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Risk-Taking Behaviour of Pedestrians on National Highways of Pakistan

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ABSTRACT

An important area of study in the field of road safety is the complex dynamics of pedestrian risk-taking behaviour on national highways. Surveys, interviews, and observational studies carried out at various locations along national highways are just a few of the qualitative and quantitative methods used in this multidisciplinary study that incorporates insights from transportation engineering, sociology, and psychology. The goal of the study is to recognize and comprehend the various elements such as environmental factors, demographics, and infrastructure that impact pedestrians' choices to partake in unsafe activities. The investigation of psychological elements, such as perception of danger and decision-making procedures, enriches the examination of cognitive elements influencing pedestrian decisions in high-risk environments. The effectiveness of current safety protocols and public awareness initiatives is also evaluated in the study. The goal of the research is to provide evidence-based interventions and policy recommendations, such as better infrastructure design, signage, and educational programs, by revealing these insights. The ultimate objective is to provide information for policies aimed at improving pedestrian safety and lowering the number of fatalities and injuries on national roadways.

KEYWORDS: Pedestrians, Risk-Taking Behaviour, Pedestrian Bridges, Road Safety

1 INTRODUCTION & LITERATURE REVIEW

This research delves into the intricate realm of pedestrian perspectives on national highways, with a specific focus on safety and pedestrian preferences. Surveys conducted at various points along highways serve as a primary method for capturing the motivations and perceptions of pedestrians, particularly in relation to bridge locations. To understand the multifaceted nature of this issue, the study draws upon survey data, on-site observations, and in-depth interviews, providing a comprehensive exploration of pedestrians' experiences along national highways. In the literature review, a key consideration is the impact of pedestrian infrastructure on behaviour. Meneses Falcón et al. (2010) [1] examined risky behaviour in teenage drivers of both two- and four-wheelers using questionnaires from the provinces of Andalucia and Madrid. They discovered that motorcyclists were more likely to engage in behaviours linked to driving over the speed limit (17.4%) and failing to use protection (16.2%). Yue Li's (2010) [2] study examines how pedestrian compliance at a signal-controlled two-stage crossing is affected by bad weather and signal design. It finds that both factors lead to less safe road-crossing behaviour and emphasize the need for better traffic control strategies in these situations. Tom and Granié (2011) [3] used observations at

signalized and unsignalized crossings to evaluate gender-based differences in pedestrian behaviour in France. Havard and Willis (2011) [4] conducted an effect analysis on the installation of a new zebra-style pedestrian crossing in Edinburgh, UK. They did this by combining observations made through video analysis with in-home questionnaires. The findings suggest that the pedestrian crossing, such a zebra crossing, can greatly improve pedestrian's experience crossing roads and, consequently, the overall walking experience. Based on observations from before and after video cameras, Khatoon et al. (2012) [5] evaluated the effect of the installation of a flyover on pedestrian behaviour at an intersection in Delhi, India. Pešić et al. (2015) [6] investigated pedestrian conduct at unsignalized crossings in Belgrade, Serbia, with reference to cell phone use during crossings. Through direct observations at two crossroads, 1194 pedestrians were counted, and 11.5% of them were using cell phones when crossing the street. Iryo-Asano (2017) [7] investigated how pedestrian behaviour changed at five different signalized crossing locations in Nagoya City, Japan. She discovered that pedestrians abruptly changed their speed, which increased the danger of collisions with turning cars. To create models that anticipate how pedestrians would cross streets, human behaviour studies have been conducted using intercept surveys in Bogotá (Cantillo et al., 2015) [8]. It was found that pedestrians were reluctant to use pedestrian bridges and were always looking for a quicker way to cross. Yongqing Guo (2019) [9] investigates how quickly people cross at signalized crossings using a two-stage crossing method. The findings show notable differences in walking pace according to group size, age, and gender, providing information for improving pedestrian infrastructure and signal timing. According to a study by Monalisa Patra (2019) [10], pedestrian foot overbridges in Mumbai, India, are underutilized (26%). A binary logit model indicates that the overall crossing time ratio of pedestrians has a substantial impact on the decision to choose foot overbridges over at-grade crosswalks. Dedunu Bandara (2020) [11] assesses the usefulness of overpasses and underpasses for pedestrians in various Sri Lankan metropolitan environments. The results emphasize how important the "Self-enforcement feature" is to improving utilization; underpasses work better in business and transit sectors, while overpasses work better in regions near schools and colleges. This study by Ling Wang (2020) [12] uses field measurements and prediction models in Shanghai, China, to uncover significant elements impacting pedestrian spatial violations. It highlights the importance of the presence of a median, the kind of land use, and the number of lanes. By examining physiological data collected from pedestrians while they engage in realistic walking behaviours, Seth LaJeunesse (2021) [13] examines pedestrian quality of service (QOS) for crossings of roadways. The results show that stress levels relate to road conditions rather than crossing locations. By analysing data from the 2013–2015 General Estimates System (GES) and the 2016–2018 Crash Report Sampling System (CRSS), Dania Ammar's(2022) [14] research pinpoints important variables that affect the increased risk of serious injuries or death for pedestrians involved in single-vehicle collisions at intersections over a six-year period. Fernando Pereira da Fonseca (2022) [15] used Smart Pedestrian Net (SPN) method, a multi-criteria approach based on Geographic Information System (GIS), is used in this study in Guimarães, Portugal, to assess and map the pedestrian network's walkability. Julián Arellana's (2022) [16] study in Barranquilla, Colombia, combines stated preference and revealed preference data to examine the variables that influence pedestrians' decisions when choosing between direct crossings, pedestrian bridges, and signalized

intersections. In developing countries, especially in Pakistan, pedestrian bridges and underpasses are not well-utilized. According to Fazal E. Ghafoor's research (2023) [17], 71.83% of pedestrians do not use these structures, and underpasses are statistically more significant than bridges. Improved accessibility to footbridges and underpasses is linked to increased pedestrian safety, according to the Manman Zhu (2023) [18] study in Hong Kong, which uses a three-dimensional digital map to assess the intricate network of pedestrian paths. Lynn M. Hulse (2023) [19] reveals uncertainties and discomfort in AV interactions; while positive implications for AV programming and safety are noted, short-term mobility concerns are highlighted. In Bulandshahr, Uttar Pradesh, India, Shalini Rankavat (2023) [20] conducted a study using a Rank-ordered logit model to investigate pedestrians' perceived risk at identified blackspots. The results showed that median width and traffic speed are the most perceived risk factors, with increased lane numbers being riskier for females and older age groups.

2 RESEARCH METHODOLOGY

The study aimed to gather comprehensive data on pedestrian perspectives on national highway bridges. Surveys were administered at bridge locations with varying traffic volumes, rural-urban settings, and proximity to amenities, focusing on reasons for bridge use, location appropriateness, desired changes, safety concerns, accessibility hindrances, and other challenges faced by pedestrians. Trained observers documented real-time pedestrian behaviour patterns, navigation and flow, accessibility evaluation, and safety hazards. Time-lapse recordings captured pedestrian flow variations throughout the day to identify peak usage periods and potential congestion points. Enriched in-depth interviews provided deeper insights from key informants, including frequent bridge users, diverse perspectives, and open-ended exploration. Quantitative analysis was used to identify correlations between demographics, bridge usage patterns, and satisfaction levels, while qualitative analysis uncovered emergent themes and narratives related to pedestrian experiences. Triangulation and interpretation cross-verified findings from all data sources to validate and enrich findings, identify areas of convergence and divergence across different data sets, and facilitate the construction of a nuanced and multifaceted picture of pedestrian experiences. The research findings have been disseminated through academic publications, conference presentations, and targeted reports, providing specific insights and recommendations to urban planners, transportation authorities, and government agencies responsible for bridge design and infrastructure development. This comprehensive approach has helped to understand the factors influencing pedestrian experiences and develop strategies to improve bridge design and accessibility.

2.1 Site Selection & Survey

We conducted survey on five different locations in this study on N-5 national highway. We selected a patch of around ~37 kms from Taxila to Rawalpindi in N-5 national highway to study the risk-taking behaviour of pedestrians under the influence of different road conditions, population density and traffic volume. The locations of the survey sites are shown in figure 1 on N-5 Highway from Taxila to Rawalpindi. We conducted a survey at five different locations shown

in figure 1 with overhead bridges, engaging pedestrians in each area. Our goal was to gather insights and preferences by asking targeted questions. After collecting responses, we carefully analysed the data to understand pedestrians' perspectives on safety, accessibility, convenience, and overall satisfaction with the overhead bridges.

Table 1: Location of Survey Sites

Site	Location	National Highway	Coordinates	
			Northing	Easting
Site 1	Near Daewoo Express, Islamabad	N-5	3722335 m	310199 m
Site 2	Near Pirwadhai Mor, Peshawar Road, Rawalpindi	N-5	3721215 m	313750 m
Site 3	Near Kainat Travels Terminal, Peshawar Road, Rawalpindi	N-5	3721121 m	314207 m
Site 4	Near Rahat Bakers, Main Peshawar Road, Chour Harpal Rawalpindi	N-5	3720717 m	315068 m
Site 5	Near Chour Chowk Bus Stop, Misrial Road, Rawalpindi	N-5	3720534 m	315494 m

Figure 1 : Location of Survey Sites (N-5 Highway from Taxila to Rawalpindi)

3 RESULTS & DISCUSSION

3.1 Demographic details

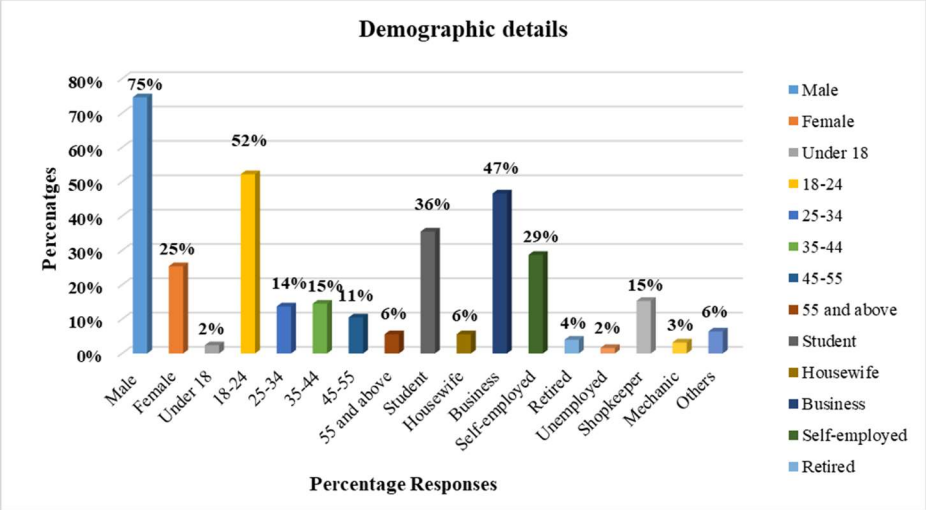

Figure 2: Demographic Details

The graph in figure 2 specifies age, gender distribution, education level and profession of interviewees who participated in questionnaire. The gender distribution shows the graph with 74.6% being male and 25.4% female. It was observed as shown in figure 2 that females were reluctant in answering the questionnaire. The educational level reflects that mostly were in their "bachelor's and above" level of education.

3.2 Questionnaires

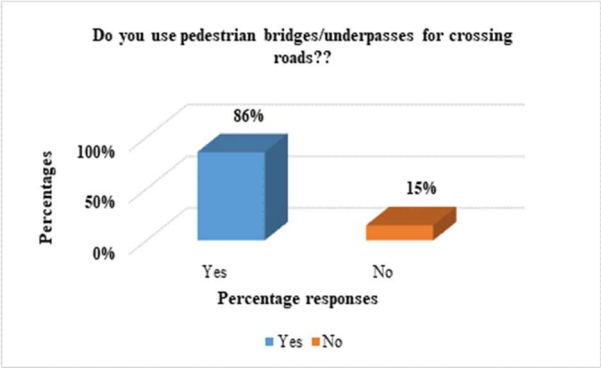

Figure 3: Usage Tendency

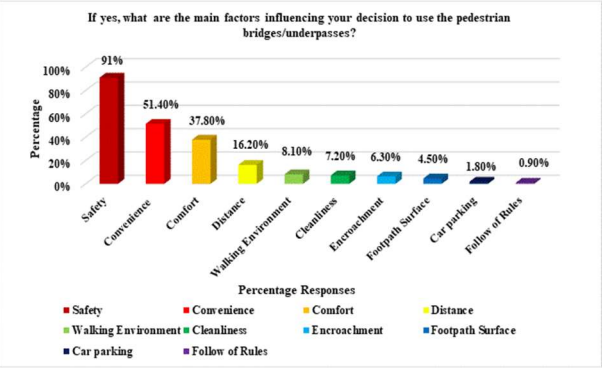

Figure 4: Determining Factors for Usage

The data in figure 3 indicates that 85.5% of interviewees use pedestrian bridges or underpasses for crossing roads, while 14.5% do not use pedestrian bridges or underpasses.

While the figure 4 concludes that 91% of the interviewees thought that safety was the main influencing factor for using the pedestrian bridges/underpasses while the second major factor was convenience with 51.4% of the interviewees choosing it as shown in figure 3. While comfort (37.8%) and distance (16.2%) were the other factors picked by the interviewees as a main factor for using the pedestrian bridges/underpasses.

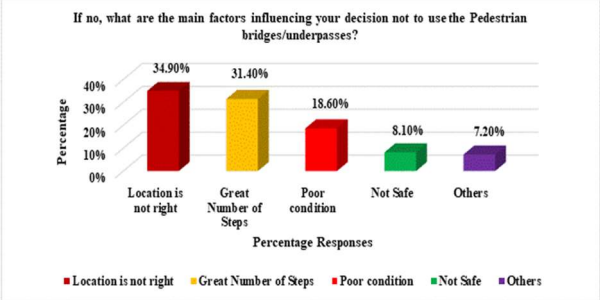

Figure 5: Factors Enforcing Avoidance

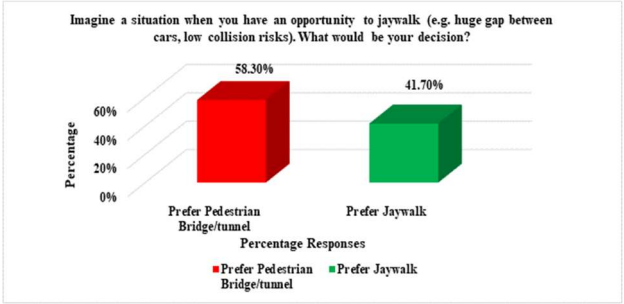

Figure 6: Use of Jaywalk vs Bridge.

The interviewees were asked the reasons for not using the pedestrian bridges/underpasses. The study shown in figure 5 reflects that 34.9% of the interviewees said that the location of the bridges/underpasses was the factor bridges were not being used. While 31.4% of the interviewees were of the opinion that due to the greater number of steps, they don't use these bridges. While some of them (18.6%) said bridges/underpasses were in poor condition (no cleanliness etc.) with 8.1% believed bridges/underpasses were not safe.

The interviewees were asked a question that whether they would prefer jaywalking or not. The study showed that 58.3% of them believed that they would prefer using Pedestrian bridges/underpasses as shown in figure 6. While 41.7% said that they would prefer jaywalking rather than using bridges/underpasses.

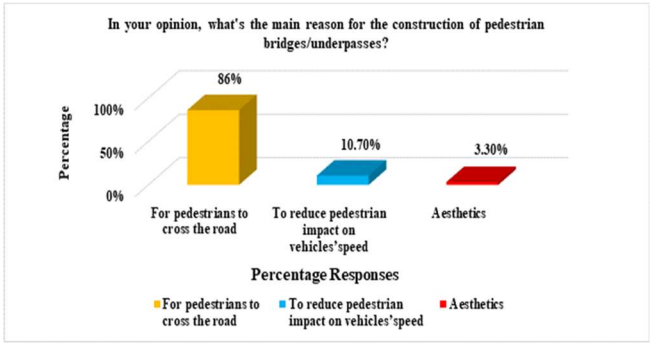

Figure 7: Purposes of Construction

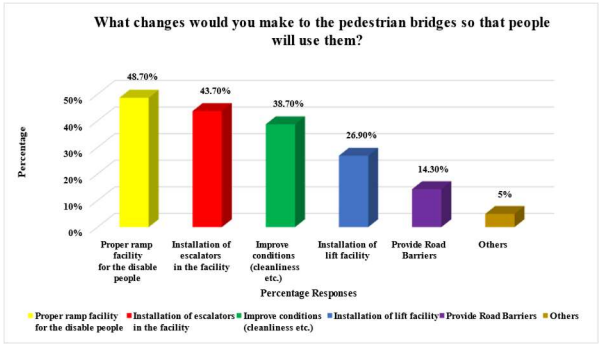

Figure 8: Modifications to Enhance Usage

The interviewees were asked to give their opinion about the purpose of the construction of the pedestrian bridges/underpasses. The study shown in figure 7 showed that 86% of the interviewees said that it was constructed for pedestrians to cross the roads/highways. While 10.7% of them

believed it was constructed to reduce the pedestrian impact on the vehicles speed as reflected in figure 7.

Interviewees were also asked about the changes which should be made to the pedestrian bridges/underpasses for them to be used frequently by pedestrians. The study reflected in figure 8 showed that 48.7% of them said that a ramp facility for the disabled persons must be provided. While 43.7% of the interviewees believed escalators must be installed to reduce the difficulty in walking the stairs. While 38.7% said improving the conditions of the bridges/underpasses is like proper maintenance. While 26.9% ask for lift installation & some of them (14.3%) ask for proper road barriers installation as shown in figure 8.

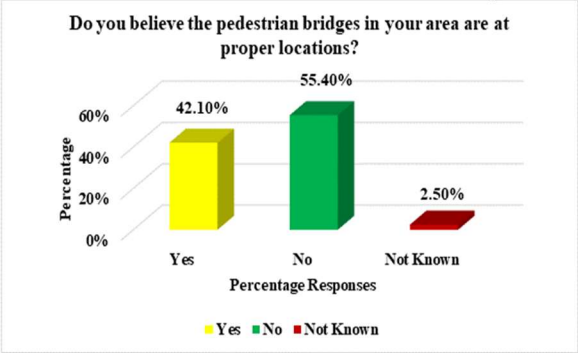

Figure 9: Location Suitability

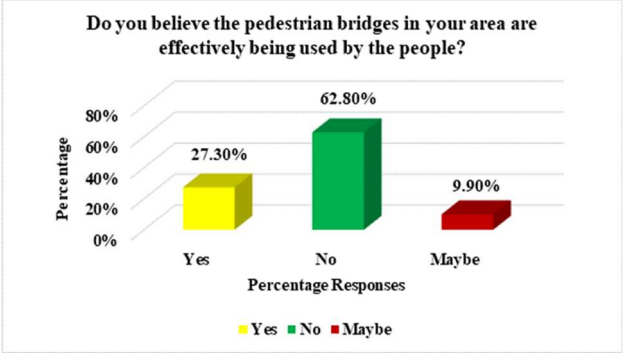

Figure 10: Percentage Effective Usage

From the survey that we conducted, we concluded that 42.1% of the interviewees thought the bridges' location was proper that made them efficient however 55.4% had contrary thoughts. 2.5% didn't have a particular opinion as shown in figure 9. The difference was because the bridges were slightly away from the main connecting street, therefore most of the people were not benefited.

According to the data in figure 10, we concluded 27.3% of the interviewees thought the bridges were not being used effectively by the people however 62.8% had contrary thoughts while 9.9% had a mix opinion. The bridge location was not adequate about main connecting street that was most used by the people. Therefore, it caused a change in peoples' opinion.

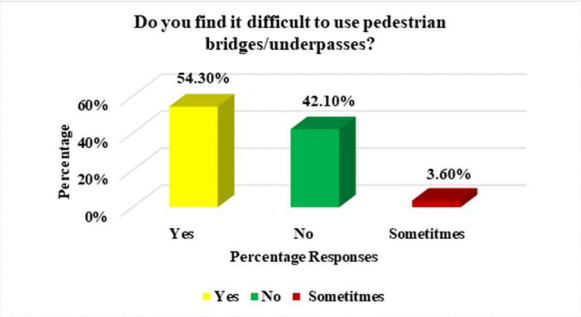

Figure 11: Difficulties Being Faced

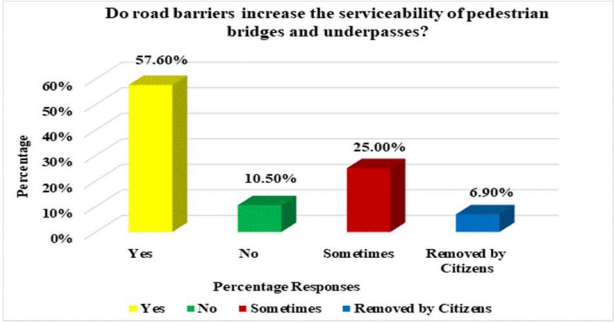

Figure 12: Effect on Serviceability by Road Barriers

From the survey data shown in figure 11, we concluded that 54.3% of the interviewees find it difficult to use the bridges/underpasses while 42.1% were satisfied with their use. 3.6% found it difficult when their destination was away from the bridge's location. This difference was due to reasons like, bridges away from their houses or destination, stairs that are difficult for elderly to use, tidiness of bridges or risk of theft.

Among the people that we interviewed 57.6% had the opinion that road barriers would increase the serviceably of the pedestrian bridges/underpasses, however 10.5% had contrary opinion as shown in figure 12. There were 25% of them who thought that to some extent road barriers increased the serviceability of bridges/underpasses while other time people may still cross either by climbing over or just removed them (opinion of 6.9%).

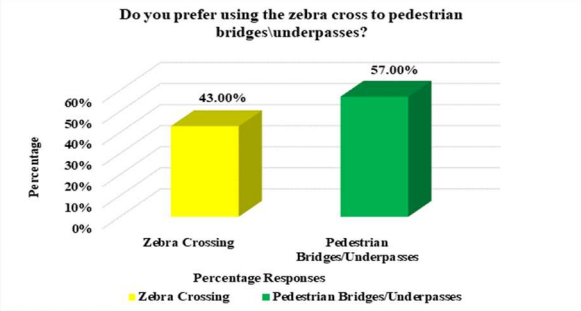

Figure 13: Tendency of Using Road Barriers

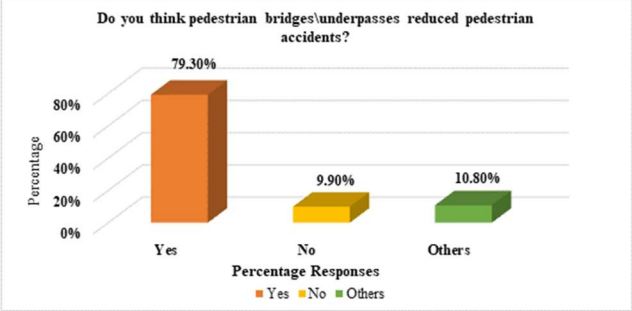

Figure 14: Role in Avoiding Accidents

The survey allowed us to conclude that 43% of the interviewees preferred using zebra crossing however 57% were slanting towards use of pedestrian bridges/underpasses as per data shown in figure 13. The difference in opinion was due to the following reasons: elderly cannot use high stairs, bridges/underpasses were further away, bridges/underpasses took more time to reach and cross, vacant bridges were safety risk, no proper lighting at night etc.

The survey data in figure 14 shows a majority of respondents (79.3%) believe pedestrian bridges/underpasses reduce accidents, while a smaller percentage (9.90%) express doubt about the

efficiency of pedestrian bridges/underpasses. The responses categorized as "Others" (10.80%) may indicate a lack of conclusive opinion or have a neutral opinion about the asked question.

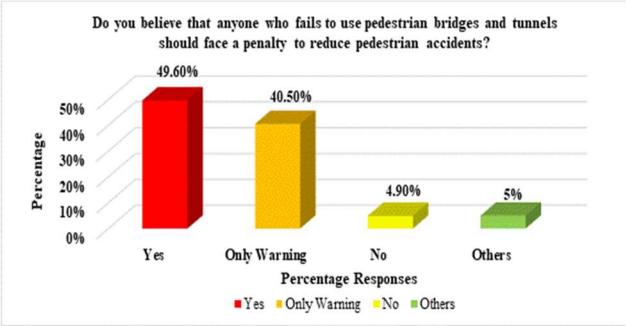

Figure 15: Percentage Opinion about Penalizing Violators

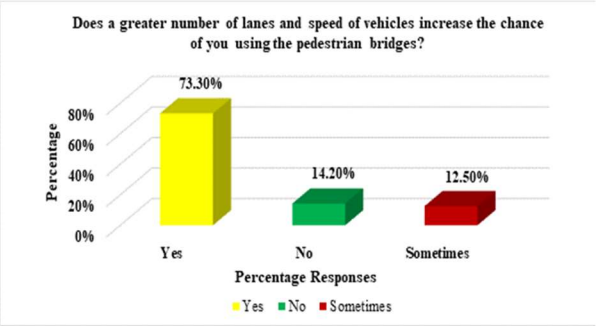

Figure 16: Increased Traffic Volume vis a vis Usage.

According to the data shown in figure 15, the survey revealed that 49.6% of respondents believe pedestrian facilities should be fined for crossing the road in the wrong place, while 40.5% believe a warning is sufficient. Some suggested giving a warning first, but if continued, a fine may be imposed. The results indicate varying opinions on the severity of rules for pedestrian safety, indicating a need for varying levels of enforcement.

We conducted a survey to find out why individuals choose to utilize pedestrian facilities. The majority of the respondents (73.3%) shown in figure 16 claimed that traffic, the number of lanes, and the speed of vehicles could all influence the decision of using the pedestrian facilities as crossing three-lane or more-lane roadways is difficult for them. However, 12.5% of respondents believe that some people who consistently jaywalk don't really have any consideration about the speed the vehicles or how many lanes they have to cross. The data shown in figure 15 demonstrates that there are a variety of reasons why individuals cross the road when they shouldn't, and to increase safety, it's critical to comprehend these motivations.

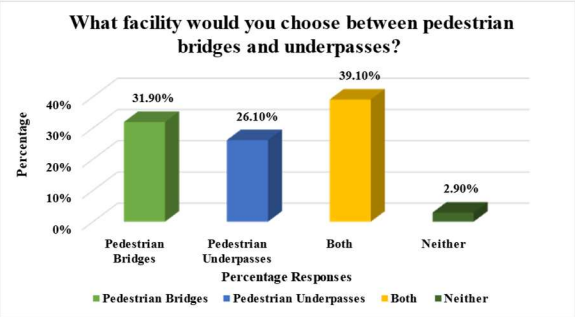

Figure 17: Preference Between Bridges & Underpasses

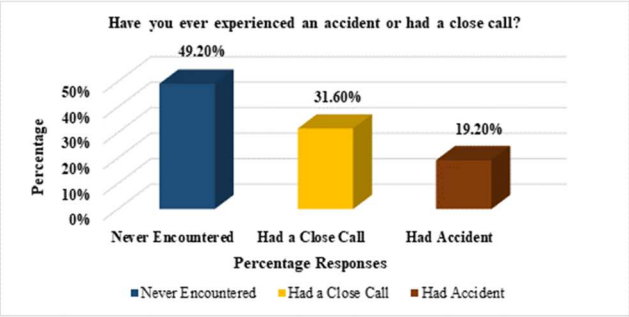

Figure 18: Personal Experience of Accident

Amongst the respondents to the survey shown in figure 17, 31.9% said they would rather use pedestrian bridges or underpasses, depending on which was available where they lived. However, according to 31.9% of respondents, pedestrian bridges are a safer option. The respondents were concerned about the security of pedestrian underpasses, specifically their potential to risk the safety of pedestrians due to increased susceptibility to criminal activity, especially at night, provide the justification for this tendency.

The nuances of safety factors that impact people's choices for particular pedestrian infrastructure in cities are highlighted by these results shown in figure 18. Amongst the people interviewed shown in figure 18, 49.2% said they had never been in any accidental situations when jaywalking. However, the cumulative proportion rises to 50.8% when including the percentages of those who were involved in an accident (19.2%) and those had a close call (31.6%) as reflected in figure 18. This research highlights a notable incidence of harmful episodes related to jaywalking by showing that slightly over half of the respondents were exposed to accidental scenarios when engaged in jaywalking.

4 CONCLUSION

Studying how pedestrians behave on national highways provides a deep insight into the complex factors influencing their decisions in risky situations. Field observations reveal the intricacies of these decisions. Data showed that while some considered jaywalking safe, most opted not to do so, indicating differing perceptions of risk. Opinions on pedestrian infrastructure varied, with few believing pedestrian bridges were well-placed, while the majority disagreed. Many found using these structures difficult, highlighting the need for improvements in accessibility. A surprising finding was that many respondents said they would use pedestrian bridges more if there were more lanes and faster traffic. Analysis of graphs showed that jaywalking, poor pedestrian infrastructure, and difficulty using pedestrian bridges significantly influenced risk-taking behaviour. This highlights how traffic conditions impact pedestrian decisions. These findings stress the importance of targeted awareness campaigns and improving physical infrastructure to enhance pedestrian safety on national highways. Addressing these issues requires a comprehensive strategy that prioritizes creating pedestrian-friendly environments and promoting responsible driving behaviours.

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