region reveals information about street design, pedestrian activity, landscape elements, and the built environment. Each point exhibits unique characteristics:

Table 2 Comparative Analysis of Street in Key Urban Corridors of Sylhet City

| Location	Road Width (ft)	Pedestrian Walkway (ft)	Median	Landscape/Buffer Zone	Special Features / Notes
Tukerbazar	20'	4' (interrupted)	2'	Landscaping zone between road and walkway	Narrow road, median exists but is minimal, walkway needs continuity
Temukhi	26'	4' (Both sides)	5'	Moderate	Adequate width, better median, functional pedestrian zone
SUST Gate	20'	5'	3' (vegetated)	15' landscaping with food court and vendors	Community gathering space, active edge, good landscape integration
Mount Adora Hospital	20'	6'	3' (planted)	Minimal	Safety-enhanced with zebra crossing, speed bumps
Modina Market	26'	4'	2' (manicured)	3' sidewalks to bazaar	Commercially dense, accessible but median could be wider
Ambar Khana	25'	4'	None	Minimal	Commercial hub, lacks median for traffic separation
Shahi Eidgah	20'	3'	None	Limited	High pedestrian density area, lacks median, sidewalks narrow
Arambagh	20'	3'	None	Shaded sidewalks	Quiet residential street, shaded walkways but no median
Tilagarh	25'	4'	None	Shaded sidewalks with trees	Decent pedestrian quality, lacks median for traffic regulation
MC College	20'	3' (Plus 5' sidewalks)	None	Green spaces and water sources	Educational zone, environment-friendly design
Shah Poran Road	28'	3'	None (But 3' buffer + 6' landscape)	Spiritual corridor with footbridge	Strong landscape character, one of the widest, pedestrian space still narrow
Airport Street	25'	4' (Unpaved)	None	Tree planting	Lacks developed sidewalks, significant green edges
Chowkidekhi	25'	3'	None	Shaded sidewalks, heavy tree cover	Comfortable microclimate but lacks median
Chowhatta	25'	3'	None	Minimal	Busy node, minimal pedestrian space
Bandarbazar	25'	3.5'	13' (Under Keane Bridge)	Terminal zone	Tallest and most pronounced median in the dataset, but mixed usability
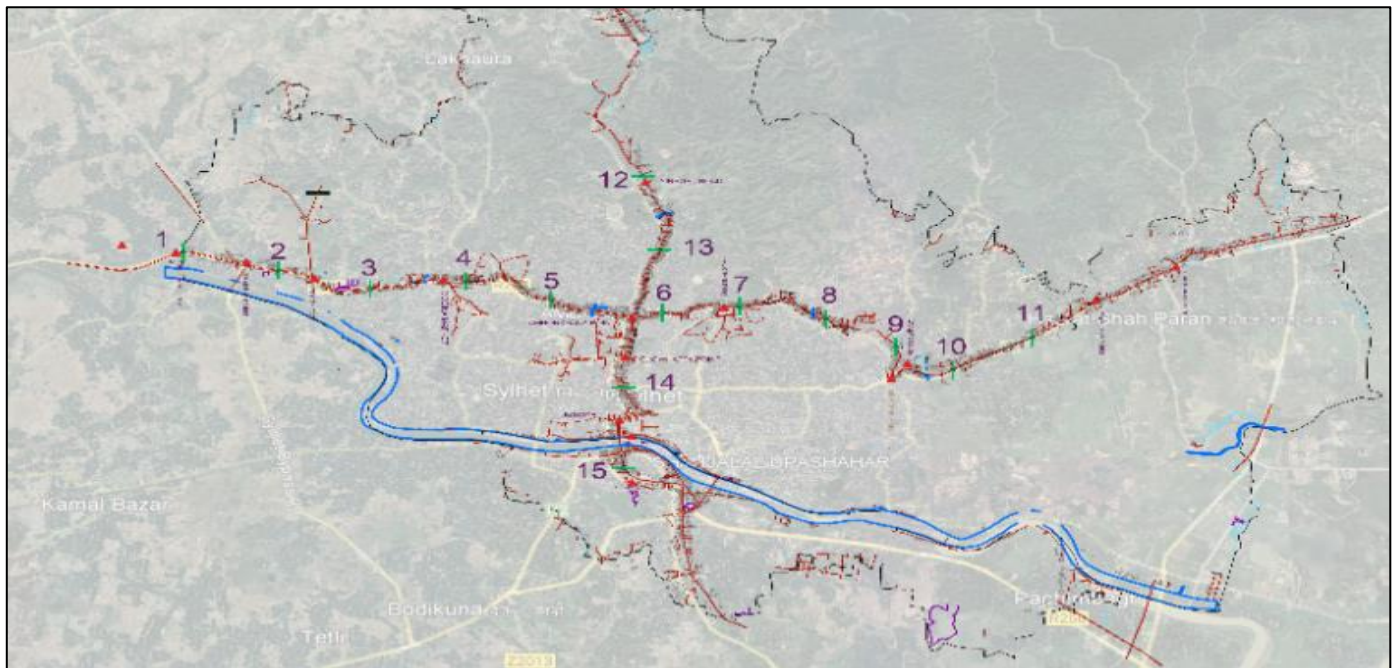
Fig 2 15 (Fifteen) Vibrant Points on the Spinal Streets of SCC Area (Author).

This detailed study highlights a variety of characteristics in each segment, indicating potential to improve pedestrian connectivity, landscape quality, and traffic flow along Sylhet's key roadways.

In this study, we investigate the streetscape of Sylhet by breaking it down into separate components: roadways, pedestrian routes, medians, light poles, signs, scenery, and vegetation. Each component is examined to discover current obstacles and inadequacies, such as those in accessibility, safety, environmental sustainability, and visual coherence. By addressing these specific issues, we hope to suggest focused solutions that contribute to a more unified, functional, and sustainable streetscape design in Sylhet, therefore improving the entire urban experience for inhabitants and tourists alike.

II. METHODOLOGY

This study used both qualitative and quantitative methodologies to better understand the complex dynamics of street traffic, landscape components, and pedestrian interactions in the Sylhet City Corporation (SCC) region. To interpret and enrich our results, we had open talks with local experts and SCC citizens. This technique enabled us to identify particular community requirements while also gathering local views about how the street landscape and pedestrian spaces interact. This collaborative approach is consistent with urban design methods that prioritize user-centered design and acknowledge the importance of local involvement in building sustainable public places (Gehl, Cities for people, (2010) (Jacobs, 1961).

Data collecting was complemented by desktop research on international design criteria, such as those from NACTO (National Association of City Transportation Officials), IRC (Indian Roads Congress), and the Bangladesh Road Transport Corporation (BRTC). These publications provided best practices for urban street design, which we tailored to SCC's specific setting while maintaining sustainability and compliance with local circumstances. By combining these criteria, we were able to develop solutions that addressed SCC's urban concerns while also increasing environmental resilience (Carmona, 2013) (Moudon, 1997).

Over the course of three months, primary data was collected through direct observation, sketching, pictures, and informal interviews with around 50 people at 15 key sites. This in-depth qualitative technique was beneficial in capturing user behavior and street dynamics. Furthermore, software technologies such as AutoCAD, Photoshop, and Google Earth aided data processing and visualization, assuring accurate portrayal of street components (Moudon, 1997).

Secondary resources, including as books, papers, and historical documents, helped us better comprehend SCC's urban morphology and streetscape. Quantitative approaches were used to examine and synthesize the data, linking the historical and functional elements of street use in SCC. This research provides practical ideas for a unified, sustainable urban design while retaining a strong focus on community and regulatory norms (Alexander, 1977) (Shirazi, 2017).

A participatory approach was also used, involving open conversations with field specialists, local stakeholders, and community people, notably for street planting and vegetation profiles. Engaging local voices was critical for meeting landscape demands while ensuring solutions were consistent with SCC's cultural and geographical character (Lynch, 1960) (Tibbalds, 1992). This regulatory and community-focused approach is consistent with current urban design techniques that prioritize community participation in sustainable planning.

Table 3 Research Methodology

Category	Details
Research Type	Mixed-method (Qualitative and Quantitative)
Study Focus	Street traffic, landscape components, and pedestrian interaction in Sylhet City Corporation (SCC)
Data Collection Methods	- Direct observation - Sketching - Photography - Informal interviews (~50 people at 15 key sites) - Desktop research
Qualitative Techniques	- Community consultations with experts and locals - Open conversations on user behavior and streetscape needs - Participatory methods
Quantitative Techniques	- Data analysis using metrics and design standards - Historical and morphological synthesis
Software Used	AutoCAD, Photoshop, Google Earth
International References	NACTO, IRC, BRTC design standards
Secondary Resources	Books, journals, and historical documents
Design Principles	User-centered design - Sustainability - Environmental resilience - Community involvement
Duration	3 months
Participatory Elements	Involvement of field specialists, local people, and stakeholders in planning, especially street vegetation
Outcomes	Context-specific design solutions for SCC that are sustainable, compliant with regulatory standards, and reflective of community needs and cultural context

III. RESULT

The urban fabric of Sylhet City Corporation reveals a complex set of infrastructural challenges, particularly within its street network, which directly impacts mobility, safety, and livability. Through a detailed site analysis and observation of arterial roads, pedestrian zones, and key intersections, this assessment identifies critical urban issues ranging from road width inefficiencies and unauthorized parking to poor pedestrian infrastructure and median-based shortcomings. The following table consolidates the major problems observed across different parts of the city and proposes targeted, context-specific design interventions to enhance functionality, inclusivity, and resilience in Sylhet's evolving urban landscape.
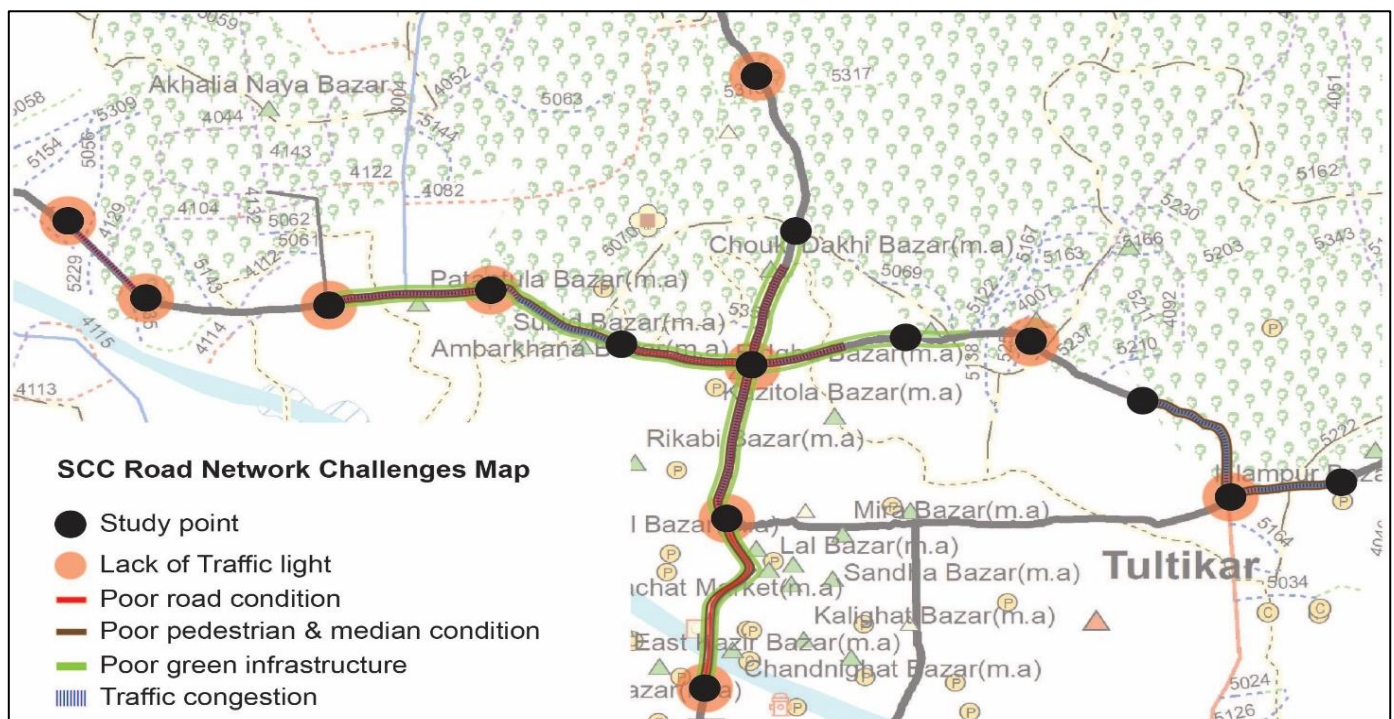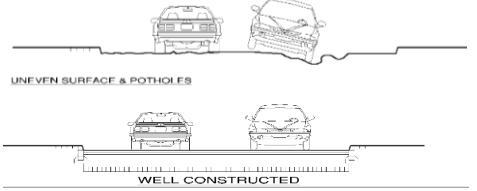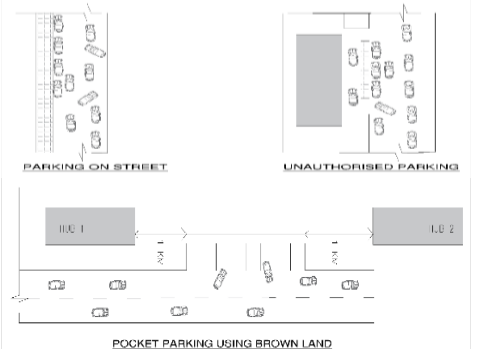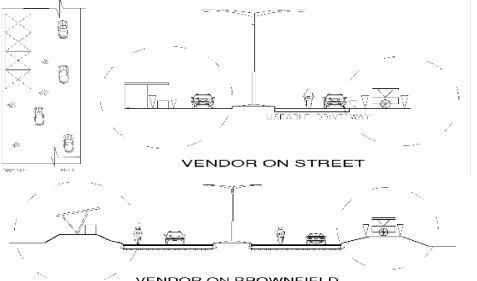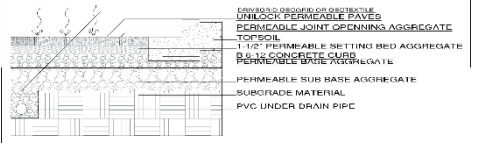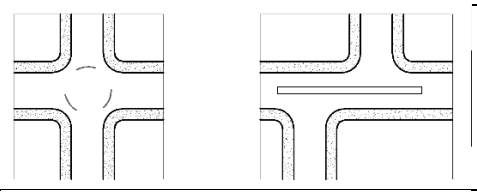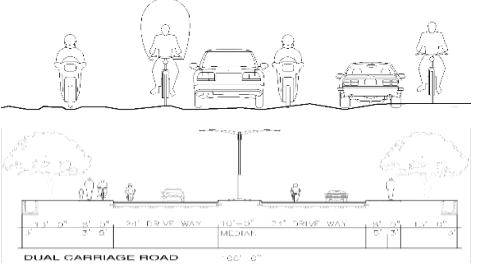

Fig 3 SCC Area Road Network Challenges Map (Author).

Table 4 Road Related Problems and Solutions

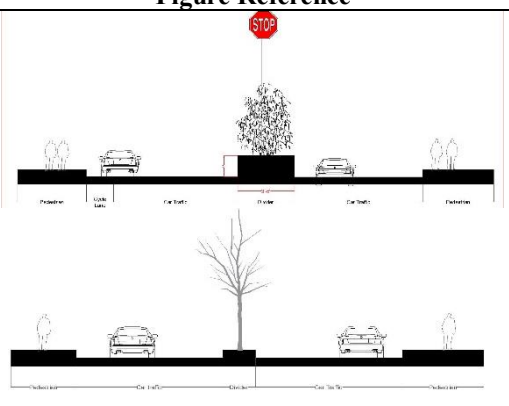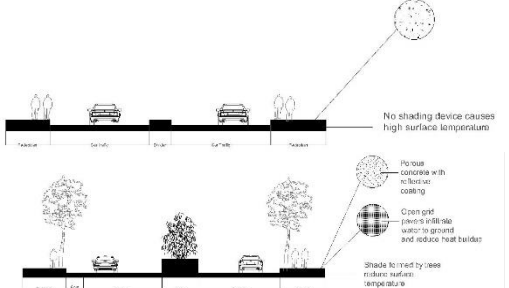| Problem	Affected Area(s)	Proposed Solution	Figure Reference
Road Width Issues	Entire SCC; worsened in commercial and monsoon-heavy areas like Modina Market, Bandar-Bazar	Arterial roads mostly meet or exceed required width (44 ft+). Propose lane separation for different vehicle types to improve traffic flow and reduce accidents.	Road Type: Arterial Road Width: 50 ft Actual Traffic Volume (PCU/h): 2095 Traffic Volume Capacity (PCU/h): 2500 Therefore, the required road width to accommodate the traffic volume should be 44 ft or more.
Poor Road Conditions	Entire SCC; worsened in commercial and monsoon-heavy areas like Modina Market, Bandar-Bazar	Use high-grade materials (PMB asphalt, concrete), adopt multi-layered road designs, ensure regular inspections and weather-resistant surfacing.	
Unauthorized Parking	Zindabazar, Bandar-Bazar, Ambarkhana, Modina Market, other busy commercial hubs	Designate pocket/off-street parking, enforce no-parking zones, adopt parking tech (apps), public awareness drives, and involve locals for monitoring.	
Road Encroachment by Hawkers	Zindabazar, Chawhatta, Bandar-Bazar, MC College, Ambarkhana zone	Allocate designated vendor zones with modular/ mobile kiosks. Use regulated pop-up markets and tech-based vendor management systems.	
High Surface Temperatures	Major asphalt-based roads; particularly open, exposed roads like Airport Road, Tilagor, Shahporan Road	Use reflective coatings, heat-resistant materials, add greenery, apply expansion joints, and real-time surface condition monitoring.	
Problematic Intersections	Ambarkhana, Shahi Eidgah, Chawhatta, Zindabazar, Modina Market, MC College crossing	Implement round abouts, adaptive sig nals, clear signage, segregated turn lanes,pedestrian cros s-ings, under passes.	
Mixed Traffic Flow	Shahporan Road, Tuker Bazar, Chawhatta, Tilagor, and all major arterials	Create distinct lanes for rickshaws, motor bikes, and trucks. Enforce lane disc ipline, improve mark ings, and conduct awareness programs.	

Additionally, to justify the street width, we created an analysis of the whole scenario, The traffic volume analysis of Sylhet's main roads reveals a blend of adequate and near-capacity conditions. The corridors from Ambarkhana to Airport and Tukerbazar, which are 50–52 feet wide, are functioning well within their limits, allowing for a smooth flow of traffic. On the other hand, the routes from Ambarkhana to Bandar Bazar and Chowhatta are approaching their capacity, indicating that congestion could become an issue during peak hours, even though they meet the minimum width requirement of 44 feet. Key areas like Amborkhana, Modina Market, and Mount Adora Hospital are nearing saturation and would benefit from measures such as traffic signal installations, congestion management, and better pedestrian control. In contrast, intersections like Temukhi, Tuker Bazar, Shahporan Road, and Airport Road are comfortably under capacity, showcasing a more efficient traffic flow in those regions.

Table 5 Street Wise Transport Volume in Terms of Capacity (Source: Primary Field Data, Author, 2024)

Location	Road Width (ft)	Actual Volume (PCU/h)	Capacity (PCU/h)	Performance
Tuker Bazar	50	1440	2500	Under Capacity
Temukhi	48	1330	2400	Under Capacity
SUST Gate	50	1780	2500	Within Range
Mount Adora HospitaL	50	2026	2500	Moderate Pressure
Modina Market	48	2130	2400	High Load
Amborkhana	48	2250	2400	Near Saturation
Shahi Eidgah	48	1865	2400	Manageable
Arambagh	50	1410	2500	Under Capacity
Tilagarh	50	1510	2500	Manageable
MC College	48	1490	2400	Comfortable
Shahporan Road	52	1350	2600	Ample Capacity
Airport Road	54	1760	2700	Good Flow
Chowkidekhi	46	1240	2300	Under Capacity
Chawhatta	48	1750	2400	Moderate Load
Bandar Bazar	48	1780	2400	Stable

Table 6 Pedestrian Related Problems and Solutions

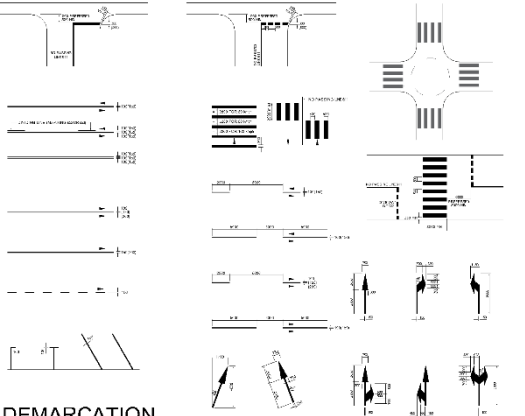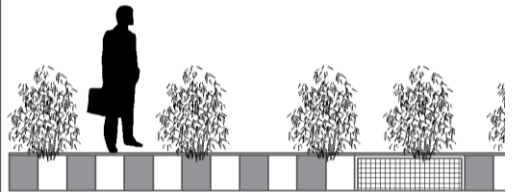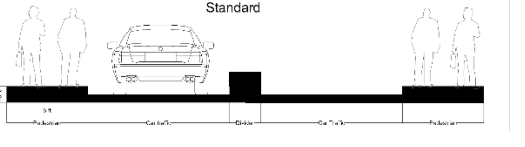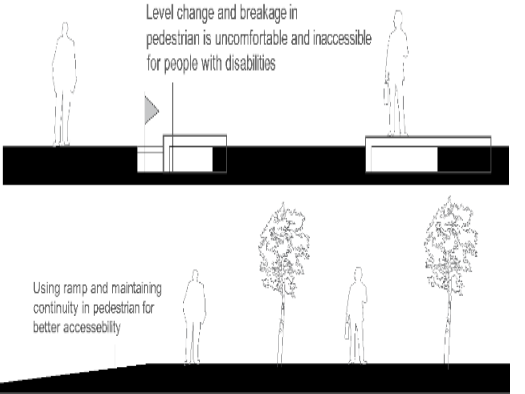| Problem	Affected Area(s)	Proposed Solution	Figure Reference
Width and Placement Issues	Citywide, especially in high-foot-traffic areas	Expand sidewalks, demarcate zones, create car-free areas, regulate vendors, install bulb-outs, use tactical urbanism, and engage community	
High Surface Temperature & Water Logging	Entire SCC, especially sun-exposed, hard-surfaced walkways	Use permeable, light-colored, or natural materials; add vegetation and shade structures to reduce heat and manage drainage	
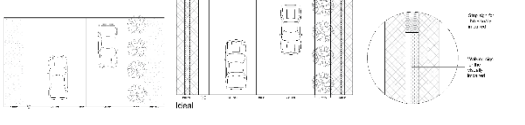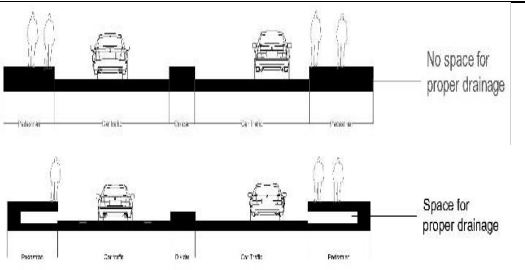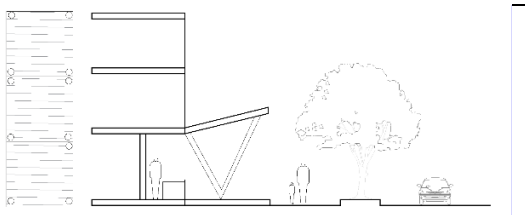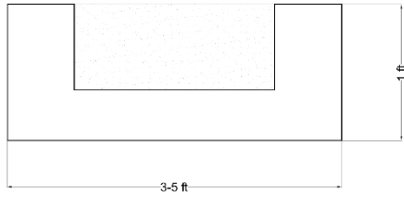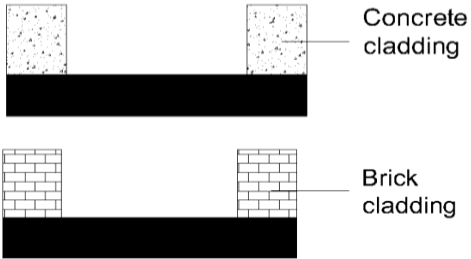
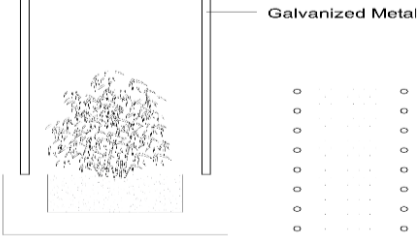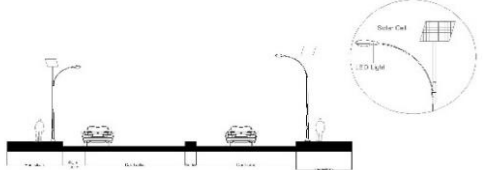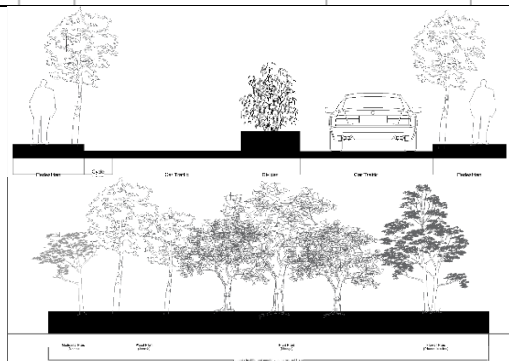| Clear Demarcation of Pedestrian Zones | Throughout SCC | Paint bright lines, use barriers (curbs/bollards), install signage, introduce greenery, apply flexible lane strategies | |
Dedicated Pedestrian Areas	Main shopping streets, parks, community hubs	Establish car-free zones, define boundaries with signage, involve community, enhance with seating, art, greenery	
Insufficient Pedestrian Infrastructure	Lacking in many areas, especially at major road crossings	Build/upgrade sidewalks, cross walks, signals; define pedestrian networks; maintain regularly	
Steep Elevation Changes on Walkways	Hilly or uneven urban areas in SCC	Regrade paths, add ramps or gradual steps, use non-slip materials, tactile paving, conduct regular repairs	
Lack of Facilities for the Physically Impaired	Throughout SCC, especially near public buildings and intersections	Add ramps, tactile tiles, non-slip surfaces, audio signals, access -ible signage; comply with WHO standards	
Unsafe Use of Drain Covers as Walkways	City areas with open drain systems	Build separate sidewalks, rein force slabs, use warning signs and barriers during maintenance, inspect regularly	
Obstruction by Vendors and Shops	Busy markets: Zindabazar, Bandar-Bazar, Modina Market, Chawhatta, Shahi Eidgah	Designate vendor zones, enforce display limits, use planters /bollards to preserve paths, educate comm unity, support pop-up vending	

Table 7 Median Related Problems and Solutions

Problem	Affected Area(s)	Proposed Solution	Figure Reference
Narrow or Inadequate Medians	Pathantula, Amberkhana, Shahi Eidgah-Tilagor, Zindabazar, Lamabazar	Expand medians, create U-turn lanes or roundabouts, ins -tall pedestrian crossing zones, use visible and durable materials, enforce traffic control	
Improper Median Construction and Maintenance	High-traffic corridors and poorly maintained areas	Use reinforced concrete, precast barriers, guardrails, stone/masonry cladding; implement regular maintenance schedules	
Inadequate Landscaping in Medians	70–80% of SCC medians, especially between Amberkhana and Shahi Eidgah	Add native plants (4–5 ft), establish maintenn- ance plan, improve irrigation, use visually appealing low-maint enance materials	
Inadequate Median-Based Lighting	Citywide, particularly pedestrian walkways and crossings	Add pedestrian-foc used light poles, use motion-sensor and LED lighting, expand lighting coverage to sidewalks and cross ings	
Lack of Pedestrian Lights	Sidewalks and roadside paths across SCC	Install low-height poles, use LED and motion sensors, improve lighting uniformity and safety at night	
Gaps in Streetscape Vegetation	Ambarkhana–Shahi Eidgah, Zindabazar, Chowhatta, Lamabazar, Bandar	Identify planting spaces, use diverse native plant species, implement green walls, drip irrigation, cooling zones, and community engagement	

For more insights into the importance of community involvement and policy change in urban traffic management, you can refer to sources like the World Health Organization's guidance on urban planning and traffic safety, or research from the Institute of Transportation Engineers, which emphasizes the role of public awareness campaigns in promoting responsible.

➤ *Street Infrastructures:*

Sylhet City Corporation is grappling with some serious street infrastructure challenges that make getting around the city safely and efficiently quite a task. One of the biggest issues is the encroachment of roads by hawkers and informal vendors, particularly in busy spots like Versity Gate, Ambarkhana, Chowhatta, Bandar Bazar, and Tilagarh. These encroachments squeeze the space available for both pedestrians and vehicles, leading to congestion and a higher

risk of accidents. Another pressing concern is the complete lack of functioning traffic lights on SCC roads. Without any regulated intersections, traffic can turn into a chaotic mess, especially during rush hours, creating unsafe conditions for drivers and pedestrians alike.Even though there are pedestrian overbridges in places like Bandar Bazar, Versity Gate, Shahporan, and Tilagarh, they're mostly ignored due to poor design, lack of maintenance, and accessibility issues. Consequently, people often end up crossing the roads at ground level, which can be quite dangerous.
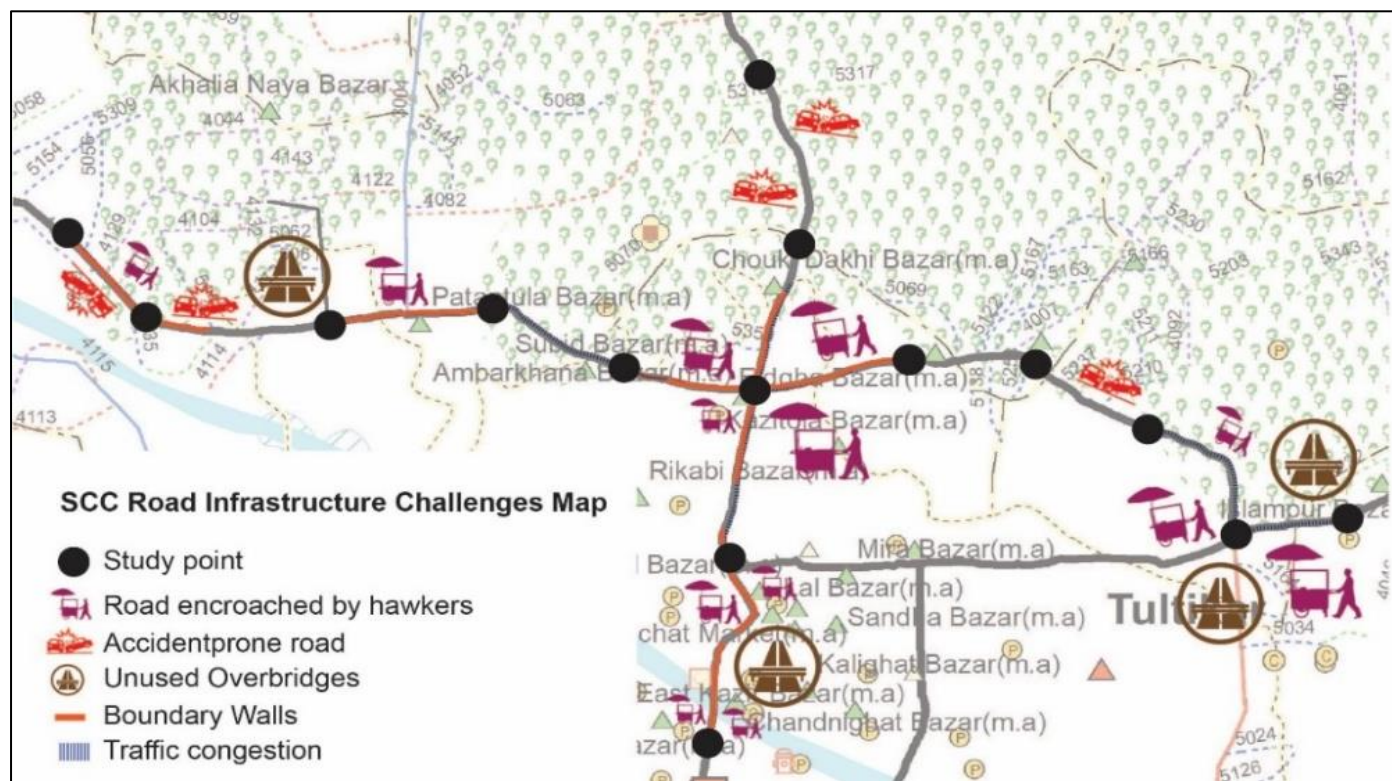
Fig 3 SCC Road Infrastructure Challenges Map.

IV. DISCUSSION

To enhance the streetscape, transportation, and pedestrian safety in Sylhet, a comprehensive urban planning strategy is necessary. The following are actionable solutions and policy suggestions:

➢ *Development of Public Transport:*

Establishing a well-structured bus system (Sylhet City Service) with reasonable fares would decrease dependence on CNG vehicles, which exacerbate traffic congestion and inflate costs. Coordinating bus routes with designated stops and adequate shelters can improve accessibility and alleviate traffic issues.

Fig 5&6 Small Transportation Increase, City Service Bus (Author).

Fig 7&8 Artificial Traffic Congestion Occurred, and Road Space Required to Transport 50 People: Pedestrians, Cyclists, Bus Passengers, and Car Drivers *[Infographic]* (Source: https://www.facebook.com/photo/?fbid=1014701820671155 &set=a.461150419359634; retrieve: 11.08.25), and, https://medium.com/@jasoncbrancato/time-to-rethink-your-commute-3eeff83adf5b; retrieve: 11.08.25)

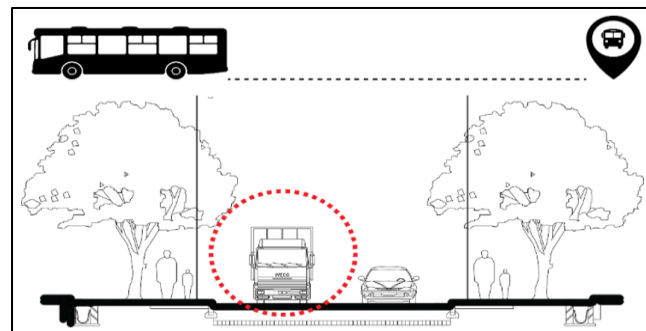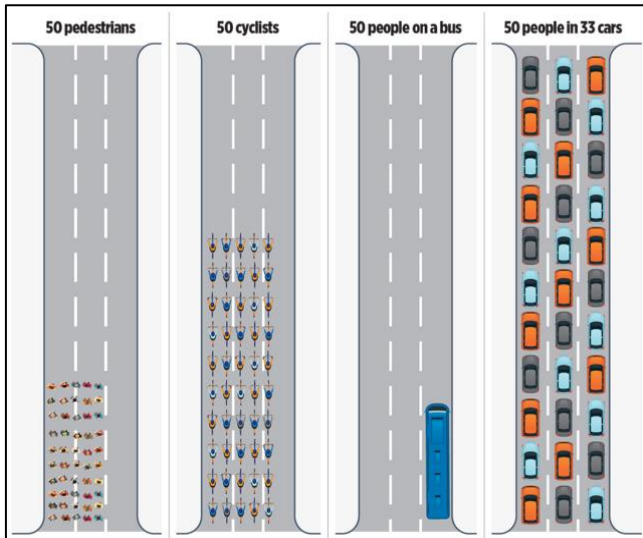Partially traffic congestion occurs due to the street users/vehicle mismanagement what we can find in fig. 07; there is no way to understand what happened or why so traffic jam sitting few meters behind the scene. This can be solved by public concern which can be achieved by training the vehicle drivers properly and maintaining the traffic rules. With the rapid growth of a city, we can replace many smaller vehicles by few bigger vehicles to transport people; road space required to transport 50 people: pedestrians, cyclists, bus passengers, and car drivers [infographic, fig. 08]. We can lessen traffic jam by introducing bigger volumetric vehicle in place of smaller vehicle.

➢ *Refuge Islands and Elevated Crossings:*
Subconsciously people try to avoid the elevated walkways, they want the easier accessibility on the ground. So, the pedestrian friendly walkway is a must. Implementing pedestrian islands and raised crossings at intersections can help to slow down traffic and provide safe zones for pedestrians to pause while navigating busy streets.

➢ *Relocating Hawkers to Foot Over Bridges:*
The proposal to move hawkers to currently underutilized over bridges serve a dual purpose. It enhances the functionality of these structures while simultaneously alleviating road encroachments that lead to accidents and traffic congestion. This relocation would provide hawkers with safer, more visible locations that benefit from steady foot traffic.

Fig 9&10 Foot Over Bridge Need to be Converted to Hawker's Market (Author).

➢ *Innovative Foldable Vendor Shop Design:*
The creation of foldable vendor shops attached to roadside buildings presents a novel approach to organizing street vending. These retractable units can be set up during designated hours, ensuring that they do not permanently obstruct pedestrian pathways or vehicular traffic. This initiative fosters economic activity while promoting improved urban management.
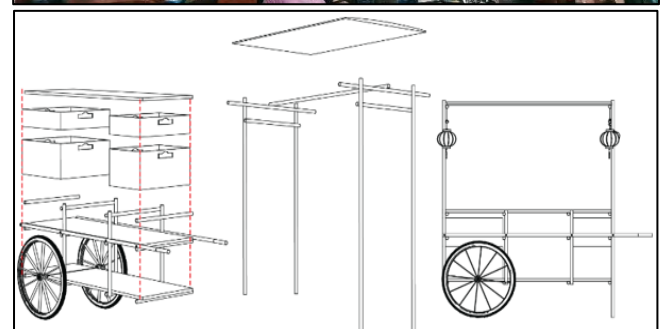

Fig 11&12 Street Vendors Cart Design (Proto-Type).

➢ *Enhancing Traffic Safety and Prioritizing Pedestrians:*
To bolster pedestrian safety, a policy mandating that drivers pause briefly at crossings could be implemented. This measure aligns with international best practices for pedestrian safety, similar to cities where vehicles yield to pedestrians at marked crossings.

➢ *Revitalizing Boundary Walls:*
Dull and uniform walls can be transformed with murals or greenery, enhancing the urban landscape and encouraging the use of nearby pedestrian areas. Traffic Management and Speed Regulation. Places like Ambarkhana, Temukhi, Chowhatta, Zindabazar, Lamabazar where, traffic is vastly congested, and streets doesn't have that much of room for vegetation, Boundary walls can be replaced green walls.

Fig 13&14 Roadside Solid Wall, and Roadside Green Wall (Source: Google street-view), and, https://www.sksteeltw.com/en/product/green-wall-facade.html; retrieve: 11.08.25)

➢ *Speed Control:*
Enforcing speed limits of 30–50 km/h in urban settings and incorporating speed bumps or curb extensions can significantly reduce accident risks. Research indicates that pedestrians have a considerably higher survival rate in collisions when vehicles are traveling at lower speeds.

➢ *Dedicated Pedestrian Walkways:*
Constructing proper sidewalks and pedestrian barriers can effectively direct foot traffic and minimize jaywalking, thereby reducing hazards. Additionally, incorporating trees can enhance the environment.

➢ *Security Guidelines:*

Developing a software-based system, which will help the police to detect the illegal parking and vendors in the streets. Every point of the city should be monitored by the CC camera.

➢ *Upgraded Street Lighting:*
Inadequate lighting heightens the likelihood of accidents during nighttime. Installing sufficient LED lighting along roadways and pedestrian pathways will improve both safety and visibility.

➢ *Driver Education and Enforcement of Traffic Laws:*
Raising awareness of traffic regulations among drivers and ensuring rigorous enforcement is crucial for altering behavior and preventing accidents.

➢ *Underpass or Overpass:*
Existing Overpass are not used that much by the urbanites. Infact,95% of the overpass has been abandoned since their establishments. So, underpass can be a better solution considering its user-friendly zone. Moreover, stepping down creates a psychological impact of not working hard that much in a human's mind. In a whole, underpass is the key solution, for the nodes and existing intersections. But it should be flood- resilient.

➢ *Time Based Street Closing:*
Shahi Eidgah, a possible area of scopes for creating a night life zone is now under a threat of running trucks from the evening. A bypass road is present. So, closing the road in front of shahi Eidgah and maintaining trucks in the bypass lane can create an opportunity for the future tourist city.

➢ *Technology Based Solution:*
Installing speed cameras in Sylhet might be an important step toward improving traffic control and road safety, especially on major highways and high-traffic locations where speeding and reckless driving are prevalent. Here's how it may assist, along with other possible traffic control technologies:

● *Speed Cameras:*
Installing speed cameras at strategic locations, particularly on arterial highways and near accident-prone areas, can discourage speeding by automatically monitoring and recording vehicle speed. This encourages drivers to follow speed restrictions, lowering the likelihood of accidents and enhancing overall road safety (Elvik, 2010). Furthermore, penalties for speeding infractions can help fund road repair and safety measures.

● *Automated Number Plate Recognition (ANPR):*
This system can be used in conjunction with speed cameras to identify and track cars. This might help in managing traffic flow, catching traffic offenders, and ensuring that vehicles are registered and roadworthy.

● *Traffic Signal Synchronization:*
Installing synchronized traffic lights on important roadways, which are managed by smart traffic management systems, can reduce congestion and enhance flow. These

systems modify signal timing based on real-time traffic data, lowering wait times and fuel consumption from idle cars (Stevanovic et al., 2008).

- *Pedestrian Safety Measures:*

Installing pedestrian-specific devices like countdown clocks and lit crosswalks can help to increase pedestrian safety. In congested areas, sensors can detect pedestrian movement, giving them priority at junctions and decreasing accidents.

- *Smart Traffic Cameras for Violation Detection:*

AI-powered cameras can detect and report traffic offenses such as unlawful lane changes, signal jumping, and parking violations. This can assist enforce traffic regulations without relying primarily on manual enforcement, freeing up police resources for other duties.

- *Real-Time Traffic Monitoring and Alerts:*

A real-time traffic monitoring system that includes GPS may offer drivers with live traffic updates, allowing them to avoid crowded regions. Implementing a citywide traffic app for Sylhet will allow vehicles to make more educated route decisions, lowering overall congestion.

- *Public Education and Awareness:*

In addition to technology, public education initiatives on safe driving techniques and road safety are crucial. Compliance may be promoted by teaching drivers about the consequences of speeding, obeying traffic signals, and showing consideration for pedestrian zones.
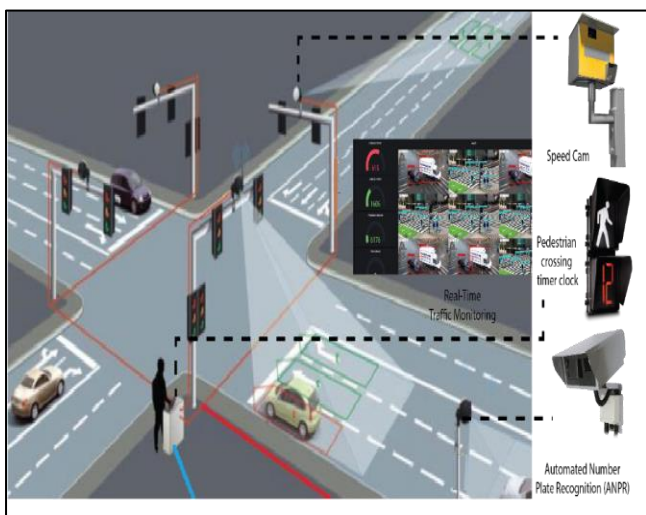

Fig 15 Smart Technologies for Traffic Control
(Source:
https://www.electronicwings.com/users/SUJANAABIRAMI
C/projects/1645/smart-traffic-control-system-using-image-
processing and partially modified by author; retrieve:
11.07.25).

It would take careful planning, community involvement, and consistent funding to implement these technologies in Sylhet. But when combined, they might significantly improve pedestrian safety, traffic flow, and the overall effectiveness and safety of the urban mobility system.

➢ *Public Negligence and Traffic Rule-Breaking Tendencies*

Road safety and traffic management are made more difficult in Sylhet by pervasive carelessness and a propensity to disregard traffic laws. Many locals have a nonchalant attitude toward driving regulations, frequently ignoring speed limits, seat belt usage, and helmet requirements. In addition to regularly crossing roadways carelessly, sometimes ignoring traffic signals and crosswalks, pedestrians also contribute to dangerous circumstances. In addition to a lack of thorough driving instruction, this culture of carelessness is also impacted by the belief that traffic regulations are not properly enforced and that infractions frequently go unpunished (Hossain, 2013).

Since a bribe can occasionally erase a traffic ticket or avoid more severe fines, the frequent tendency to disobey the law without fear of consequences is a key element. Repeated violations are encouraged by this lack of responsibility, which further erodes adherence to traffic regulations and fosters an unsafe, unpredictable driving environment. Research shows that this conduct not only raises the number of accidents but also makes it difficult to create a dependable traffic system that puts safety first (Rahman, 2019).

According to studies, traffic compliance in Bangladesh is among the lowest in South Asia. According to reports, the nation sees 5,000 road deaths on average each year, which are caused by things like rule-breaking and lax enforcement (GovPilot, 2023). Furthermore, the issue has been made worse by a lack of public education and awareness on road safety. The state of road safety in Sylhet and throughout Bangladesh continues to be a serious public health and safety concern in the absence of improved law enforcement, a clearer role description for traffic police, and public education programs.

Both public education and police enforcement must be prioritized in order to address this. According to research, fostering public respect for traffic regulations is just as important to successful traffic safety as enforcing severe fines. There is more potential to lower infractions and enhance road conditions when motorists and pedestrians understand that compliance improves personal safety as well as the safety of the larger community. However, persistent public awareness campaigns, prominent enforcement, and uniform application of sanctions across all groups are necessary to bring about this change in behavior.

A multifaceted strategy centered on strengthening enforcement, driver education, and accountability is necessary to solve the problems of inefficient law enforcement and noncompliance with traffic regulations in Sylhet. Here's how:

- *Increase Traffic Law Enforcement:*

Give traffic cops distinct roles and duties and uniform procedures for handling infractions. By increasing police enforcement's accountability and transparency, the use of body cams and computerized ticketing systems can help lower bribery (Hossain, 2013).

- *Programs for Public Awareness and Driver Education:*

    To inform drivers and pedestrians about traffic laws, safety precautions, and the consequences of infractions, a focused public awareness campaign is necessary. To encourage a culture of safety, incorporate instruction on traffic rules into school curricula and regularly host seminars for drivers (Peden et al., 2004).

- *Driver's License Reforms:*

    Implement more stringent guidelines for acquiring and extending a driver's license. For commercial drivers in particular, this might involve required driving exams and recurring refresher courses to guarantee that all drivers possess the rudimentary knowledge and abilities needed for traffic (Rahman, 2019).

- *Create a Traffic Violation Database:*

    Create a centralized system that allows law enforcement and other government organizations to view traffic infractions for every motorist. In order to promote long-term behavioral change, repeat offenders may be subject to harsher sanctions or possibly a temporary license suspension (Elvik, 2010).

- *Community Involvement and Transparency:*

    To promote safer streets, engage local businesses, groups, and leaders. Inform the public on a regular basis on enforcement actions and road safety enhancements, reiterating the notion that following the law is advantageous to the community as a whole.

- *Upgrade Infrastructure and Monitoring:*

    To keep an eye on traffic behavior, place automated violation detection systems, speed cameras, and CCTV at busy junctions and accident-prone locations. According to Papageorgiou et al. (2003), this technology can lessen the need for manual enforcement and offer verifiable proof to successfully execute sanctions.

    By integrating these methods, Sylhet may improve road safety and compliance while moving toward a more organized and transparent traffic management system.

- ➤ *Smart App for Smart Traffic System*

    Through an inclusive Community Participatory Management System (CPTM), the suggested app-based smart traffic management system for Sylhet has the potential to completely transform urban street management and traffic flow. Here is a summary of the features, potential functionality, and advantages of the app:

- *Real-Time Navigation and Traffic Data:*

    Users may observe real-time traffic updates, recommended routes, and road closures thanks to the app's ability to collect real-time traffic data from GPS-enabled devices and sensors. The software may use this data to dynamically modify traffic signal timings, relieving strain on important junctions and reducing congestion in high-traffic areas.

- *CPTM, or Community Participatory Management System:*

    Residents may use the CPTM app to report problems including illegally parked cars, obstructed pedestrian pathways, faulty traffic signals, and incorrect street vendor setups. Issues can be reported by users and forwarded to the appropriate authorities or community organizations for expedited resolution. This strategy fosters a feeling of local accountability and ownership while reducing reliance on government-only actions.

- *Assigning and Monitoring Tasks to Community Groups:*

    The software improves the interaction between residents and street management by giving community groups particular tasks, which promotes a form of community-based stewardship. For instance:

- ✓ Street Vendor Organization: By organizing specific spaces for vendors, local authorities can maintain clear pedestrian routes.
- ✓ Traffic Marshals: Volunteer groups can assist in managing heavy traffic during peak hours or events.
- ✓ Tree Maintenance Groups: Locals can take charge of making sure that plants in medians are properly watered, pruned, and maintained.

- *Tracking Reports and Issue Resolution:*

    The software tracks every issue that is filed in real time, notifying users when a problem is fixed or assigned to a community member. The app can present a list of complaints that have been rectified and highlight community members who are actively working to improve traffic and street management in order to promote responsibility.

- *Awareness and Training for Drivers:*

    The app may include certification courses, mini-quizzes, and traffic education materials in partnership with regional transportation authorities to increase public awareness of traffic laws and safe driving techniques. Over time, this seeks to lower accident rates by educating people about safe driving practices and reducing the number of unlicensed drivers.

- *Local Funding and Business Involvement:*

    The app may ask nearby companies to promote or sponsor specific street features (such keeping up flower beds or other vegetation). Businesses receive recognition within the app in exchange, which strengthens their resolve to make cities better and motivates them to take an active role in local administration.

- *Traffic Management Database:*

    Long-term planning can benefit from the analysis of data gathered by the app on public behavior, traffic patterns, and reoccurring problems. This information may be used by authorities to pinpoint high-risk locations, schedule upcoming infrastructure upgrades, and create plans for enduring problems like reoccurring traffic jams or unlawful street vendor encroachments.

Fig 16&17 Lot Based Traffic Management App, Zindabazar Street.
(Source: https://youtu.be/37rI-yj6Gow?si=RoFznxibo1YxcIhG; retrieve: 11.08.25)

Fig 18 Smart Traffic Management System (Source: Modified by Author).

> *Community Participatory Traffic Management (CPTM)*

CPTM provides a novel and more efficient approach to road management through community involvement. To make adjustments, authorities frequently have to deal with a lot of paperwork and red tape, which can result in persistent problems including inappropriate street vendor locations, unlawful store expansions, poorly maintained street plants, and traffic hazards to go unaddressed for a longer time. When only the authorities attempt to address these problems, it takes longer, and individuals are already impacted by the time any actions are taken. Reliance on officials is one reason why these issues continue to reappear. One major factor contributing to these problems' recurrence is the absence of a sense of ownership and responsibility within the community. By allocating duties to various community groups, CPTM promotes a sense of ownership and forges a bond between the roads and the neighborhood.

• *Community Groups Involvement in CPTM:*

Considering the problems, CPTM identifies groups within the community according to their role, function, age group and allocates responsibilities accordingly to enable more time-effective solutions. A very natural and acute sense of ownership and responsibility rises within the community in the process. The community groups are:

Table 7&8 CPTM Structure

Group	Age Group	Role	Functions	CPTM-Specific Duties
Regulatory Body	Mixed (All Ages)	Decision-making and supervision	Ensures unity, oversees community affairs	- Supervise CPTM system - Report activities to traffic authorities - Coordinate among groups - Distribute duties - Context-based decision-making
Students	10–17	Learning and early engagement	Develop understanding of community, act through schools	- Roadside tree plantation • Ages 10–14: pedestrian-side only • Ages 15–17: allowed on medians - Each student maintains 3–5 trees - Report on upkeep
Youth Clubs	18–40	Social activism and innovation	Lead community change, form activity groups	- Volunteer management of student tree programs - Participate in traffic control during need

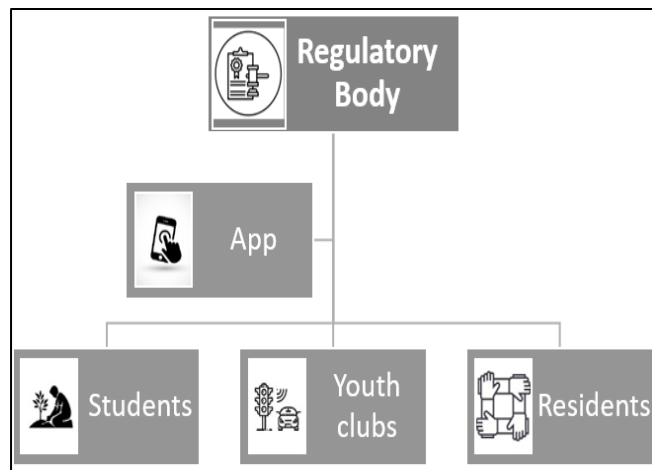| Residents	All Ages	Core community stakeholders	Maintain civic responsibility, support safety and development	- Report traffic crimes via app - Raise awareness and community engagement - Supervise youth and students - Manage funds for youth/student activities

Fig 19 CPTM Group's Coordination Structure

V. CONCLUSION

In terms of urban street planning and traffic control, Sylhet City Corporation has a number of interconnected problems, such as extreme traffic, poor pedestrian infrastructure, and a lack of green space. Urban quality of life and walkability are compromised by narrow and badly maintained sidewalks, high surface temperatures from hardscape materials, and a lack of clearly designated pedestrian spaces. Inadequate law enforcement and poor driver instruction hinder traffic flow, while illegal street sellers and shop expansions make it harder for pedestrians to cross the street. A multifaceted response to is required. When combined with community involvement, the implementation of an intelligent, app-based traffic management system will expedite issue reporting and foster efficient communication with law enforcement. Promoting a feeling of local pride may assist reduce illegal vendor activity and enhance long-term compliance with street-use regulations.In order to reduce heat and improve pedestrian comfort, shaded green areas along sidewalks and medians must be created and maintained. Sylhet can build a more secure, accessible, and sustainable urban environment and lay the groundwork for resilient future expansion by instituting a thorough set of rules centered on morphology, environment, and community involvement.

ACKNOWLEDGEMENT

ABBREVATION

CPTM: Community participatory traffic management, SCC: Sylhet City Corporation

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