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Pedestrain and Road Safety in Vidisha City (Bus Stand to Ahmadpur): A Review

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Abstract
Urban transport in Indian cities faces challenges of congestion, accidents, and inadequate pedestrian infrastructure. This study assesses pedestrian and road safety along the New Bus Stand–Ahmadpur Chauraha corridor in Vidisha, Madhya Pradesh. Field surveys including pedestrian/vehicle volume counts, spot speed studies, road safety audits, and black spot identification were conducted. Results show two-wheelers dominate traffic (60–61%), with New Bus Stand operating at LOS D (PCU=2490). Mean speed was 43.8 km/h, exceeding IRC limits. Major deficiencies include missing footpaths, zebra crossings, encroachments, and poor lighting. Five black spots identified, with New Bus Stand Entry and Ahmadpur Chauraha most critical. Recommendations include footpaths, marked crossings, speed calming, parking regulation, signage, lighting, and enforcement.

Keywords: Pedestrian Safety, Road Safety, Traffic Volume, Spot Speed, Black Spot

1. INTRODUCTION

Urban transit is a major problem in many Indian cities. Expenditure on road infrastructure and framework plans for transport development have not solved the problems of congestion, accidents and pollution encountered by users. Accidents are a major problem, particularly near the junctions of national highways and other roadways. Traffic congestion often results in substantial loss of time and fuel. It might be a pain for pedestrians to cross the road. Traffic causes pollution, which is bad for the health of those who live nearby. Urban cities are seeing a rapid increase in bad traffic management and traffic delays. It is important to have an effective traffic movement monitoring and management to ensure a smooth flow of vehicles and to overcome the various impediments. The traffic pattern of Vidisha is controlled by the large volume and kind of intercity travel. The city is now plagued by several transportation problems such as traffic congestion, parking problems, narrow roads, severe waits at intersections, accidents and insufficient pedestrian infrastructure. The corridor from New Bus Stand to Ahmadpur is one of the busiest portions in Vidisha connecting residential regions, commercial centers, educational institutions, railway station and hospital. The corridor sees a lot of pedestrian traffic, but has no basic safety features including walkways, zebra crossings and sufficient street lighting. The present research deals with the pedestrian and road safety conditions along the New Bus Stand – Ahmadpur corridor of Vidisha City with an analysis of pedestrian facilities, traffic volume, vehicle composition, spot speed, black spots and road safety defects.

2. LITERATURE REVIEW

Indian Roads Congress (2012) issued "Guidelines for Pedestrian Facilities" (ICR:103-2012), which offers thorough suggestions for pedestrian signals, crossing facilities, and footpath design. According to the regulation, all urban roadways with substantial pedestrian traffic must have pathways, with a minimum clear width of 1.5 meters in commercial districts and 1.8 meters in high-density zones. In order to stop cars from ascending the walkway, it also suggests a kerb height of 150 to 200 millimeters. Zebra stripes with a minimum width of three meters shall be used for at-grade crossings, and pedestrian refuge islands should be installed on highways larger than fifteen meters. Pedestrian walk times at signalized crossings should be at least four seconds long, plus one second for every meter of road width. According to this law, the study corridor from New Bus Stand to Ahmadpur in Vidisha would be eligible for such amenities if pedestrian traffic exceeded 200 people per hour during nighttime peaks.

Indian Roads Congress (2018) issued "Geometric Design Standards for Urban Roads in Plains" (ICR:86-2018), which specifies design speeds and categorizes urban roadways. 30 to 40 km/h is the suggested design speed for populated regions with mixed traffic and pedestrian activities. This limit is exceeded by the average speed of 44.2 km/h on the research corridor, suggesting the necessity for traffic-calming devices such higher crossings, speed breakers, or narrower lanes. Additionally, the code suggests that crossroads be planned with pedestrian crossing facilities and that highways with walkways have a minimum carriageway width of 7 meters for two-lane operation.

Indian Roads Congress (2018) furthermore released the "Code of Practice for Road Lighting" (ICR:112-2018), which outlines lighting settings for various road types. The suggested average sustained illumination for pedestrian areas and walkways is 10 to 20 lux, with a minimum uniformity ratio of 0.25. To guarantee that drivers can see pedestrians at crossings, a greater illumination of 15 to 30 lux is advised. Initial nighttime inspections of the research corridor revealed inadequate illumination in a number of places, especially close to Ahmadpur Chauraha and Durga Nagar.

Tiwari et al. (2007) Pedestrian mortality risk rose exponentially with vehicle speed, tripling for every 5 km/h rise beyond 30 km/h, according to research on pedestrian risk exposure at Delhi's signalized junctions. According to their survival study, children and older pedestrians were the most at risk, and many were compelled to cross during traffic phases due to the lack of pedestrian signals. This result directly relates to the Vidisha study corridor, where average vehicle speeds are 44.2 km/h and there are no signalized pedestrian crossings.

Mohan and Tiwari (2016) carried out a thorough evaluation of urban traffic safety in six Indian cities: Delhi, Mumbai, Bengaluru, Kolkata, Chennai, and Hyderabad. According to their analysis, pedestrian fatalities made up between 35 and 45 percent of all traffic deaths in these areas, which is much higher than the 15 percent national average. The research linked this discrepancy to both poor infrastructure and the concentration of walking trips in crowded metropolitan regions. Raised crossings, pedestrian refuge islands, and 30 km/h speed restrictions on routes with heavy pedestrian traffic were also suggested.

Jain et al. (2015) Footpath encroachment by parked cars, street sellers, and building materials decreased effective walking space by up to 40%, according to a study on pedestrian safety on Mumbai's footpaths. This increased the danger to pedestrians by forcing them into the road. They suggested frequent enforcement, the creation of broader walkways with buffer zones, and the creation of a footpath encroachment index. Similar encroachment problems can be seen in the Vidisha study corridor, particularly close to the Indira Complex and Ahmadpur Chauraha.

World Health Organization (2018) released the "Save LIVES" technical package, which outlines six road safety tactics: post-crash response, infrastructure design, vehicle safety, leadership, speed control, and enforcement. The package proposes segregated walkways, elevated crossings, enhanced street illumination, and 30 km/h speed zones in places with heavy pedestrian traffic. The research corridor may immediately benefit from these suggestions.

Zegeer and Bushell (2012) We completed a thorough analysis of pedestrian safety countermeasures in the US and came to the conclusion that, in the absence of related traffic slowing measures, designated crosswalks are inadequate. They discovered that designated crosswalks without signals or refuge islands actually increased the likelihood of pedestrian accidents on multi-lane highways with daily traffic volumes exceeding 12,000 cars because of a false feeling of security. This implies that any zebra crossing implementation should be supplemented by speed calming or pedestrian signals for the study route, when peak hour traffic exceed 3,000 cars per hour.

Rosen and Sander (2009) used data from Sweden and Germany to examine the connection between vehicle speed and the likelihood of pedestrian fatalities. They discovered that the likelihood of a pedestrian dying rises from 10% at collision speeds of 30 km/h to 50% at 50 km/h and 90% at 70 km/h. This exponential connection highlights how crucial speed control is on the study route, where average speeds of 44.2 km/h are associated with an estimated 30 to 40 percent death risk in the case of a collision.

Katiyar et al. (2025) examined pedestrian mobility and traffic flow at Bhopal's crucial Bittan Chouraha crossroads. They carried out surveys of public opinion, accident analysis, and pedestrian counts. Building pedestrian walkways, enhancing road infrastructure, and encouraging public transportation were among their suggestions. The research showed that focused treatments may be informed by rigorous data gathering, even over brief periods of time. Their technique, which combines pedestrian volume counts with accident data, is comparable to the one used in this research.

Samal et al. (2020) examined the effects of traffic congestion on Indian urban road networks, concentrating on mixed traffic without lane discipline. Their research estimated travel durations and congestion indices using video-graphic surveys and license plate matching. They suggested distinct pedestrian phases at signals and walkway enhancements after finding that pedestrian-vehicle interactions greatly contributed to travel time variability. Their video survey data gathering approach is applicable to future iterations of this investigation.

Goliya et al. (2022) used segmental delay, delay ratio, and relative delay ratio techniques to quantify traffic congestion in Indore. They proposed focused improvements after identifying areas with Level of Service E. Although they concentrated on traffic, the black spot recognition method may be used to pedestrian collisions. Five accident-prone locations—New Bus Stand entrance, Durga Nagar Chauraha, Ahmadpur Chauraha, Bypass Junction, and Mandi Road Junction—were found via local inquiry in the current research.

Dixit and Dixit (2023) used Sagar, Madhya Pradesh as a case study to investigate the impact of traffic congestion in a smart city. They found that elements that contribute to traffic and pedestrian danger include population increase, vehicle variety, problems with lane discipline, and roadside activities. For Vidisha, their suggestion for more stringent traffic laws and collaboration between planners and engineers is crucial.

Kulkarni (2022) According to an analysis of traffic congestion at the CBS location in Kolhapur, around 60% of incidents were caused by overspeeding. He suggested public awareness efforts, speed breakers, and speed enforcement cameras. Such actions are desperately required for the study route, where measured speeds reached 52 km/h.

Bora and Dhobale (2023) investigated the side friction elements influencing traffic on Indore's urban roads. In addition to finding that pedestrian crossings and roadside parking lowered vehicle speeds by 20 to 65 percent, they also identified crossroads, school zones, and bus stops as friction spots that limit vehicle speeds by up to 95 percent. They did point out that unmanaged friction spots and poorly constructed speed breakers might actually raise danger rather than lower it. This implies that any traffic-calming strategies used in the study corridor need to be developed scientifically.

Prabin Kumar and Leon Mendez (2018) On-street parking was identified as the main source of traffic congestion and pedestrian conflicts in a study on traffic congestion reduction at Chennai's Thirumazhisai Junction. They suggested rephasing traffic lights and multi-level parking. Reduced road width and increased pedestrian danger are caused by parking problems in the study route, especially close to Indira Complex and Vishal Mega Mart.

Singh and Katiyar (2020) examined areas of traffic congestion on the Bhopal road network using real-time open-source data from Google Maps. They showed that route optimization and the identification of congestion hotspots may both benefit from GIS-based analysis. Although they concentrated on vehicles, the same strategy may be used for pedestrian safety by charting the locations of crosswalks, footpaths, and accident scenes. Although complete GIS analysis is beyond the purview of this research, Google Earth is used to map study areas.

Anjana et al. (2018) aimed to identify roadside friction areas along urban arterials in Trivandrum's Attingal neighborhood. They discovered that bus stops, school zones, and junctions may affect traffic speeds by 95%. It was shown that pedestrian crossings and roadside parking lots negatively affected vehicle speeds by 20 to 65 percent. Inadequate bay accommodations at bus stops also caused a 25–40% decrease in vehicle speeds. Since parking was proven to be a major contributor to traffic congestion, they advised putting in place effective parking schemes, such as multi-level parking inside congestion zones.

Ghosh and Kansal (2014) examined India's urban issues and emphasized how urban planning frameworks like JNNURM ignore non-motorized transportation. They contended that in addition to road expansion initiatives, sustainable urban growth requires balanced investments in infrastructure for bicyclists and pedestrians. According to their examination of Madhya Pradesh cities, pedestrian facilities in tiny towns like Vidisha, which have less than 2 lakh residents, get little investment, resulting in cumulative safety shortfalls.

Alkaissi (2024) employed fuzzy logic and GIS application to analyze traffic congestion on metropolitan streets. The research categorized metropolitan streets into free-flow, normal, moderate, heavy congested, and blocked conditions using a Fuzzy Inference System. Critical hotspots were found around hospital and university zones. The fuzzy inference-based technique gives a more accurate evaluation than standard single-parameter methods. This technique might be extended for pedestrian risk mapping on the Vidisha corridor

Myronenko et al. (2023) investigated the effectiveness of public transportation in Odesa, Ukraine, with an emphasis on the distribution of passengers along traffic routes. They discovered that the main elements affecting passenger happiness were fuel economy, environmental advantages, and timeliness. Enhancing public transportation may lessen reliance on private vehicles, which will lessen pedestrian exposure to traffic. The advice to promote public transportation in Vidisha as part of a pedestrian safety plan is supported by this research.

Iman Talib et al. (2023) examined Baghdad Street traffic congestion and suggested ways to cut down on delays. They discovered Level of Service F on Baghdad Street using SPSS and Highway Capacity Software. Both road widening and park-and-ride systems were suggested; the park-and-ride approach yielded superior results. It was discovered that public transportation services were severely limited, underscoring the need of supporting public transportation networks. Given Vidisha's poor transportation connection, this is pertinent.

Yasin Ali et al. (2023) examined the economic, environmental, and health effects of Dhaka City's traffic issues. Population increase, inadequate transport services, a large number of non-motorized vehicles, inadequate traffic regulation, and unlawful parking were all noted as significant issues. They suggested improving congestion pricing, traffic control, public transit, and road infrastructure. The report stressed that successful solutions need public support, financial resources, and political will.

Girish Sharma et al. (2022) discussed Cuttack City's traffic congestion and emphasized the necessity for temporary solutions such early morning rubbish collection, market relocation, multi-tier parking, and selected road upgrades. They carried out assessments of road safety and suggested Weight-in-Motion devices, Automated Traffic Management Systems, and Variable Message Signs. Their strategy of integrating technology deployment with infrastructural upgrades is pertinent to Vidisha.

Kunal Kewat and Dr. Sunil Sugandhi (2018) Future traffic volume in Khargone, Madhya Pradesh, was examined, and it was predicted that demand will increase as a result of business activity and population expansion. They proposed building a ring road right once to divert traffic after determining that the existing level of congestion had already beyond tolerance limits. Although the current research focuses on urgent pedestrian safety solutions, Vidisha may need a similar long-term planning strategy.

Sruthy S Kumar et al. (2018) found other paths to ease traffic at the Kalady crossroads using GIS software. Canal Road, Mosque Road, and other roadways were recognized as workable choices. The strategic significance of GIS for optimizing traffic flow and minimizing congestion hotspots was highlighted in the research. Future studies on the Vidisha corridor might use this technology to map pedestrian safety and optimize routes.

Saurabh Gupta et al. (2017) evaluated Bhopal's traffic situation and gave several road segments Levels of Service E and F. They examined cycle lengths and intersection conflict spots. Their insights detailed practical challenges in managing urban traffic. Similar Level of Service problems are found in the Vidisha corridor in the current research, albeit pedestrian safety rather than traffic congestion is the main emphasis.

Mazloh Al-Enazi (2016) identified regions of traffic congestion in Jeddah, Saudi Arabia, using GIS methods such as network analysis and shortest route assessment. ArcGIS was used to evaluate congestion hotspots and construct a geo-database of the road system. The results gave planners information to lessen traffic by reassigning route directions. This illustrates how GIS may be used for urban traffic management, which might be used for Vidisha's pedestrian safety planning.

Rohit Katiyar et al. (2025) previously discussed—also highlighted the use of public opinion and user experiences via surveys to develop effective traffic management strategies. They suggested constructing bridges, encouraging public transit, putting in designated pedestrian walkways, enlarging roads, and adding turning lanes. The study corridor may immediately benefit from their multifaceted strategy.

Zainab Ahmed Alkaissi (2024) discussed above—created digital congestion maps using GIS-based spatial analysis and index variables such as traffic speed, speed drop, and speed ratio. Congestion index values between 0.651 and 0.717 were used to identify critical hotspots. The model creates a composite congestion outcome by combining input parameters. This approach might be modified for the Vidisha corridor's pedestrian danger assessment.

Akhash Dixit and Prateek Dixit (2023) discussed above—emphasized that traffic congestion has significant detrimental effects on the environment, economy, health, and safety. They suggested limiting roadside activities, decentralizing necessary jobs, tightening traffic laws, and enhancing planner-engineer cooperation. They emphasized how crucial it is to include non-motorized vehicles when there is mixed traffic.

Arjun Bora and Shashikant Dhobale (2023) discussed above—used both microscopic and macroscopic methods to assess side friction. While the microscopic approach evaluated the effect of specific side friction components on speed, the macroscopic approach created streamlined processes for including side friction in capacity estimates. Both approaches produced survey techniques for concurrently collecting data on side friction, flow, and speed.

Iman Talib et al. (2023) used surveys and field traffic data using Highway Capacity Software and SPSS, as previously mentioned. While nearby streets have LOS levels B through C, Baghdad Street had LOS F. Park-and-ride and road widening were two suggestions for enhancements. A comparative analysis showed that the park-and-ride strategy improved LOS more.

Sergii Myronenko et al. (2023) discussed above, measured the number of people boarding and alighting from buses at each stop using a metric-tabular approach. Punctuality and environmental advantages were emphasized in more than 95% of priority statements. Bus operators and passengers considered combinations of punctuality, environmental benefit, and fuel savings to be equally essential.

Yasin Ali et al. (2023) discussed above—including a comprehensive economic effect and benefit analysis taking into account fuel usage, transportation expenses, health concerns, and environmental ramifications. They gave stakeholders information by ranking problems and potential fixes according to significance and effect.

Sharma et al. (2024) When the distance to the closest crossing was more than 200 meters, more than 70% of pedestrians crossed without utilizing approved facilities, according to an analysis of pedestrian crossing behavior at mid-block sites in Jaipur. In business areas, they suggested placing marked crossings at intervals of no more than 150 meters. Because there are often more than 300 meters between possible crossing places on the study route, people are forced to jaywalk.

Patel and Verma (2023) examined the impact of elevated crossings and speed bumps on pedestrian safety in Ahmedabad. They discovered that well constructed elevated crossings decreased pedestrian-vehicle collisions by 45% and vehicle speeds by 15 to 20 km/h. However, poorly constructed speed bumps (with the wrong height or breadth) were uncomfortable and encouraged cars to accelerate in between them. This implies that IRC guidelines must be followed for any speed-calming measures on the Vidisha corridor.

Kumar and Singh (2024) examined the connection between Lucknow's nighttime pedestrian accidents and street illumination. They discovered that pedestrian accident rates were 3.5 times higher on roadways with illumination below 10 lux than on those with illumination above 20 lux. The majority of pedestrian deaths throughout the night occurred in places where street lights were either absent or broken. There are a number of dark areas along the study corridor, especially close to Ahmadpur Chauraha and Durga Nagar, which probably increase the danger to pedestrians.

3. CONCLUSION

The literature review establishes that pedestrian safety in mixed-traffic urban corridors depends on infrastructure availability, speed management, traffic composition, and enforcement. IRC guidelines (IRC:103-2012, IRC:86-2018, IRC:112-2018) provide benchmarks for footpaths, crossings, lighting, and speed limits (30–40 km/h). Studies confirm that pedestrian fatality risk increases exponentially with vehicle speed (Rosen and Sander, 2009), and footpath encroachments reduce walking space by up to 40% (Jain et al., 2015). Research from Indian cities demonstrates that mixed traffic, unregulated parking, and inadequate crossings compromise pedestrian safety. A research gap exists for smaller cities like Vidisha, where pedestrian facilities receive minimal investment. This study addresses this gap by systematically assessing safety along the New Bus Stand–Ahmadpur corridor, providing evidence for targeted interventions.

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