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Pedestrian Safety During Road Construction Works Along Federal Route (F050)

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Abstract

This study assesses the low level of safety of Federal Route (F050) in the Parit Raja area, specifically within road construction zones for pedestrian road users. It addresses the research gap regarding pedestrian safety during road construction works by examining the level of safety of the road according to pedestrian road users, as well as their behaviors. The objectives include determining pedestrians' perception of facility safety, facility convenience, vehicle speed, and pedestrians' behavior when using the road according to the perceived safety and convenience levels, with recommendations for improvement. Data gathered from a survey conducted digitally and distributed to 150 pedestrian road users in Parit Raja were analyzed using SPSS. The findings highlighted significant concerns and the need for improved safety measures to protect pedestrians, suggesting potential areas for further research and development in pedestrian safety protocols and construction practices.

1. Introduction

Road construction is a vital component of infrastructure development and maintenance, evident in both urban and rural settings. These projects range from routine maintenance to extensive road expansions, aiming to modernize road networks and enhance safety, tourism, and economic development (Shishinashvili et al., 2018). However, during construction, the presence of pedestrians, especially in crowded areas, becomes a significant concern. Pedestrians must navigate shared spaces with heavy equipment, workers, and various vehicles, creating safety challenges that demand careful attention. Ensuring pedestrian safety is crucial as it manages the interaction between pedestrians and vehicles and provides insights into current pedestrian policies (Ishaque et al., 2006).

Construction zones are dynamic environments where the coexistence of workers, machinery, temporary barriers, and changing traffic patterns create a complex web of interactions. While motorized vehicles benefit from clear guidance through barriers, arrows, and flagmen, pedestrian safety is often overlooked. The lack of a separator system between pedestrian pathways and road lanes is a common factor affecting pedestrian safety during construction projects (Rostiyanti et al., 2020).

Despite comprehensive regulations like the Arahan Teknik Jalan (ATJ) 2C/85 – Manual on Traffic Control Devices: Temporary Signs and Work Zone Control by Jabatan Kerja Raya Malaysia, which detail traffic management strategies for vehicles, there are no specific guidelines for pedestrian safety in work zones. This oversight can be attributed to inadequate facilities, lack of public awareness, and insufficient government involvement (Karlyana et al., 2018). The hazards present to pedestrians during road construction are often overlooked, raising concerns about the adequacy of pedestrian protection.

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This study aims to determine pedestrians' perceptions of safety when walking along Federal Route (F050) in Parit Raja and analyse the correlation between pedestrians' behavior and their safety perceptions along this route. The research focuses on a 7-kilometer stretch of Federal Route 50 (F050) in Parit Raja, Batu Pahat, examining the provision or lack thereof of safety measures for pedestrians during road construction. It also investigates pedestrian adaptability to safety shortcomings, which can lead to accidents, injuries, and fatalities.

The significance of this study lies in its potential to highlight the need for prioritizing pedestrian safety in road construction projects. As urban development and infrastructure expansion continue, pedestrian safety often remains a secondary concern. This research aims to identify critical areas where pedestrian safety is compromised during construction, providing valuable insights for policymakers, urban planners, and construction professionals. By addressing these overlooked aspects, the study aspires to enhance safety measures, reduce accidents, and create more pedestrian-friendly urban environments, thereby reducing the risk of injuries in areas with inadequate infrastructure and high vehicle speeds (Pavithra et al., 2020).

2. Materials and Methods

This study utilized a quantitative research design for analysis. A Questionnaire was distributed to 150 random pedestrian road users. The purpose of the questionnaire is to determine the relationship between the dependent variables, which are pedestrians' avoiding behavior and distracted behavior, and the independent variables, which are pedestrians' perception of the safety of pedestrian facilities and vehicle speed, and convenience of pedestrian safety.

The questionnaire is separated into three sections: section A which is respondents' demography, section B which is respondents' perception of safety and section C which is respondents' behavioural study.

Two types of analysis are utilised in this study, descriptive analysis to analyse the percentage of demographic characteristics as well as their frequency, along with the mean and standard deviation in levels of safety perceived by the pedestrians, and correlation analysis to determine the relationship between variables mentioned previously.

2.1 Study Area

This study has been conducted in the Parit Raja area, specifically within a 7 kilometre stretch of road along Federal Route (F050) as shown in the figure below. A digital questionnaire was distributed by approaching pedestrian road users and handing them the link to the questionnaire directly.

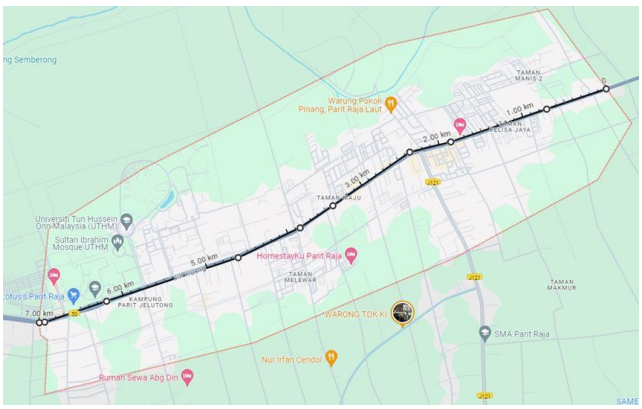

Fig. 1 Kilometre Stretch of study area in Parit Raja (Google Maps)

2.2 Research Design

The questionnaire is divided into three sections: information of respondents, survey queries regarding pedestrians' perceptions of safety, and a behavioral survey, lightly based on the Walking Behavior Questionnaire (WBQ). The WBQ is a validated tool for measuring risky and safe walking behaviors among pedestrians, aiding in designing behavioral-based interventions and educational programs for road risk reduction and safe walking promotion (Useche et al., 2020).

The questionnaire comprises three sections: Section A, Section B, and Section C. Section A includes questions about the population and respondents' usage patterns as pedestrians. Section B consists of questions on respondents' perceptions of safety when traversing Federal Route (F050) as pedestrians. Section C addresses Respondent's behavior patterns when using the road as pedestrians that using a Likert Scale 5-point. In total, the questionnaire contains 35 questions: 7 in Section A, 14 in Section B, and 14 in Section C.

2.2.1 Reliability Test

The initial survey was conducted, where 20 respondents were involved, and the results were analysed using Cronbach's alpha to measure the internal consistency of a set of items or scales, which then would support the validity of this survey when conducted on a larger scale. The table below shows the reliability quality of the questionnaire in the pilot study, ensuring it attains a Cronbach Alpha value of 0.6 and above.

Table 1 Cronbach Alpha score interpretation (Glen, 2023)

Cronbach's alpha (α) values	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.9$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

The tables below show the reliability test results for section B and section C of the questionnaire:

Table 2 Cronbach's Alpha value for respondents' perception of safety

Cronbach's alpha (α)	Number of Items
0.94	14

Table 3 Cronbach's Alpha value for respondents' behavior

Cronbach's alpha (α)	Number of Items
0.88	14

3. Results and Analysis

This chapter presents a comprehensive analysis of the data collected for this study. The data, obtained from surveys administered to 150 respondents in Parit Raja has been meticulously analysed to uncover significant insights. The statistical analysis was conducted using SPSS software, ensuring a rigorous examination of the data.

3.1 Demographic Analysis

The demographic profiles, safety perceptions, and behavioral trends of respondents were gathered through a structured survey. The collected survey data were then analysed using both univariate and multivariate statistical techniques, as shown in Table 4 below:

Table 4 Respondents Demography

Item	Frequency	Percentage (%)
Gender		
Male	81	54
Female	69	46
Age		
Under 25	66	44
25 -65	61	40.7
Over 65	23	15.3
Employment status		
Employed	43	28.7
Unemployed	107	71.3

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Residential Status		
Permanent Resident	74	49.3
Temporary Resident	76	50.7
Health Complication / Disabilities		
Yes	25	16.7
No	125	83.3
Average Walking Distance as a Pedestrian		
Below 1 Kilometre	100	66.7
More than 1 kilometre	50	33.3
Puporse of Walking		
Walking to work or school	63	58
Other Reasons	87	42

3.2 Mean and Standard Deviation Analysis

Table 5 below shows the mean and standard deviation of respondents' perception of safety and convenience (classed). The standard deviations for facility safety (0.61), facility convenience (0.59), and vehicle speed (0.71) reflect the variability of the responses, with vehicle speed showing the highest variability among the three variables. This analysis highlights the areas of concern for pedestrians in road construction zones, emphasizing the need for improvements in safety, convenience, and vehicle speed management to enhance pedestrian safety.

Table 5 Mean and standard deviation of respondents' perception of safety, convenience and vehicle speed

Item	Mean	Standard Deviation
Facility Safety	1.94	0.61
Facility Convenience	1.76	0.59
Vehicle Speed	1.57	0.71

Table 6 below shows the mean and standard deviation of respondents' behavior when using Federal Route 50 (F050) as a pedestrian. Avoiding has a mean score of 3.67, which indicates that the respondents are prone to avoid certain areas or facilities, and distracted has a mean score of 1.85 which indicates that the Respondents are less prone to be distracted when walking through road construction zones in Federal Route 50 (F050).

Table 6 Mean and standard deviation of respondents' behavior

Item	Mean	Standard Deviation
Avoiding	3.67	0.85
Distracted	1.85	0.91

3.3 Correlation Analysis

Table 7 shows the correlation analysis between variables. In general, pedestrians are more likely to exhibit avoiding behavior as they perceive the road facilities to be less safe, and less convenient, and vehicle speeds to be less safe. However, the correlations are weak, indicating that other factors might also play a significant role. As for distracted behavior, pedestrians are less likely to exhibit distracted behavior when they perceive the road facilities to be less safe and less convenient, and vehicle speeds to be less safe. This is because they become more aware and cautious in such conditions. The moderate correlations suggest a stronger relationship compared to avoiding behavior.

Table 7 Pearson's Correlation analysis for related variables

		Facility Safety	Facility Convenience	Vehicle Speed	Avoiding Behavior	Distrcted Behavior
Facility Safety	Pearson Correlation	1				
Facility Convenience	Pearson Correlation	0.854**	1			
Vehicle Speed	Pearson Correlation	0.680**	0.752**	1		
Avoiding Behavior	Pearson Correlation	0.100	0.048	0.108	1	
Distracted Behavior	Pearson Correlation	0.206*	0.328**	0.507**	0.398**	1

**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

4. Discussions

A correlation of 0.100 (p=0.223) between facility safety and avoiding behavior indicates a very weak positive correlation, suggesting that as the perception of facility safety decreases, pedestrians slightly increase avoiding behavior, though the relationship is not strong.

For facility safety and distracted behavior, a correlation of 0.206 (p=0.011) shows a weak positive correlation, significant at the 0.05 level, indicating that as the perception of facility safety decreases, pedestrians are less likely to exhibit distracted behavior and become more aware.

Regarding facility convenience and avoiding behavior, a correlation of 0.048 (p=0.559) indicates an extremely weak positive correlation, suggesting that as the perception of facility convenience decreases, pedestrians slightly increase their avoiding behavior, but the relationship is very weak.

For facility convenience and distracted behavior, a correlation of 0.328 (p<0.001) shows a moderate positive correlation, significant at the 0.01 level, indicating that as the perception of facility convenience decreases, pedestrians are less likely to be distracted and become more cautious.

5. Conclusion

The study also found that as the perception of safety and convenience decreases, pedestrians are more likely to exhibit avoiding behavior. This was evident from the weak positive correlations between facility safety, facility convenience, vehicle speed, and avoiding behavior. Pedestrians tend to navigate away from perceived hazards, indicating a need for better safety measures and infrastructure improvements in the construction zones.

The study also highlighted the importance of vehicle speed management. The perception of vehicle speed safety was low, with a mean score of 1.57. Lower perceived safety regarding vehicle speeds was associated with increased avoiding behavior and decreased distracted behavior, emphasizing the need for effective speed control measures to enhance pedestrian safety.

Based on these findings, recommendations to improve pedestrian safety in road construction zones include enhancing road safety measures through clear signage, barriers, and adequate lighting to enhance visibility and ensure pedestrian security. Improved visibility and well-marked pedestrian pathways can significantly enhance safety perceptions among pedestrians. Additionally, improving infrastructure convenience by providing well-marked pathways and temporary walkways can reduce obstructions and enhance navigation safety. Lastly, enforcing strict speed limits and implementing traffic calming measures like speed bumps and visible signage can effectively manage vehicle speeds, minimizing potential conflicts and creating a safer environment for pedestrians.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of the paper.

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