



Enhancing Pedestrian Safety on Critical Stretch of South-West Zone, Surat City

¹ Prof. Sejal S. Bhagat, ² Drashti R. Patel

¹ Assistant Professor (M. Tech - TCP), Civil engineering Department, Sarvajani Collage of Engineering & Technology, Surat

² M. Tech. (Town and country Planning); Sarvajani Collage of Engineering & Technology, Surat

Abstract : The increase in population has contributed to a rise in the demand of vehicles, which has raised the number of vehicle accidents. Thus, in India, traffic accidents rate among the world's leading causes of mortality. The Ministry of Road Transport & Highways reports that there will be 11.9% more road accidents in 2022 than there were in 2021. Although roads and junctions are constructed with vehicular traffic in mind, pedestrian traffic is ignored. One obvious example of a sustainable form of transportation is walking. The utilization of non-motorized modes of transportation and enhancing streets through appropriate, inclusive, visionary city planning are highlighted in the National Urban Transport Policy of 2006. Surat Municipal Corporation is working to provide non-motorized transport amenities, including as bike lanes and walkways, in Surat city together with other transportation infrastructure. Street for people challenge inspire cities to create walking-friendly street through quick measure, in response to COVID-19 This study area of work includes data gathering on pedestrian behavior, accident analysis, infrastructure evaluation, driver compliance, and safety awareness. The research will identify problem areas, propose solutions, and produce a complete pedestrian safety plan for the selected area. However, these are not being used efficiently because of a lack of administrative skills and public awareness. The research focuses on important metropolitan roads in Surat and applies a non-motorized transportation approach to intersection planning and redesign.

Index Term: NMT, Pedestrian safe movement, walking street, pedestrian infrastructure, safety -

I. INTRODUCTION

The scenario is going to deteriorate as a result of the continued expansion. Energy and land conservation, pollution control, and greenhouse gas emission reduction are all urgently needed. Both are major contributors to these problems and a solution is urban transportation. Therefore, planning and managing infrastructure and urban transportation services need to be done right now. India's second-largest energy consumer is the transportation sector. Every type of road user is having trouble getting around. The pedestrians are deprived of a path that is safe, clear of obstacles, and free from conflicts. There is currently a severe lack of infrastructure and urban transportation services, both in terms of number and quality. Walking, bicycling, and using public transportation are examples of preferable means of transportation; in contrast, the usage of cars and two-wheelers is increasing. As a result, traffic congestion is getting worse, urban mobility and road safety are decreasing, and pollution, fossil fuel use, and accident rates are constantly increasing. The NUTP was launched by MOUTH in 2006, with a focus on promoting the use of non-motorized transportation and enhancing streets through appropriate, inclusive, and visionary city planning. In Surat city, SMC is also making an effort to provide NMT amenities like bike lanes and walkways in addition to other transportation infrastructure. However, they are not being used effectively because of a lack of public knowledge and administrative skills. The NMT method to intersection planning and redesign on a major Surat road is the subject of the researcher's work.

1.1 Importance of non-motorized form of travel

Nowadays, the majority of research on urban transportation planning in developing nations tends to focus on motorized transportation infrastructure (both public and private). As a result of increased motorization, there is a rise in traffic jams, environmental degradation, and traffic accidents. NMT, or non-motorized transport, is one of the best alternatives to mitigate the

drawbacks of motorization. The non-motorized modes of transportation include riding on foot, bicycles, rickshaws, and vehicles drawn by animals. Non-motorized modes are safe, easy to use, non-polluting, and utilize locally available human and animal energy. They involved minimal operating costs. These modes are great choices for excursions up to 5 km in duration and are practical for shopping, school outings, and crowded areas. Bicycles appear to be the second most dependable means of transportation after walking, which is arguably the most basic for short distances. Some amenities that are bike and pedestrian friendly are to maximize non-motorized mobility, a great urban environment that ensures safety, accessibility, and proximity is also vital.

2. Literature Review

A number of transportation issues have developed as a result of the rapid urbanization and growing economic growth. Significant air pollution, high accident rates, air traffic congestion, and greenhouse gas emissions have resulted from the extraordinary growth in the usage of private autos. Old towns and the core business district, which were built with pedestrians in mind, do worst. surroundings Degradation in these areas affects people's health and causes a variety of illnesses. As a result, preserving pedestrian safety is essential to the overall transportation system. Pedestrian comfort, safety, and freedom of movement are all directly impacted by vehicle traffic. quicker in pace Everywhere in the city, there has been an increase in car traffic, which has led to more accidents and less safety for pedestrians. (Shafna shukkoor, Sangeeth K, 2021).

The transportation system has become the lifeblood of any city, but even though it is intended for human traffic, pedestrians—those without cars—rarely have any good space on these roads. The transportation circumstances for non-motorized travel are deteriorating in cities due to the unclear status of this mode of transportation in an urban transportation system, underscoring the urgent need for change. A key component of road design is the comprehensive integration of pedestrian needs and traffic challenges. preservation of nature and possibilities For cross-cultural exchange, a resource-conserving setting with efficient public transit and more walking options should be established. major objectives for urban planners. The pedestrian network is crucial to the expansion of cities. (; Sejal bhagat, Manoj patel, Palak shah, 2014)

Because cars and two-wheelers are among the most common Personal Motorized Vehicles (PMV) in Indian cities, traffic congestion is a problem. Public transportation is frequently despised for a variety of reasons, including inadequate frequency on connected routes, a lack of awareness regarding utilization, and others. The current street design on Sitabuldi Market Street, which is favored by pedestrians, is being examined to find issues pertaining to pedestrian movement. encountered by walkers, and extra measures are being taken by proposing a suitable roadway design to improve pedestrian circumstances. (Amruta kakirde, Omkar Parishwad, 2016)

2.1 Case study of Atal Path Bhopal, Madhya Pradesh

During the first phase of the Smart City selection process, Bhopal was designated as a Smart City. With a population of about 18 lakhs and an area of 285.9 sq km, the city has implemented ₹380 Cr. of smart mobility initiatives out of 83 projects totaling ₹3105 Cr. under the Smart Cities Mission. Based on the ideas of transit-oriented development, Bhopal implemented area-based development (ABD) in the New Market area. The Atal Path, which serves as the ABD's main artery, is designed as a prototype next-generation road with contemporary amenities and an inclusive Route of Travel for all forms of transportation. The project is designed to be a spine that passes through the New Market neighborhood and is safe for bicyclists and pedestrians. This project is unique in Bhopal as it incorporates subterranean utility conduits within the RoW structure. The project's goal was to create cutting-edge street infrastructure in the ABD region that sets the standard for future work and integrates all of the components of a healthy street's design. (street for people(pathway of change from india's smart cities) Design criteria of Atal path

- A 8.6m wide continuous footpath with elements like raised property entries are incorporated to maintain a, continuous walking surface at a uniform level.
- 2.5m wide segregated cycle tracks on both sides at the footpath level along with cycle boxes at junctions have been implemented to improve cycling infrastructure.
- Green verges are implemented to guide pedestrians to cross at the junction crossings.
- Cobblestone strips are provided on the carriageway surface for traffic calming.

- The junctions are realigned and made compact to reduce the speeds of the turning vehicles. Further to improve walking and cycling continuity at the junction, cycle tracks are lowered at the carriageway level. Bollards are installed along the crossings to ensure motor vehicles do not encroach the pedestrian/ cyclist zone.
- Addition of the utility trench below the cycle track was one of the key design features of the street transformation.
- Materials like bituminous concrete, Kota stone, tactile tiles for footpath, and Thermodrin FRP Covers have been used as part of the design (street for people(pathway of change from india's smart cities))

3. Recommended policies

3.1.1 Smart Cities Mission's Role: Since its launch in 2015, the Smart Cities Mission has emphasised the need for networks of safe, inclusive, accessible, and liveable streets as a strong foundation on which smart cities can grow. The Mission developed guidelines for the design of Healthy Streets to support the creation of safe walking and cycling infrastructure. In 2020, as Covid-19 brought our cities to a halt, citizens across India took to walking and cycling not just to exercise, but also to access essentials and services. Leveraging this opportunity, the Smart Cities Mission launched two national initiatives—the Streets4People and India Cycles4Change Challenges—to inspire Indian cities to work with their citizens and urban practitioners to create walking and cycling-friendly streets. Over 1300 Smart Mobility projects have been implemented under the Mission including over 2500 km of Smart Streets with universal accessibility and designated pedestrian paths, and over 570 km of cycle tracks. 15 cities have adopted the Health Streets Policy and 9 cities are working towards its implementation. 19 cities have prepared 3 year action plans with network plans for scaling up walking and cycling transformation. To increase the uptake of cycling, cities have also deployed public bicycle-sharing systems with over 10,000 bicycles and launched several awareness campaigns such as Cycle to Work. With support from the Mission, cities across the country have been able to achieve dramatic transformations of their streets. This compendium aims to capture the learning from these projects to provide inspiration and valuable lessons for other cities across the country to scale up this transformation nationwide. (Ministry of Housing and Urban Affairs, 2024)

3.2.1 Indian road congress (IRC 103-2012):

Walking on foot is a very important kind of transportation. A sizable percentage of journeys up to 1.2 kilometers in length in urban areas are made by foot. Furthermore, every journey must begin and end with a stroll. Fitness is a plus for pedestrians who do not use gasoline. Pedestrian amenities make residential areas and districts more interesting and safe while also adding to the liveliness of the urban environment. (IRC:103-, 2012) Pedestrian facility are describe below:

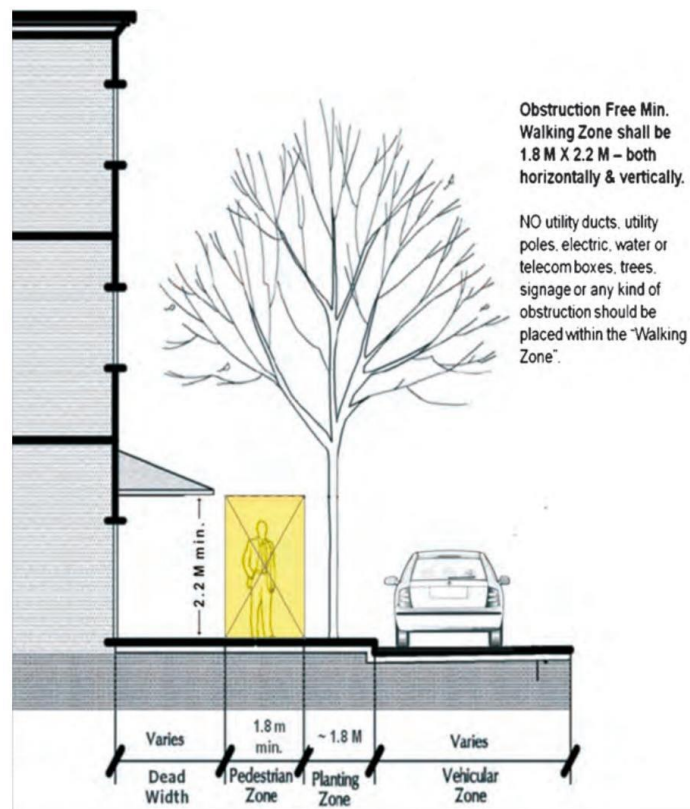
3.2.1.1 At grade pedestrian crossing:

Sidewalks, crosswalks, grade-separated pedestrian crossings, and shared use routes are examples of pedestrian facilities.

Footpath / sidewalk: Pedestrian footpaths are defined as any area primarily used by 'all' pedestrian. They can be adjacent to roadways, or away from the road. Footpaths should be regarded as a transportation system which is connected and continuous, just like roadways and railways. (IRC:103-, 2012)

Footpath / sidewalk should be divided in to three zones walking or pedestrian zone primary Function of this zone is to provide free walking for people without any obstructions, frontage or dead zone function is to serve as a transitional space between public footpath & building line, footpath or furnishing zone can consists of plants / tree light pole, road furniture. footpath width is 4 m and vertical clearance is 2.2 m, frontage width is 0.5 m, furnishing width is deepened on the type of road. (IRC:103-, 2012).

Figure 1 clear walking zone with separate from planting zone



(Source: Indian Road Congress 103-2012)

Pedestrian crossing: Pedestrian crossings are often available at intersections or the midblock portion of the roadway where they are intended to be used. Principles of pedestrian crossings

- Pedestrian must be given the shortest possible direct route to cross the street; therefore the most preferred crossing for them is “at-grade”.
- Mid Block Crossings must be provided for people to cross the street safely between building entries or bus stop locations or active land uses on opposite sides of the street.
- Crossings must be provided at all T-junctions.
- At grade pedestrian crossing both near intersection and mid-block, raised pedestrian crossing (table top) should be made mandatory in case of multilane roads with heavy volume of vehicular traffic. (IRC:103-, 2012)

3.2.1.2 Grade separated pedestrian crossing: Grade-separated pedestrian crossings are elevated or underground crossings designed to separate pedestrians from vehicular traffic, ensuring safety and efficiency. These crossings typically involve overpasses, underpasses, or bridges, allowing pedestrians to cross roads without interfering with vehicle flow. They offer numerous benefits, including reduced risk of accidents, improved traffic flow, and enhanced pedestrian mobility. Grade-separated crossings also promote pedestrian comfort and accessibility by minimizing waiting times at traffic signals and providing uninterrupted pathways. Additionally, they contribute to urban aesthetics and can be integrated with public spaces or green infrastructure.

Foot over bridge: A foot over bridge (FOB) is a raised structure constructed to allow pedestrians to safely cross over busy roads, railways, or other obstacles without obstructing vehicular or railway traffic. These bridges are typically equipped with staircases, ramps, or elevators for accessibility and are often adorned with handrails for safety. FOBs serve as vital pedestrian infrastructure in urban and suburban areas, providing safe passage across high-traffic areas where at-grade crossings would be hazardous.

Pedestrian subway: pedestrian subway, also known as an underground pedestrian passage or pedestrian underpass, is a subterranean walkway designed to facilitate safe and convenient pedestrian crossings beneath roadways, railways, or other barriers. These underground passages are typically accessed via staircases, ramps, or elevators and are equipped with lighting, signage, and other safety features. Pedestrian subways offer several advantages in urban and suburban environments. They provide a dedicated and protected space for pedestrians to cross busy thoroughfares or railway tracks without the need to contend with vehicular or

train traffic. By separating pedestrians from vehicles or trains, pedestrian subways enhance safety and reduce the risk of accidents, particularly in areas with high pedestrian and vehicle volumes.

4. Study area profile

The state of Gujarat in western India contains the city of Surat, which has seen tremendous urbanization and population increase in recent years. Surat is one of the biggest cities in Gujarat and the nation, with an estimated population of over 7 million as of the most recent data available. In surat city, which has 9 zone currently. The selection of zone which is based on population. According to the comprehensive mobility plan 2046, observed that west zone and south west zone has the higher expenditure as compare to different zone. The critical stretch selected on below list. The city contains lower and moderate income group housing, resulting in a high NMT and PT share, About 28% of work trips are made by two wheelers, whereas only 0.52% trips are made by PT. Work trips made by three wheelers contributes to 4.6%. For education purpose, about 13% of trips are made by walk and cycle.

Surat has different zone. Pedestrian in surat have average walk trip length of 2.9 km. pedestrian trip are for the educational purpose is 29% and Generally run on the katargam, vedgam, khodiyar nagar walled city, athwagate. In sachin udhna Walk trip area generated due to the diamond and textile industries. First three selected zone are considered as per walkability map. Then counting the school on the district education Office in Surat. Area of the zone are listed on the surat municipal corporation. Major focus on the Institutional, Market, Commercial area because average walk trip are generated on this Area According to the comprehensive mobility plan surat. The total number of school in surat is 1355, with 7,63,424 number of student enrolled. 47% of the trips are by NMT transport modes, 31% are walk trips and 14 are cycle trips.

Concluding remark

Based on a comprehensive literature review on pedestrian safe movement, it is evident that ensuring the safety of pedestrians is a multifaceted challenge that requires a holistic approach. Numerous studies emphasize the importance of various factors such as infrastructure design, traffic management, enforcement of regulations, and public awareness campaigns in promoting pedestrian safety. Infrastructure interventions such as sidewalks, crosswalks, pedestrian signals, and traffic calming measures play a crucial role in creating safe environments for pedestrians. Additionally, the implementation of innovative solutions like pedestrian bridges, underpasses, and dedicated pedestrian zones can significantly reduce the risk of pedestrian accidents.

Furthermore, effective traffic management strategies, including speed reduction measures, traffic calming techniques, and the separation of pedestrian and vehicular traffic, are essential for enhancing pedestrian safety. Strict enforcement of traffic laws, particularly regarding speeding and yielding to pedestrians, is also critical in preventing accidents and ensuring compliance with safety regulations. Moreover, education and awareness campaigns aimed at both pedestrians and motorists can help promote a culture of safety and encourage responsible behavior on the roads.

References

- 1) Indian road congress(IRC:103-2012)
- 2) Street for people (pathway of change from India's smart cities)
- 3) Mona Fernando, Goran Smith, Elisa Conticelli, Pedestrian Network Concept: A Systematic Literature Review, 2023 <https://doi.org/10.1016/j.urbmob.2023.100051>
- 4) Alireza Mohammadi, Behzad Kiani Hasan,2023, Pedestrian Road Traffic Accidents in Metropolitan Areas: GIS-Based Prediction Modeling of Cases in Mashhad, Iran, ,Sustainability 2023, 15, 10576. <https://doi.org/10.3390/su151310576>
- 5) James Damsere-Derry, Nicholas Anarfi Bofah,2023, Road safety benefits and challenges associated with pedestrian footbridge patronage along the Madina-Adenta highway, <https://doi.org/10.1080/21650020.2023.2193240>
- 6) Laxman Singh, Geetam Tiwari, 2023, Identification of road traffic crashes hotspots on an intercity expressway in India using geospatial techniques, <http://creativecommons.org/licenses/by-nc-nd/4.0/>