



ASSESSMENT OF DRIVERS' BEHAVIOURS AND NEAR-MISS OCCURRENCES AT UNSIGNALIZED INTERSECTIONS IN PORT HARCOURT: A CHI-SQUARE ANALYSIS

Emmanuel Ihuoma Mike-Ogburia and Achemie Lewis Oba *

Department of Civil Engineering, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt.

* Corresponding Author

ORCID Details

Emmanuel Ihuoma Mike-Ogburia: <https://orcid.org/0009-0006-1773-511X>

Oba Achemie Lewis: <https://orcid.org/0009-0005-7121-1803>

Open Access Research Journal of Engineering and Technology, 2026, 11(01), 110–117

Publication history: Received on 14 August 2026; revised on 24 September 2026; accepted on 26 September 2026

Article DOI: <https://doi.org/10.53022/oarjet.2026.11.1.0067>

Copyright © 2026 Author(s) retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution License 4.0

ABSTRACT

Road traffic crashes remain a leading cause of death and injury in developing countries, and unsignalized intersections are recognised as high-risk locations where competing traffic streams cross without signal control. In Port Harcourt, Nigeria, weak enforcement and mixed traffic conditions make driver behaviour a critical determinant of intersection safety. This study examined the relationship between observed driver behaviours and near-miss occurrence at three unsignalized intersections in Port Harcourt: Rivers State University, Agip and Rumukrushu junctions. Field data were collected using a structured observation checklist and operational definition guide, manual tally sheets, a field notebook, stopwatch and measuring tape, with operational definitions kept consistent with Highway Capacity Manual and Highway Safety Manual concepts and MUTCD-type traffic control device principles. A total of 890 approach movements were observed, of which 245, representing 27.5 percent, resulted in a near miss. Four behaviour categories were recorded: speeding, failure to yield, distracted driving and safe driving. A chi-square test of independence examined the association between behaviour category and near-miss occurrence at each intersection. Results showed a statistically significant association between driver behaviour and near-miss occurrence at all three intersections, with speeding and failure to yield accounting for the largest shares of near misses, while safe driving recorded the lowest rates. Vehicle-to-vehicle conflicts, at 65.3 percent, were more frequent than vehicle-to-pedestrian conflicts, and 60 percent of near misses occurred during peak periods. Targeted enforcement, driver education and low-cost geometric improvements are recommended for the studied intersections.

Keywords: Near-miss; Driver behaviour; Unsignalized intersection; Chi-square test; Traffic safety; Port Harcourt

1 INTRODUCTION

Road traffic crashes are a persistent global public health and economic burden, with low- and middle-income countries bearing a disproportionate share of fatalities relative to their vehicle ownership levels. Intersections, and unsignalized intersections in particular, are consistently identified as locations of elevated crash risk because they concentrate conflicting vehicle and pedestrian movements without the mediating control of traffic signals, leaving right-of-way

negotiation to driver judgement, informal convention and, in many developing-country contexts, weak enforcement of traffic rules.

Because crash data in many developing countries are sparse, inconsistently recorded and often limited to fatal or severe outcomes, researchers have increasingly turned to surrogate safety measures and traffic conflict techniques (TCT) as a proactive alternative to reactive, crash-based safety evaluation [1; 2; 3; 4; 5]. A near miss, or traffic conflict, is an observable event in which two or more road users approach one another in space and time to such an extent that a collision is imminent if their movements remain unchanged, and it is treated as a proxy indicator of underlying crash risk [6]. This approach is particularly relevant in Nigeria, where the traffic conflict technique has previously been used to document unsafe driver behaviours such as incorrect indicator use and tailgating at conflict-prone locations [7].

Port Harcourt, the capital of Rivers State, has experienced rapid growth in vehicle ownership and urban travel demand over the past two decades, and several of its major road corridors and intersections, including those along Ikwerre Road, have been reported to suffer from congestion, poor driver habits, inadequate pedestrian crossing facilities and on-street trading that encroaches on the carriageway [8]. These conditions are compounded at unsignalized junctions, where the absence of signal control places a heavier burden on driver compliance with right-of-way rules. Despite the volume of literature on traffic congestion and capacity in Port Harcourt, comparatively little published work has directly linked observed driver behaviour categories to near-miss occurrence at the city's unsignalized intersections using a structured observational and statistical approach.

This study addresses that gap by examining driver behaviour and near-miss occurrence at three unsignalized intersections in Port Harcourt: Rivers State University, Agip and Rumukrushu junctions. The specific objectives are to (i) determine the distribution of driver behaviours, namely speeding, failure to yield, distracted driving and safe driving, and their associated near-miss outcomes at each intersection; (ii) determine the frequency of near misses by conflict type (vehicle-to-vehicle and vehicle-to-pedestrian) and by time period (peak and off-peak); and (iii) statistically test the relationship between driver behaviour category and near-miss occurrence using the chi-square test of independence. The findings are intended to provide an empirical basis for targeted enforcement, driver education and low-cost engineering interventions at unsignalized intersections in similar urban settings.

2 MATERIALS AND METHODS

2.1 Study Area

Three unsignalized intersections were selected for this study on the basis of their traffic volume and previously reported congestion or safety concerns: Agip junction, Rumukrushu junction and the Rivers State University junction, all located within Port Harcourt metropolis, Rivers State, Nigeria. These intersections were chosen because they are major, high-conflict junctions along heavily trafficked corridors serving the university, industrial and residential areas of the city, and because none of the three is currently controlled by traffic signals, so right-of-way at each is negotiated informally between drivers, and between drivers and pedestrians.

2.2 Instrumentation

Field data were collected using the following instruments and materials: (i) a structured observation checklist and operational definition guide, used to standardise the classification of driver behaviour and near-miss events; (ii) manual tally sheets and an observation session log, used to record the frequency of each behaviour and outcome as it occurred; (iii) a field notebook, used to record contextual and directional notes on approach geometry, sightlines and unusual occurrences; (iv) a stopwatch, used to time vehicle approach and gap-acceptance intervals; (v) a measuring tape, used to verify approach and conflict-point distances; and (vi) printed location maps and digital maps accessed via smartphone, used to confirm intersection geometry and approach labelling in the field.

2.3 Operational Definitions and Observation Procedure

Observations were structured around definitions adapted from the traffic conflict technique literature [2; 3; 4] and were kept consistent, where applicable, with operational concepts in the Highway Capacity Manual for unsignalized intersection analysis, the safety evaluation logic of the Highway Safety Manual, and right-of-way and signage interpretation principles similar to those captured in manuals in the tradition of the Manual on Uniform Traffic Control Devices (MUTCD). A near miss was operationally defined as an observed interaction between two road users, vehicle-to-vehicle or vehicle-to-pedestrian, in which evasive action (braking, swerving or stopping) was required to avoid an imminent collision. Four mutually exclusive driver behaviour categories were recorded for each observed approach: speeding (travelling at a speed visibly inconsistent with prevailing traffic and site conditions), failure to yield (proceeding without according right-of-way to a vehicle or pedestrian with priority), distracted driving (observable inattention, such as phone use or lack of visual scanning, at the point of conflict) and safe driving (compliant, attentive

behaviour with no contributing violation). Each observed approach was classified by a trained observer as resulting in a near miss or no near miss, and the outcome was logged on the manual tally sheet against the corresponding behaviour category and time stamp. Observations were conducted at each intersection across peak periods (7:00-9:00 am and 4:00-6:00 pm) and an off-peak period (10:00 am-12:00 pm), with the field notebook used to record approach direction, weather and any site-specific factors that could affect behaviour.

2.4 Data Analysis

Data recorded on the tally sheets were aggregated into behaviour-by-outcome contingency tables for each intersection, cross-tabulated by conflict type (vehicle-to-vehicle versus vehicle-to-pedestrian) and by time period (peak versus off-peak). Descriptive statistics (frequencies and percentages) were computed to characterise the distribution of behaviours and near-miss occurrence at each location. To test whether near-miss occurrence was statistically associated with driver behaviour category, a chi-square test of independence was applied to each intersection's 4 x 2 behaviour-by-outcome contingency table, using the standard formula:

$$\chi^2 = \sum [(O_{ij} - E_{ij})^2 / E_{ij}] \quad \text{-----} 1$$

where O_{ij} is the observed frequency and E_{ij} is the expected frequency for cell (i, j), computed from the row and column totals under the null hypothesis of independence between behaviour category and near-miss occurrence. The test statistic follows a chi-square distribution with degrees of freedom equal to $(r - 1)(c - 1)$; for the 4 x 2 tables used here, this gives 3 degrees of freedom. A significance level of $\alpha = 0.05$ was adopted, and the null hypothesis of independence was rejected where the computed p-value fell below this threshold [9]. Analyses were performed in Python using the SciPy statistical computing library.

3 RESULTS AND DISCUSSION

3.1 Behavioural Distribution and Near-Miss Occurrence by Intersection

A total of 890 approach movements were observed across the three intersections. Overall near-miss occurrence was highest at the Rivers State University junction (95 of 290 movements, 32.8 percent), followed by Agip junction (85 of 300 movements, 28.3 percent) and Rumukrushu junction (65 of 300 movements, 21.7 percent). The behavioural distribution at each intersection is presented in Tables 1 to 3.

Table 1: Behavioural distribution at Rivers State University junction

Behaviour Category	Near Miss	No Near Miss	Total
Speeding	45	35	80
Failure to Yield	35	25	60
Distracted Driving	12	48	60
Safe Driving	3	87	90
Total	95	195	290

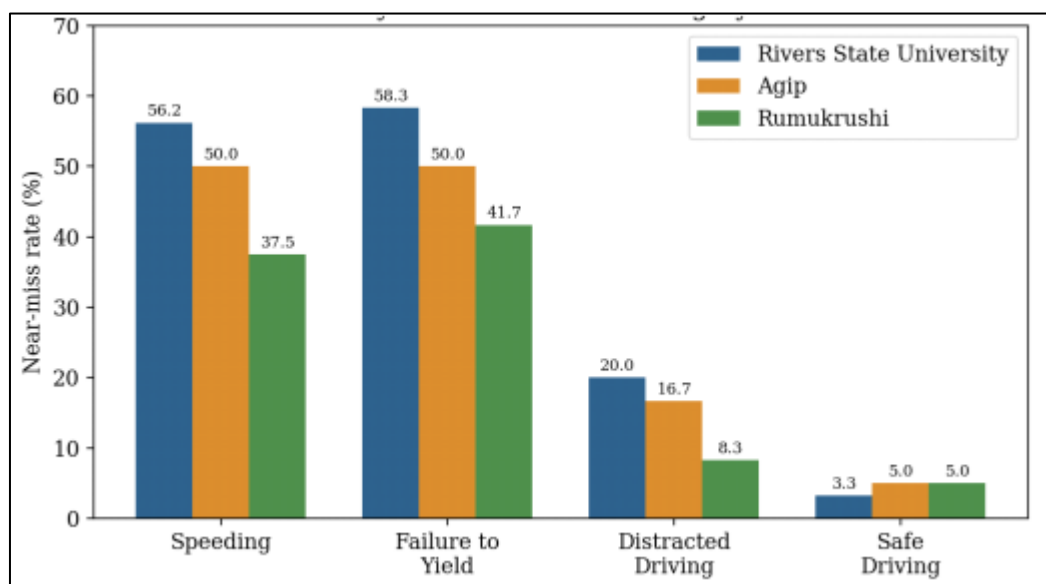
Table 2: Behavioural distribution at Agip junction

Behaviour Category	Near Miss	No Near Miss	Total
Speeding	40	40	80
Failure to Yield	30	30	60
Distracted Driving	10	50	60
Safe Driving	5	95	100
Total	85	215	300

Table 3: Behavioural distribution at Rumukrushu junction

Behaviour Category	Near Miss	No Near Miss	Total
Speeding	30	50	80
Failure to Yield	25	35	60
Distracted Driving	5	55	60
Safe Driving	5	95	100
Total	65	235	300

At all three intersections, speeding and failure to yield were associated with the highest within-category near-miss rates. At the Rivers State University junction, 56.2 percent of speeding approaches and 58.3 percent of failure-to-yield approaches resulted in a near miss, compared with 20.0 percent for distracted driving and only 3.3 percent for safe driving. A similar pattern was observed at Agip junction (50.0 percent for speeding and failure to yield, against 16.7 percent for distracted driving and 5.0 percent for safe driving) and at Rumukrushu junction (37.5 percent for speeding, 41.7 percent for failure to yield, 8.3 percent for distracted driving and 5.0 percent for safe driving). This consistent ordering, with speeding and failure to yield carrying substantially higher near-miss rates than distracted driving, and safe driving carrying the lowest rates, indicates that outright violation of speed and right-of-way expectations, rather than inattention alone, was the dominant behavioural contributor to near-miss occurrence at the unsignalized intersections studied. Figure 1 illustrates this pattern graphically, showing the near-miss rate for each behaviour category side by side across the three intersections.

**Figure 1: Near-miss rate (%) by driver behaviour category and intersection.**

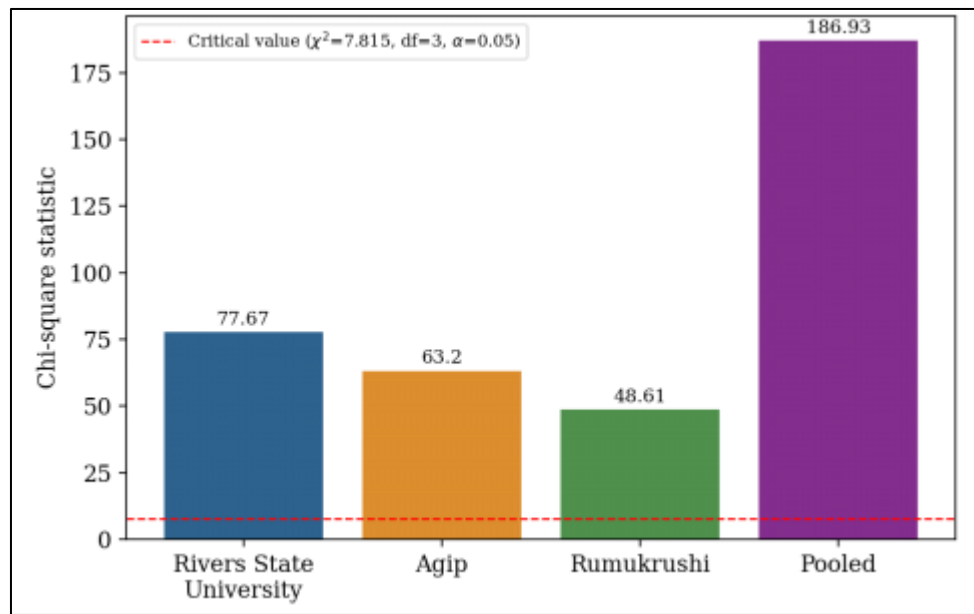
3.2 Chi-Square Test of Independence

The chi-square test of independence was applied to the behaviour-by-outcome contingency table for each intersection and to the pooled dataset across all three intersections. The results are summarised in Table 4.

At every intersection, and in the pooled dataset, the computed p-value was far below the adopted significance level of 0.05, so the null hypothesis of independence between driver behaviour category and near-miss occurrence is rejected in each case. Driver behaviour is therefore statistically associated with near-miss occurrence at all three unsignalized intersections studied, a result consistent with the descriptive pattern in Section 3.1 and with the broader traffic-conflict literature, which treats observable behavioural violations as reliable precursors of conflict severity [10; 6]. Figure 2 plots the computed chi-square statistic for each intersection and the pooled dataset against the critical value of 7.815 ($df = 3, \alpha = 0.05$); every bar clears the critical-value line by a wide margin, visually confirming the strength of the association.

Table 4: Chi-square test results for the association between driver behaviour and near miss occurrence

Intersection	χ^2	df	p-value
Rivers State University	77.67	3	9.70×10^{-17}
Agip	63.20	3	1.22×10^{-13}
Rumukrushi	48.61	3	1.58×10^{-10}
Pooled (all intersections)	186.93	3	2.81×10^{-40}

**Figure 2: Chi-square statistic for the behaviour-near-miss association, by intersection, against the critical value.**

3.3 Conflict Type: Vehicle-to-Vehicle versus Vehicle-to-Pedestrian

Table 5 presents the distribution of near misses by conflict type. Vehicle-to-vehicle conflicts outnumbered vehicle-to-pedestrian conflicts at every intersection: 63.2 percent versus 36.8 percent at the Rivers State University junction, 64.7 percent versus 35.3 percent at Agip junction, and 69.2 percent versus 30.8 percent at Rumukrushi junction, giving a pooled split of 65.3 percent vehicle-to-vehicle against 34.7 percent vehicle-to-pedestrian. This pattern is broadly consistent with the mixed-traffic, high-vehicular-density character of Port Harcourt's unsignalized junctions, where competing vehicle movements dominate the conflict environment, although the substantial minority share of vehicle-to-pedestrian conflicts, particularly at the Rivers State University junction where pedestrian crossing demand is high, underscores the continuing exposure of pedestrians at these locations, consistent with concerns raised for the same corridor by [8] regarding the absence of dedicated pedestrian crossing facilities. Figure 3 presents these counts graphically.

Table 5: Vehicle-to-vehicle and vehicle-to-pedestrian near-miss distribution

Intersection	Vehicle-to-Vehicle	Vehicle-to-Pedestrian	Total
Rivers State University	60	35	95
Agip	55	30	85
Rumukrushi	45	20	65
Total	160	85	245

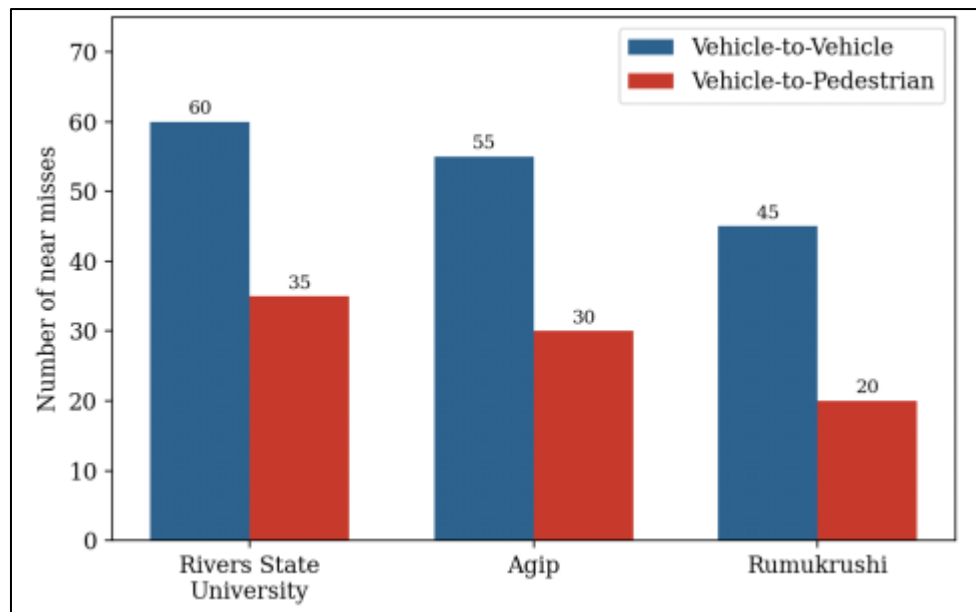


Figure 3: Vehicle-to-vehicle and vehicle-to-pedestrian near-miss counts by intersection.

3.4 Temporal Distribution of Near Misses

Table 6: Near-miss occurrence by time period

Intersection	Peak Period	Off-Peak Period	Total
Rivers State University	57	38	95
Agip	51	34	85
Rumukrushi	39	26	65
Total	147	98	245

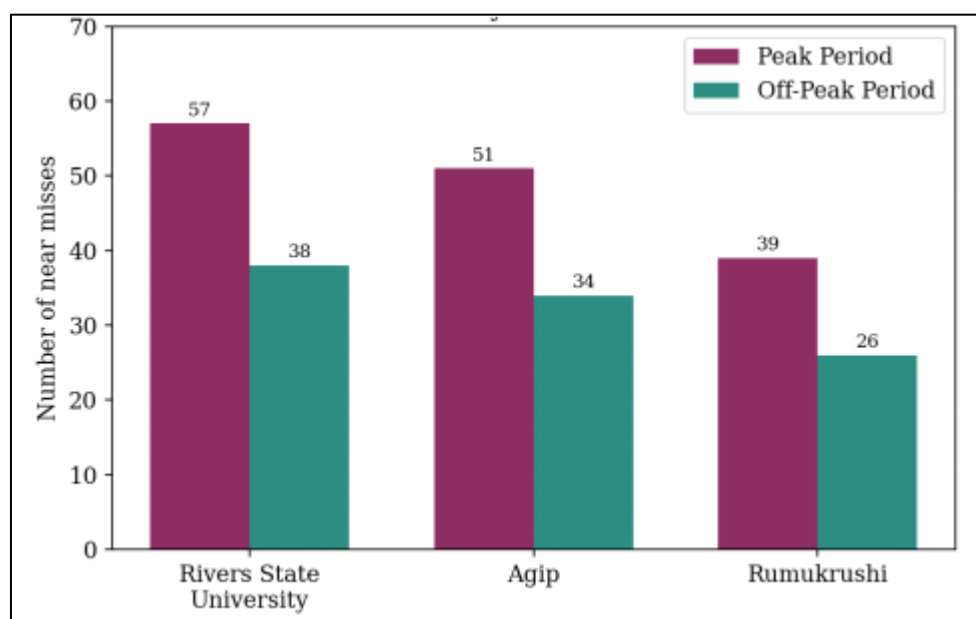


Figure 4: Near-miss occurrence by time period and intersection

Table 6 shows the distribution of near misses by time period. At each intersection, 60 percent of near misses occurred during the peak periods (7:00-9:00 am and 4:00-6:00 pm) and 40 percent during the off-peak period (10:00 am-12:00 pm), a proportion that was uniform across all three locations. This concentration of near misses in peak periods is

consistent with the higher traffic volumes, denser gap-acceptance conditions and greater driver impatience typically reported during peak travel in congested Nigerian urban corridors (Uzundu, Jamson, & Lai, 2019), and it points to peak-hour enforcement and gap-management measures as a priority for the intersections studied. Figure 4 presents the peak versus off-peak counts for each intersection.

4 DISCUSSION

The results confirm, through a formal chi-square test, what the descriptive distributions already suggest: driver behaviour is not independent of near-miss occurrence at unsignalized intersections in Port Harcourt. This is consistent with the traffic conflict technique literature, in which observable violations such as speeding and improper right-of-way behaviour have long been treated as leading indicators of conflict and crash risk rather than incidental correlates [1; 2; 5]. The particularly strong association of speeding and failure to yield with near-miss occurrence, relative to distracted driving, suggests that at these specific junctions, deliberate or habitual violation of speed and priority expectations is a more immediate safety concern than momentary inattention, a distinction with direct implications for the design of countermeasures: speed and yielding violations are more amenable to enforcement, signage and geometric measures (for example, raised tables, rumble strips or clearer priority markings), whereas distraction is more amenable to public education.

The predominance of vehicle-to-vehicle conflicts over vehicle-to-pedestrian conflicts mirrors the vehicle-dense character of these junctions reported in related Port Harcourt traffic studies [8], although the meaningful share of pedestrian conflicts, especially at the university junction, echoes findings elsewhere in Nigeria that pedestrian infrastructure is frequently inadequate at high-conflict locations [11]. The uniform 60:40 peak-to-off-peak split across all three intersections is a striking finding: it suggests that, at least for the sampling windows used in this study, the relative risk exposure by time of day is a stable feature of these junctions rather than one that varies markedly by location, which is broadly consistent with peak-period risk concentration reported by [7] at other Nigerian conflict sites. Taken together, these findings support prioritising peak-hour, behaviour-focused interventions, complemented by pedestrian facility improvements, at the three intersections studied.

5 CONCLUSIONS

This study examined driver behaviour and near-miss occurrence at three unsignalized intersections in Port Harcourt, Nigeria, using structured field observation and the chi-square test of independence. Near-miss occurrence was highest at the Rivers State University junction (32.8 percent of observed approaches), followed by Agip junction (28.3 percent) and Rumukrushu junction (21.7 percent). Speeding and failure to yield were the behaviours most strongly associated with near misses at all three intersections, while safe driving was associated with the lowest near-miss rates. The chi-square test of independence confirmed a statistically significant association between driver behaviour category and near-miss occurrence at each intersection and in the pooled dataset ($p < 0.001$ in all cases), rejecting the null hypothesis of independence. Vehicle-to-vehicle conflicts (65.3 percent) were more common than vehicle-to-pedestrian conflicts (34.7 percent), and 60 percent of all near misses occurred during peak periods.

On the basis of these findings, it is recommended that traffic management agencies prioritise visible enforcement against speeding and right-of-way violations during peak periods at the three intersections studied; that low-cost geometric and traffic control measures, such as clearer priority signage, speed-reducing features and marked pedestrian crossings, be introduced, particularly at the Rivers State University junction where pedestrian exposure is highest; and that targeted driver education addressing yielding behaviour and attentiveness be pursued in the vicinity of these junctions. This study is limited by its cross-sectional, observation-based design and the absence of a direct link to recorded crash severity outcomes; future work should extend the observation protocol to additional unsignalized intersections in Port Harcourt and, where feasible, incorporate quantitative surrogate safety measures such as time-to-collision or post-encroachment time alongside the categorical behavioural classification used here.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

The authors wish to express their sincere gratitude to the staff of Civil Engineering Department, Rivers State University, Nigeria and Captain G. Otto for their invaluable guidance throughout the course of this study.

Funding Source

The study was self-funded and personally sponsored by Emmanuel Ihuoma Mike-Ogburia. This research received no external grant or financial support from any funding agency in the public or sectors.

Disclosure of conflict of interest

The authors declare that there is no conflict of interest, financial or otherwise, associated with this research.

REFERENCES

- [1] Perkins, S. R., & Harris, J. I. (1969). Traffic conflict characteristics: Accident potential at intersections. *Highway Research Record*, 225, 35-43.
- [2] Hayward, J. C. (1972). Near miss determination through use of a scale of danger. *Highway Research Record*, 384, 24-34.
- [3] Hydén, C. (1987). The development of a method for traffic safety evaluation: *The Swedish traffic conflict technique (Bulletin 70)*. Lund Institute of Technology, Department of Traffic Planning and Engineering.
- [4] Parker, M. R., & Zegeer, C. V. (1989). Traffic conflict techniques for safety and operations: Observers manual. Federal Highway Administration.
- [5] Tarko, A. P. (2018). Surrogate measures of safety. In *Transport sustainability* (Vol. 11, pp. 383-405). Emerald Publishing.
- [6] Arun, A., Haque, M. M., Washington, S., Sayed, T., & Mannering, F. (2021). A systematic review of traffic conflict-based safety measures with a focus on application context. *Analytic Methods in Accident Research*, 32, Article 100185.
- [7] Uzundu, C., Jamson, S., & Lai, F. (2019). Investigating unsafe behaviours in traffic conflict situations: An observational study in Nigeria. *Journal of Traffic and Transportation Engineering (English Edition)*, 6(5), 482-492.
- [8] Otto, C. G., & Awarri, A. W. (2022). Public transport sector development in Port Harcourt: A road map for reducing traffic congestion. *International Journal of Research in Engineering and Science*, 10(8), 1-10.
- [9] McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica*, 23(2), 143-149.
- [10] Allen, B. L., Shin, B. T., & Cooper, P. J. (1978). Analysis of traffic conflicts and collisions. *Transportation Research Record*, 667, 67-74.
- [11] Adogu, P. O. U., Ilika, A. L., & Asuzu, M. C. (2009). Predictors of road traffic accident, road traffic injury, and death among commercial motorcyclists in an urban area of Nigeria. *Nigerian Journal of Medicine*, 18(4), 393-397.