



Pedestrian Safety at Signalized Intersections in Developing Countries: A Critical Appraisal

Abarar A. Khalak^a, Mohammed Hussien^b, Sulihat Ahmed^c, Tejas Pandya^d

^a Assistant Professor, Civil Engineering Department, Grow More Faculty of Engineering, Himatnagar, Gujarat, India, 383001.

^b Dean, College of Engineering & Technology, Samara University, Ethiopia, East Africa, mdhussen2004@gmail.com.

^c Head, Department of Civil engineering, CET, Samara University, Ethiopia, East Africa., engsah2019@gmail.com.

^d Tejas Pandya, Assistant Professor, CED, PIET, Parul University, Vadodara, Gujarat, India, tejas.pandya14403@paruluniversity.ac.in

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ABSTRACT

This study presents a critical appraisal of pedestrian safety at signalized intersections in developing countries. The research evaluates the challenges and issues related to pedestrian safety, including the impact of traffic signal design, pedestrian behavior, and infrastructure shortfalls. By conducting a diverse review of existing literature, the paper aims to identify key factors influencing pedestrian safety at signalized intersections in developing nations. The study also proposes potential strategies and conciliations to improve pedestrian safety, considering the unique socio-economic and infrastructure constraints prevalent in these regions. The outcomes of this research contribute to the development of policies and interventions aimed at enhancing pedestrian safety and reducing the risk of pedestrian-related accidents at signalized intersections in developing nations.

Keywords: Pedestrian Safety, Signalized Intersections, Conflict Analysis

INTRODUCTION

Pedestrian safety at signalized intersections is a main concern in developing countries, where rapid urbanization and increasing traffic volume present notable challenges. As urban centers expand and transportation infrastructure develops, the safety of pedestrians at signalized intersections becomes a critical point for urban planning initiatives. Understanding the unique dynamics of pedestrian safety in developing nations is essential for implementing effective interventions and improving road safety. As shown in figure 1, most of the pedestrians break the rule while maneuvering the intersections in almost all developing countries.

This research paper focuses to critically appraise the factors determining pedestrian safety at signalized intersections in developing countries, with an aim on the specific case of developing nations. By examining the immensity of pedestrian safety issues, identifying factors, and accessing potential interventions, this study seeks to come up with targeted strategies for improving pedestrian safety.

The critical appraisal draws upon a range of scholarly sources, government reports, and international road safety assessments, to provide a diverse analysis of the current state of pedestrian safety at signalized intersections in developing nations. By merging existing knowledge and recognizing gaps in practice, this paper focuses to offer useful insights for policymakers and transportation authority's working to mitigate the risks faced by pedestrians.



Figure 1. Pedestrians breaking rules at intersections. (Source: author)

LITERATURE REVIEW

Walking is the mode of travel mainly used in Ethiopia as it represents more than half the daily trips. The warm weather makes the use of this healthy and green mode of transport possible. However, sidewalks are often narrow, obstructed, or non-existent, making them a nuisance and a safety risk for the most vulnerable pedestrians. The WHO and the Government of Ethiopia have noticed that nearly 500 people lose their lives due to road accidents each year, 76% of whom are pedestrians. Sidewalk deficiencies and pedestrian mobility restrictions come from issues ranging from planning and design to construction and maintenance. In developing nations, it is common to find inappropriate intersections, missing sidewalk segments, deficient crossings, poor accessibility for vulnerable users, and even intentional barriers on main avenues across the city. Sidewalks also lack proper maintenance, leading them to be invaded by vegetation, rocks, or debris. Moreover, sidewalks are often occupied by street vendors, parked vehicles, or loading and unloading maneuvers. These shortages enable risky behaviors by road users, especially drivers and pedestrians: pedestrians' step into dangerous traffic, such as crossing streets in ways and places that are prohibited. Road safety initiatives have focused on roads and intersections, rather than sidewalk conditions or structured diagnoses of sidewalks and walkability. In addition to these studies not addressing sidewalk conditions and pedestrian experience mainly, sidewalk maintenance lack attention.

Signalized intersections are expected to ensure safety by giving the right of way for traffic movement including pedestrians. However, the provision of signalized pedestrian crossing facility may not ensure the safety of pedestrian due to some reasons such as traffic violation and unsafe signal phasing. At midblock, the pedestrian crossing is entirely different when compared with signalized and unsignalized intersection crosswalks. Midblock crosswalks are dangerous when compared with intersection crosswalks even though there no turning vehicles. Studies have demonstrated that midblock crosswalks account for the highest number of pedestrian accidents because of higher vehicle speed and the increase in risk-taking behavior of pedestrians due to an increase in waiting time. Cherie A, and Bayray A. conducted a study on road traffic accidents among children in Addis Ababa They figured out that almost all children affected by road traffic accidents were pedestrians (97.5%), (2.3%) were passengers and (0.2%) were bicyclists. Tulu G S et al. investigated that the poor integrated land use and transport planning, lack of convenient pedestrian facilities and street lighting forced pedestrians to illegal crossings.

Akash Jain et al. (2014) had taken three intersections for analysis. The analysis was done using the videography, time elapse and opinion survey. It was observed males take more risk compared to female and the children and elder age pedestrians are more prone to accidents. The paper described that children were the ones with less safety gaps and high crossing speeds. The males had fewer crossing speeds than female but at the same time males had less waiting time. They noted the average crossing time for angled and perpendicular crossing were 6 seconds and 1 seconds. They also found the waiting for two step crossing was more than that of one step crossing. Average pedestrian crossing speed of perpendicular crossing was around 1.36m/s while for angled crossing it was 1.98 m/s. it was also accessed that females and elders took extra time gaps and less crossing speed thus creating high safety factors.

Manik Kumar Saha et al. (2013) had considered 10 pedestrians for observational purpose and 300 questionnaires for every crossing. It was found that the young pedestrian tends to violate crossing rules more than that of elders. It was also noticed that the people who were educated and with respectable profession were keen on following rules other than students and small businessmen. The study also demonstrated that the under ways for crossing were safe but were avoided due to lack of safety and unwanted people in the under ways. There was a high risk at both ends. The study also indicated that males were more irresponsible while crossing roads while compared to females with a percentage of ration of 48.90 to 58.80 who follow rules. They noticed that the elder and younger follow rules with a 100% while 26-35 years age group tends to violate the most with a 58.29%. Interestingly, the teachers followed the rules with top priority with a 100% result at the same time all hawkers violated the rules. Unemployed people also try to follow rules with a 75.09% accuracy and at the same time small businessmen prone to violate the rules with an alarming 69.29% suggesting time is the essence for following rules and determines the waiting time.

Emese Mako et al. (2016) their agenda was to priorities the execution of infrastructural engineering, safety equipment, safe environment, and training for reducing the number of accidents at different crossing. It also highlighted that pedestrians and vehicles both are equally responsible for the accidents

caused and the major factor acting is waiting time. About 44% of pedestrians violated the rules and other 65% with driving mistakes. The major mistake from 44% is due to careless behavior contributing a 67% from the 44%. There were different irregularities in the infrastructure and after development of proper infrastructure it was observed the accident rates fell by 85%. It was also noticed that pedestrians had the facility of Refugee Island but still tried to cross the road in one go. The vehicle delay time at the crossroads also plays an important role as due to increased delay time there seems to impatience at the crossing.

Few studies have also evaluated the importance of the pedestrian speed at different locations (Knoblauch et al., 1996; Rastogi et al., 2011), such as the zebra crossing location (Varhelyi, 1998) and signalized intersections (Tarawneh, 2001). Finding of these studies suggested that males walk significantly faster than females. A recent study was focused on legal versus illegal road crossing behavior of pedestrian in China (Cherry et al., 2012).

POTENTIAL STRATEGIES / INTERVENTIONS

Following interventions may be useful to enhance the safety.

Implement pedestrian-specific traffic signals to indicate when it is safe for pedestrians to cross the crossroads. Construct islands in the center of the intersection to provide a space for pedestrians to wait while crossing the lanes. Use crosswalk markings and signage to make pedestrians visible to drivers. Implement traffic calming measures like speed bumps and raised crosswalks to slow down vehicles approaching intersections.



Figure 2. Increasing Safety at Intersections with Intelligent Solutions (source: author)

Educate pedestrians and drivers by conducting public awareness campaigns about intersection safety and the rules of the road. Figure 2 shows the intelligent solutions to increase safety at intersections for pedestrians. Plan and design intersections including curb extensions, wider sidewalks, and shorter crossing distances with pedestrian safety in mind. Designate certain intersections as pedestrian priority zones. Implement pedestrian detection systems and smart traffic signals that can identify and respond to pedestrian presence at intersections.

CONCLUSION AND DISCUSSIONS

Based on the literature review and the challenges recognized in developing nations, pedestrian safety at intersections is a main issue that requires immediate attention. The high number of pedestrian fatalities and the various shortfalls in sidewalk infrastructure and intersection design highlight the immediate need for effective strategies and interventions. To address these issues, potential strategies and interventions should be implemented to enhance pedestrian safety at intersections in developing nations. These may include the installation of pedestrian-specific traffic signals, construction of refuge islands, improvement of crosswalk visibility, implementation of traffic calming measures, public awareness campaigns, improvement of lighting at intersections, enforcement of traffic laws, and the use of pedestrian detection systems and smart traffic signals. It is important to prioritize pedestrian safety and secure that pedestrians have safe and accessible infrastructure to navigate the town. These interventions can contribute to creating a more walkable urban environment for all pedestrians.

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