




Research Article

Commercial Drivers' Knowledge of Road Safety Signs and Its Implications for Tourism Transport Safety in Kaduna Metropolis, Nigeria

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ABSTRACT

Commercial drivers play important roles in providing urban mobility and transportation for tourism, yet our understanding of their knowledge of road safety signs remains inadequate. This study examines commercial drivers' knowledge of road safety signs and symbols and the link between that knowledge and tourism transport safety. A descriptive survey design was used to gather data through structured questionnaires and field observations. Data were analyzed using descriptive statistics and Pearson product-moment correlation (PPMC). The study revealed numerous challenges in drivers' understanding of road safety signs. The traffic light sign received the highest level of knowledge (4.68), whereas the scores of the other signs were much lower, below the acceptable threshold (3.00). The pedestrian crossing was the hardest sign, requiring much interpretation (29.10%). A lack of education and awareness (52.26%) and language barriers (26.55%) were the main challenges related to drivers' road safety. Additionally, 72.88% of traffic violations or accidents were caused by drivers misunderstanding signs. The results revealed a statistically significant positive relationship between drivers' knowledge and the outcomes of the tourism transportation process ($r = 0.620$, $p < 0.05$). This means that more knowledgeable drivers have better transport results. The coefficient of determination ($R^2 = 0.384$) indicates that drivers' knowledge makes an important contribution to the results, but is not the only one. It can be concluded that increasing road safety literacy among commercial drivers will improve safety and performance in transportation processes in the Kaduna Metropolis.

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1 Introduction

Tourism and transportation are interdependent sectors that drive socioeconomic growth and global connectivity (Alina et al., 2023; Bekele, 2021). Tourism embodies the human desire to explore, while transportation provides the means to access destinations, linking travelers to attractions and enabling cultural exchange (English et al., 2021). Efficient transportation systems are essential for tourism development, ensuring the safe and timely movement of people and goods (Macha, 2021).

Despite its critical role, transportation is also a major source of risk because of road traffic accidents (RTAs). The World Health Organization (WHO, 2022) estimates 1.3 million annual deaths from RTAs worldwide, with 90% occurring in low- and middle-income countries. In Nigeria, Kaduna state recorded RTAs in 2024, bearing the highest burden in absolute terms, 7,804 crashes, and 4,348 deaths (Tanko et al., 2025). These accidents impose high social and economic costs, undermining public health, tourism safety, and sustainable development (Dalal et al., 2013; Pozdnyakova et al., 2022).

Commercial drivers, who transport tourists within urban centers, play a pivotal role in ensuring road safety. Evidence suggests that limited knowledge of traffic signs and symbols among drivers contributes substantially to accidents and non-

compliance (Anene, 2022). While prior studies in Kaduna and other Nigerian cities have examined compliance with traffic regulations, they often overlook drivers' actual knowledge, perceptions, and challenges in applying road safety rules (Oni et al., 2023). Assessing this knowledge is therefore critical for identifying gaps that hinder safe transportation and, by extension, sustainable tourism development.

Kaduna Metropolis possesses considerable tourism potential, with its cultural heritage, parks, and attractions. However, the safety of visitors depends heavily on commercial drivers' understanding of road safety and traffic signage (Ajiboye et al., 2022; Haruna, 2022). Low awareness and poor adherence to traffic signs increase accident risks, negatively affecting tourist experiences and the reputation of destinations (WHO, 2022). Previous research has reported low compliance and limited awareness among drivers, but sample sizes are often inadequate, and the focus on knowledge rather than behavior remains limited (Nthoki et al., 2024).

While previous studies in Nigeria have examined traffic rule compliance, few have quantitatively assessed drivers' understanding of road safety signs or linked such knowledge to tourism transport safety outcomes. This limits evidence-based interventions targeting transport safety within tourism-dependent urban

systems. Addressing these gaps can inform targeted interventions, such as training programs, awareness campaigns, and infrastructure improvements, ultimately enhancing road safety and tourism development. Therefore, this study aims to assess commercial drivers' knowledge of road safety signs and their implications for tourist transport safety in Kaduna Metropolis. Specifically, it seeks to assess drivers' knowledge of road safety signs, identify challenges affecting interpretation, and examine the relationship between knowledge and tourism transport safety.

2 Materials and Methods

2.1 Study Area

Kaduna Metropolis, the capital of Kaduna State, Nigeria, is geographically located between latitudes $10^{\circ} 23' 34''$ and $10^{\circ} 3' 2''$ N and longitudes $7^{\circ} 12' 3''$ to $7^{\circ} 41' 6''$ E (Figure 1). It spans Kaduna North and Kaduna South local government areas, including parts of Chikun and Igabi LGAs (Umar et al., 2025). The metropolis serves as a major administrative, commercial, and transport hub in northern Nigeria. Traffic density is still high in major

cities such as Kaduna North and Kaduna South, mainly because of rapid urbanization, an increase in the number of private cars, and insufficient road networks. The increase in traffic can be attributed to increasing population as well as mixed modes of traffic (Abdullahi & Akinwumi, 2024).

Tourism hotspots in and around the metropolis include Kajuru Castle (a notable resort destination), the National Museum of Kaduna, Sultan Bello Masjid, Murtala Square, and other cultural and historical sites that attract both domestic and international visitors (Ibrahim et al., 2025). The transport structure is characterized by the dominance of tricycles (*keke* or *Keke-Napep*), which serve as the primary mode of intraurban commercial passenger transport because of their affordability, accessibility on narrow streets, and ability to navigate congested areas. Other modes include taxis, buses, and private vehicles, but tricycles remain central to daily mobility for most residents (Collins et al., 2025).

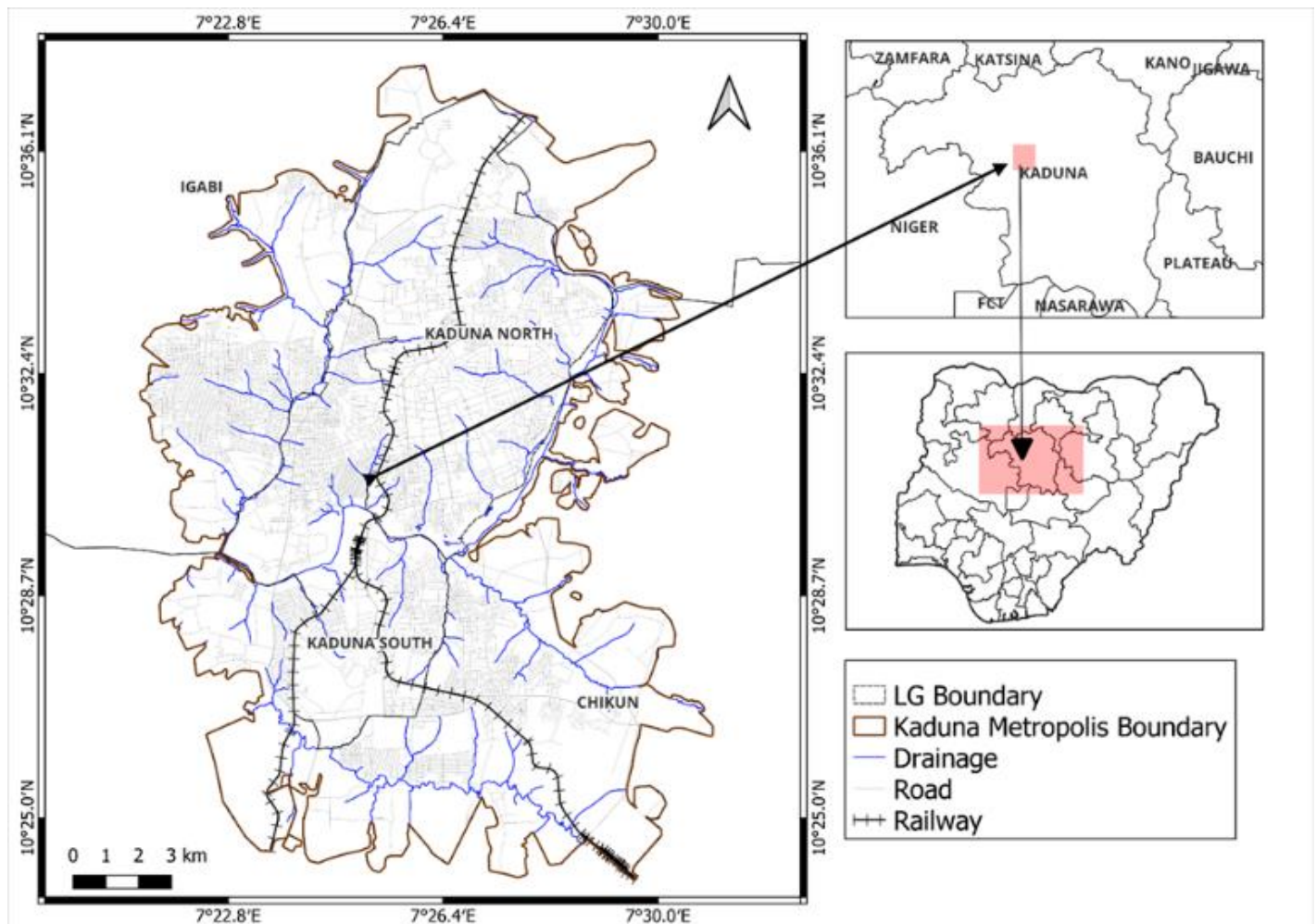


Figure 1: Map of Kaduna Metropolis (Source: GRID3 Nigeria, 2024)

2.2 Reconnaissance Survey

A preliminary reconnaissance survey was conducted to identify and map the commercial bus, taxi, and tricycle stations within Kaduna Metropolis. Key stations included the Central Market (Kasuwa) Station, Kawo Station, Sabon Tasha Station, Mando Station, Kabala, and Kasuwan Barci. The survey provided essential information for designing the sampling framework and determining the population of registered drivers.

2.3 Research Design

This study adopted a descriptive survey design to evaluate the effect of commercial drivers' knowledge of road safety signs on tourism transport safety in Kaduna Metropolis. A quantitative method was employed: structured questionnaires were administered to commercial drivers, and observational studies were conducted at major traffic points.

2.4 Data Type and Sources

This study relies primarily on quantitative data to measure commercial drivers' knowledge of road safety signs and symbols and their implications for sustainable tourism. Data were collected through structured questionnaires, interviews, and direct observation. Table 1 summarizes the data types, sources, and their relevance.

A structured questionnaire served as the primary instrument for data collection. The questionnaire included sections on sociodemographic, knowledge, and interpretation of road safety signs, compliance with traffic regulations, and perceived implications for tourist safety.

Table 1: Types, Sources, and Relevance of Data

S/N	Data Needed	Source	Relevance/Use
1	Level of commercial drivers' knowledge of road safety signs	Structured questionnaires	Assess drivers' awareness and understanding of road safety signs and symbols
2	Perception of the role of road signs in tourism promotion	Interviews with selected drivers and transport union leaders	Evaluate drivers' perceptions of the importance of road signage in tourism
3	Challenges faced in interpreting road safety signs	Qualitative responses from interviews and open-ended questionnaire items	Identify obstacles to proper interpretation and compliance
4	Influence of road signage on tourist safety and travel behavior	Observation and secondary reports from tourism and road safety agencies	Analyse the linkage between proper signage and safe tourism routes
5	Sociodemographic data of drivers	Questionnaire (Section A: Demographics)	Examine relationships between driver characteristics (e.g., age, education) and comprehension of road signs

2.5 Sampling, Sample Frame, and Sample Size

The study population comprised all the registered members of the National Union of Road Transport Workers (NURTW) and the Amalgamated Commercial Tricycle and Motorcycle Owners, Repairs, and Riders Association of Nigeria (ACOMORAN) operating within Kaduna Metropolis. As of January 2024, NURTW registered 170 buses and taxis, while ACOMORAN registered 3,886 tricycle operators, totaling 4,056 drivers.

Using Krejcie and Morgan's (1970) sample size table, 354 respondents were selected, which proportionally represented buses, taxis, and tricycles (Table 2).

A convenience sampling technique was employed to administer questionnaires to available drivers at government-approved or association-registered stations. This ensured that the respondents were representative of the population.

Table 2: Distribution of Questionnaires by Station

S/No	Station	Registered Members	Questionnaires Administered
1	Bus: Kawo – Sabon Tasha (Ahmadu Bello Way)	114	10
2	Bus: Kawo – Tudun Wada	18	2
3	Taxi: Kawo – Sabon Tasha Express	26	2
4	Taxi: Kawo – Kabala	12	1
5	Tricycle Zone 1 (Kawo Unit)	707	62
6	Tricycle Zone 2 (U/Sarki Unit)	153	13
7	Tricycle Zone 3 (U/Rimi Unit)	565	49
8	Tricycle Zone 4 (Kagoro by Express Unit)	1,324	116
9	Tricycle Zone 5 (Sabon Tasha Unit)	1,137	99
Total		4,056	354

2.6 Data Analysis

Knowledge of road safety signs should be assessed. The responses were analysed using descriptive statistics, including frequency counts, means, and percentages. A five-point Likert scale was employed: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. The mean score for each item was computed, with values ≥ 3.00 considered indicative of sufficient knowledge.

$$\text{Decision Rule: } \frac{\sum fx}{\sum x} = \frac{5 + 4 + 3 + 2 + 1}{5} = \frac{15}{5} = 3.00$$

To ensure the internal consistency and reliability of the questionnaire instrument, Cronbach's alpha (α) was computed. The Cronbach's alpha coefficient exceeded the acceptable threshold of 0.70, indicating good internal consistency. The challenges associated with interpreting road safety signs were analysed using frequency counts and percentage distributions to identify the dominant

constraints affecting comprehension and compliance.

To examine the relationship between drivers' knowledge of road safety signs and sustainable tourism transportation, Pearson product-moment correlation (PPMC) was employed. The model is expressed as follows:

$$Y = f(X)$$

where Y represents sustainable tourism transportation, and X represents drivers' knowledge of road safety signs. The strength and direction of association were interpreted using correlation coefficients, while statistical significance was evaluated at the 0.05 level.

3 Results and Discussion

3.1 Sociodemographic Characteristics of the Respondents

This study examined the sociodemographic characteristics of commercial drivers in the Kaduna Metropolis. The results are presented in Table 3.

Table 3: Demographic characteristics of the respondents

Variable	Frequency	Percentage
Age		
Below 18 years	19	5.37
18–27 years	134	37.85
28–37 years	94	26.55
38–47 years	76	21.47
Above 47 years	31	8.76
Marital Status		
Single	147	41.53
Married	207	58.47
Education Level		
Primary	74	20.90
Secondary	67	18.93
Tertiary	25	7.06
Others	188	53.11

The results in Table 3 indicate that the majority of commercial drivers in Kaduna Metropolis are young, with 85.89% of the respondents aged between 18 and 47 years. This aligns with Anene (2022), who noted that young drivers are more physically capable, adaptable, and able to meet the demands of commercial driving. Oyetubo et al. (2018) further emphasized that targeted training programs are crucial for young drivers to improve road safety awareness and reduce accident risk.

With respect to marital status, 58.47% of the drivers were married, suggesting that most had family responsibilities and were likely to demonstrate a level of social responsibility.

Educational attainment among drivers shows considerable diversity. Approximately 20.90% have

primary education, 18.93% have secondary, and only 7.06% have tertiary education. The largest group (53.11%) falls under "Others," which includes informal education, Islamic schooling, vocational training, or no formal education. Low educational levels have been widely associated with reduced comprehension of traffic rules and visual communication systems (Anene, 2022; Stephen & Umar, 2024). This suggests that deficiencies in understanding road safety signs in the Kaduna Metropolis are not merely behavioral but also structurally linked to educational limitations. Consequently, interventions aimed at improving road safety must incorporate simplified, visual, and multilingual communication strategies tailored to drivers with diverse literacy backgrounds.

Table 4: Years of Driving Experience

Years of Experience	Frequency	Percent
Less than 1 year	68	19.21
1–5 years	155	43.79
6–10 years	67	18.93
11–15 years	38	10.73
Above 15 years	26	7.34
Total	354	100

From Table 4, the majority of drivers (43.79%) had 1–5 years of driving experience. While experience can

Table 5: Identification of Road Safety Signs and Symbols

S/N	Traffic Sign	SD	D	UD	A	SA	Mean	Decision
1	Stop Sign	90	180	50	20	14	2.13	Rejected
2	Speed Limit	110	170	40	20	14	1.66	Rejected
3	No Parking	60	120	100	50	24	2.94	Rejected
4	No U-Turn	100	170	45	25	14	1.73	Rejected
5	No Horn	80	160	70	30	14	2.36	Rejected
6	No Overtaking	110	170	40	20	14	1.64	Rejected
7	No Left Turn	100	165	50	25	14	1.72	Rejected
8	No Right Turn	95	170	50	25	14	1.75	Rejected
9	Speed Breaker	105	170	45	20	14	1.69	Rejected
10	Dangerous Left Bend	110	165	45	20	14	1.66	Rejected
11	Dangerous Right Bend	100	170	45	25	14	1.72	Rejected
12	Pedestrian Crossing	105	170	45	20	14	1.70	Rejected
13	Traffic Light	5	10	20	80	239	4.68	Accepted
14	Animal Crossing	95	170	50	25	14	1.75	Rejected
15	Road Work	110	165	45	20	14	1.65	Rejected

These results highlight an important weakness in the knowledge about road safety signs among drivers, as no sign other than the traffic light scored more than the accepted value (4.68). There is a fundamental problem in the education process concerning road safety among drivers in this region. The high rate of recognition for traffic lights could be explained by their commonness in towns and their simple color coding, which does not require further processing. On the other hand, regulatory and warning signs such as “No U-Turn,” “Pedestrian Crossing,” and “Speed Breaker” demand further thinking.

These findings are in accordance with the findings of Ajiboye et al. (2022) and Oni et al. (2023), who reported poor adherence to traffic laws in Nigeria because of a lack of knowledge regarding road signs. These outcomes corroborate the idea that road safety issues in developing countries do not result from willful misconduct but emanate from ignorance and a lack of training mechanisms.

In relation to tourism, there is a potential danger posed by this lack of information since commercial drivers are responsible for transporting tourists. This may lead to incidents, delays, and improper driving techniques, compromising transportation in the tourism industry.

enhance familiarity with traffic systems and road signs, formal education, exposure to training programs, and personal attitudes toward compliance are equally critical for ensuring adequate knowledge and promoting tourist safety in Kaduna Metropolis.

3.2 Assessment of Commercial Drivers' Road Safety Signs and Symbols

Table 5 shows the knowledge of commercial drivers on road safety signs and symbols in Kaduna Metropolis.

3.3 Challenges Faced by Commercial Drivers in Understanding Road Signs

The challenges faced by commercial drivers in understanding road safety signs and symbols in the Kaduna Metropolis are shown in Table 6.

Table 6: Road Signs Most Challenging to Understand

Road Sign	Frequency	Percentage
Stop	5	1.41
Yield	58	16.38
Pedestrian Crossing	103	29.10
Speed Limit	23	6.50
No Parking	2	0.56
No U-Turn	45	12.71
Railroad Crossing	68	19.21
School Zone	38	10.74
Others	12	3.39

As shown in Table 6, the results revealed a lack of awareness/education (52.26%) and language barriers (26.55%) as key difficulties in the interpretation of the meaning behind road safety signs by motorists. From these results, it is evident that this problem has a structural basis and that comprehension problems arise mainly as a result of systematic failures.

Language barriers have become more relevant than ever in nations such as Nigeria, which embrace diverse languages, since road signs usually contain English

phrases or images that may not be easily comprehensible by all motorists. According to Nthoki et al. (2024), failure to communicate effectively through the use of visuals limits the effectiveness of road signs, particularly among informal motorists.

In addition, poor visibility and positioning of road signs also lead to difficulties in interpreting their meanings. In combination with the high density of vehicles and other forms of distractions, the mentioned elements create conditions under which motorists find it difficult to read road signs and interpret instructions.

The relationship between drivers' knowledge and sustainable tourism transportation is shown in Table 7.

Table 7: Pearson product–moment correlation between drivers' knowledge of road safety signs and sustainable tourism transportation.

Variables	Knowledge of Road Signs (X)	Sustainable Tourism Transportation (Y)
Knowledge of Road Signs (X)	1.000	0.620*
Sustainable Tourism Transportation (Y)	0.620*	1.000

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

As shown in Table 7, the Pearson product–moment correlation analysis revealed a moderate to strong correlation ($r = 0.620$; $p < 0.05$) between drivers' knowledge of road safety signs and sustainable tourism transportation.

Higher knowledge levels can lead to better results regarding tourism transportation. In turn, these results include improved safety, efficiency, and reliability. In this case, the coefficient of determination ($R^2 = 0.384$) shows that approximately 38.4% of the variance in tourism transportation results can be considered to be statistically associated with drivers' knowledge of road safety signs.

Nonetheless, correlation cannot be equated with causation. This means that although drivers' knowledge plays a considerable role, there are other influential variables involved in transport results, including infrastructure conditions, regulatory processes, drivers' attitudes, and traffic volume.

These results are consistent with those of Dalal et al. (2013) and the WHO (2022). These authors report that road safety concerns multiple variables and depends on various aspects, including human and environmental elements. Thus, improving drivers' knowledge should be considered one of many strategies aimed at increasing safety in tourism transportation in Kaduna Metropolis.

3.4 Hypothesis testing

The null hypothesis (H_0), stating that there is no significant relationship between the variables, was rejected, while the alternative hypothesis (H_1) was accepted, as the p-value was less than 0.05. These findings confirm that drivers' knowledge serves as a significant predictor of sustainable tourism transportation in Kaduna Metropolis.

The relationship between drivers' knowledge and tourism transport outcomes was statistically significant ($p < 0.05$), indicating a meaningful association between the variables.

Table 8: Factors Contributing to Difficulty

Factor	Frequency	Percent
Poor visibility/placement	32	9.04
Lack of awareness/education	185	52.26
Language barriers	94	26.55
High traffic/distractions	21	5.93
Weak enforcement	22	6.22

The primary challenge was a lack of awareness or education (52.26%), followed by language barriers (26.55%). Addressing these factors through education, better signage placement, multilingual signage, and stricter enforcement can improve road safety outcomes (Nthoki et al., 2024).

3.5 Traffic violations and accidents

Table 9 shows the level of misinterpretation of road signs and symbols by commercial drivers, leading to violations or road traffic accidents.

Table 9: Misinterpretation leading to violations or accidents

Response	Frequency	Percent
Yes	258	72.88
No	96	27.12

The results in Table 9 reveal that 72.88% of drivers admitted to involvement in violations and/or accidents resulting from incorrect interpretation of traffic signs, indicating the importance of addressing the lack of knowledge in this area. These alarming statistics suggest the need for improvement in the field of the communication of safety rules on roads.

A similar situation has been reported in other developing urban areas, where a lack of understanding of traffic signs plays a major role in the occurrence of accidents (Esse, 2021). This problem becomes especially critical when the effects of such a state of affairs on tourism are discussed.

Poor transport systems can negatively affect a city's reputation, discourage further tourism development, and cause lower visitation rates. Thus, increasing drivers'

knowledge of traffic signs is vital for both transport and tourism.

3.6 Strategies to alleviate challenges

This study examined the strategies proposed by commercial drivers to reduce the challenges they face concerning the understanding of road signs and symbols in Kaduna Metropolis. The results are shown in Table 10.

Table 10: Recommended Measures

Strategy	Frequency	Percent
Education and training	206	51.19
Infrastructure improvement	93	26.27
Enforcement	21	5.93
Regular monitoring/evaluation	34	9.61

Education and training emerged as the most important strategy (51.19%), followed by infrastructure improvements (26.27%). This emphasizes the need for a multidimensional approach that combines training, infrastructure enhancement, and monitoring to improve drivers' knowledge and compliance (Nthoki et al., 2024).

Table 11 revealed the willingness of commercial drivers to receive additional training.

Table 11: Willingness for Additional Training

Response	Frequency	Percentage
Yes	324	91.52
No	30	8.48

A large majority (91.52%) of drivers expressed a willingness to participate in additional training programs, indicating strong receptivity toward interventions aimed at improving road safety awareness and tourist transport safety (Anene, 2022).

4 Conclusion

This study demonstrates that commercial drivers in the Kaduna Metropolis have very poor knowledge of road safety signs other than traffic lights. This problem is caused mainly by structural factors, such as a lower education level, a lack of awareness, language difficulties, and poor road signs.

The strong positive association between drivers' knowledge level and tourism transportation

effectiveness indicates that drivers' understanding of road safety is an important determinant of transport efficiency, safety, and reliability. Nevertheless, since drivers' knowledge explains only some variability in tourism transport results, it can be concluded that road safety is affected by a system of various factors.

Due to the high incidence of traffic violations and accidents caused by sign interpretation errors, it is necessary to adopt measures aimed at enhancing the situation. In addition, the readiness of participants in the study to enroll in training classes is crucial and can be harnessed as an important opportunity. In summary, enhancing the ability of drivers to understand road safety signs should be viewed as very important in efforts geared toward minimizing the risks of accidents and improving the image of the Kaduna Metropolis in relation to tourism.

Based on the findings of this study, the following recommendations are proposed.

- i. Structural and continuous driver education programs should be implemented, with a focus on the practical interpretation of road safety signs using visual and multilingual approaches tailored to varying literacy levels.
- ii. Improve road signage infrastructure by enhancing visibility, placement, and clarity, particularly along major transport corridors and routes frequently used by tourists.
- iii. Enforcement mechanisms should be strengthened through increased monitoring and collaboration between the FRSC, transport unions (NURTW, ACOMORAN), and local authorities to ensure compliance with traffic regulations.
- iv. Stakeholder collaboration among government agencies, transport unions, and tourism authorities should be promoted to develop integrated road safety strategies that support sustainable tourism transportation.
- v. Future research should incorporate broader variables such as infrastructure quality, behavioral factors, and enforcement effectiveness, as well as comparative studies across multiple urban centers in Nigeria.

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