

Research Paper



Road infrastructure conditions and transport risk factors: implications for road accident impacts on motorists in north-east Nigeria

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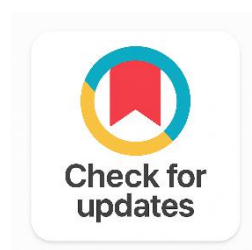
Road Infrastructure

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ABSTRACT

Road traffic accidents remain a significant public health and developmental challenge in North-East Nigeria, exacerbated by post-conflict infrastructure degradation and socio-economic pressures. This study investigated the effectiveness of existing road safety measures and the socio-economic factors influencing accident reduction among motorists in the region. Adopting a descriptive survey design, data were collected from 508 stakeholders, using a structured questionnaire. Analysis revealed that safety measures such as seatbelt enforcement, traffic patrols, and hazard signage were moderately effective, while speed enforcement cameras and public awareness programs were largely ineffective. Socio-economic factors including government budgetary commitment to infrastructure, availability of affordable transport, and regional financial stability were found to moderately influence road safety outcomes. Effective strategies identified for improving road safety included enhanced public sensitization, stricter enforcement of traffic laws, infrastructural rehabilitation, and the adoption of technology-driven monitoring systems. The study underscores the critical interplay between technical interventions and socio-economic realities in achieving sustainable accident reduction among motorists.

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1. INTRODUCTION

Road Traffic Accidents (RTAs) are a critical public health and development issue across the world, accounting for more than 90% of road traffic accident deaths in low and middle income countries [1]. This situation is especially severe in Nigeria where the country's rate of 21.4 deaths per 100,000 people is among the highest in the world (World Bank, 2022). The impact on the economy and society is great, as an estimated 3% of Nigeria's GDP is lost each year due to loss of productivity, healthcare costs and property damage caused by RTAs [2].

RTAs are a complex of various factors, including human error, vehicle condition and the road environment. Recent research has highlighted that driver behaviour is a significant factor, but the key underlying factor that is missing is road infrastructure, which is so foundational. Hazardous road conditions are one of the direct consequences of poorly designed, built and maintained roads that can lead to accidents [3]. Some of the infrastructural problems that were identified in the Nigerian context are inadequate signage, absence of street lighting, poor geometry of the roads, lack of pedestrian facilities and existence of potholes and surface defects [4], [5]. The situation is worsened due to the lack of safety standards enforcement and overloading of vehicles leading to road deterioration [6].

The North-East geopolitical zone of Nigeria is a very dire case and study area that is poorly researched. This region has come off a decade of insurgency and conflict, displacing millions of people, destroying the economy and systematically destroying public infrastructure, such as roads and bridges [7]. The transport infrastructure has been severely affected and not adequately 'repaired' in the post-conflict phase, as a result of which mobility and recovery are restricted. As a result, the road infrastructure is very deteriorated, lacks safety and repair measures are not completed or abandoned in the region [8]. Additionally, the transport risk profile is also quite unique due to the presence of additional military and informal checkpoints, restrictions on travel at night and the presence of overloaded vehicles on the roads to transport humanitarian supplies and people [9].

Although the situation is dire, few localised empirical studies have focused on how the particular conditions of road infrastructure are directly and indirectly linked to the specific transport risk factors that occur and how each of these can have a compounded effect on the impact of accidents on motorists. The majority of national studies have homogenized data and ignored local differences, and few studies have targeted the post-conflict situation infrastructural landscape [10]. This study aimed at addressing this gap, therefore. By exploring the interaction between deteriorating road infrastructure and the particular transport hazards in North-East Nigeria.

1.1. Statement of the Problem

The road network in North-East Nigeria is extremely vulnerable to the effects of the ongoing insurgency and low levels of investment, exacerbated by an environment of transport risks in the region, including security checkpoints, vehicle restrictions, and overcrowding. Although the region experiences a disproportionately high rate of severe road accidents, there is insufficient empirical analysis that specifically addresses the region's unique infrastructural deficiencies (such as collapsed road surfaces, lack of signage, etc.) and contextual risk factors that are associated with the frequency, severity and devastating effects of road accidents. This lack of knowledge translates to generic and ineffective road safety policy and infrastructure interventions, which do not take into account the distinct situation of the region after the conflict, thereby contributing to unnecessary deaths, injuries and socio-economic losses of the road user population.

1.2. Purpose of the Study

The main purpose of the study was to assess the road transport system network on safety measures among motorist in North-East Nigeria. Specifically, the study seeks to:

1. Assess the current condition of road infrastructure in North-East Nigeria.
2. Identify common risk factors associated with road transport in North-East Nigeria.
3. Investigate the impact of road accidents on motorists in North-East Nigeria.

1.3. Research Questions

1. What is the current condition of road infrastructure in North-East Nigeria?
2. What are the common risk factors associated with road transport in North-East Nigeria?
3. What is the impact of road accidents on motorists in North-East Nigeria?

1.4. Hypotheses

The following null hypotheses will be tested at a 0.05 level of significance:

1. There is no significant difference in the mean response of FRSC, VIO, FERMA, and NURTW personnel on the current condition of road infrastructure in North-East Nigeria.
2. There is no significant difference in the mean response of FRSC, VIO, FERMA, and NURTW personnel on the common risk factors associated with road transport in North-East Nigeria.
3. There is no significant difference in the mean response of FRSC, VIO, FERMA, and NURTW personnel on the impact of road accidents on motorists in North-East Nigeria.

2. RELETED WORK

This review uses recent literature to present the current understanding of the link between road infrastructure, risk factors and accident outcomes, focusing specifically on the context of the North-East Nigeria road accident crisis. Organized thematically with the focus points of the study.

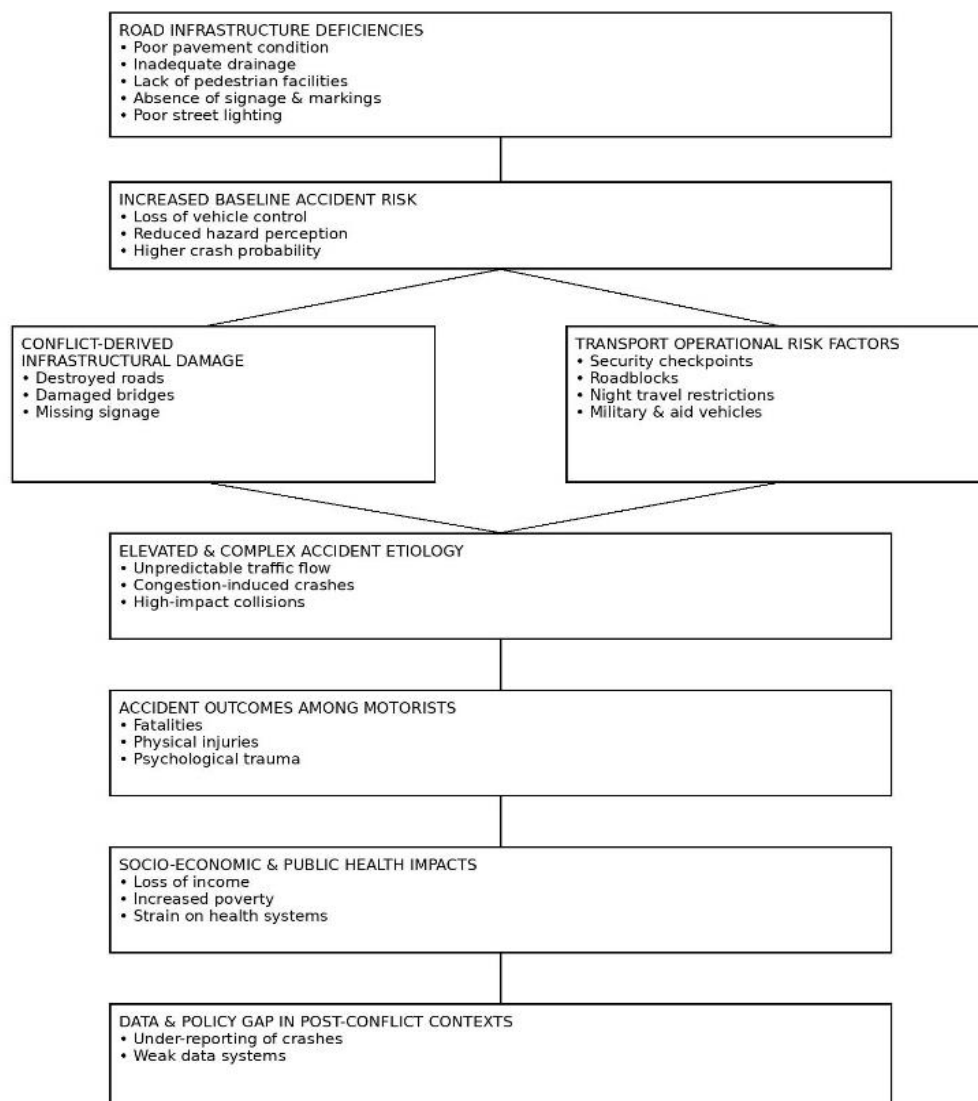


Figure 1. Conceptual Framework

Figure 1 Illustrates how road infrastructure deficiencies and conflict-related transport risk factors interact to elevate accident risk and produce severe safety, socio-economic, and public health outcomes for motorists in North-East Nigeria.

2.1. Road Infrastructure Deficiencies as a Causal Factor in Accidents

The scientific evidence shows that poor road infrastructure is not just a contextual factor, but a major contributor to the likelihood of crashes both on a global and Nigerian context. In both global and Nigerian context, it is scientifically established that poor road infrastructure is not a contextual factor, but a major contributing factors to the likelihood of accidents. These deficiencies have been recently classified as design, maintenance and safety hardware failures. Studies conducted in Nigeria point to inadequate control over vehicles and collision incidents due to poor pavement conditions (potholes and surface failures), insufficient drainage and absence of pedestrian facilities [4]. This lack of standard safety equipment makes for the lack of functional road markings, signage, crash barriers, and street lighting which can have a significant impact on the reduction of hazard perception and on the severity of the accident, especially at night [5]. The lack of these infrastructural features is seen as systemic weaknesses in governance, planning and investment processes, and inevitably adds to the dangers of driving.

2.2. The Unique Transport Risk Ecology of Conflict-Affected Regions

Recent literature increasingly has explored the subject of road safety in terms of conflict and recovery after conflict. The risk profile of transport in situations such as North-East Nigeria is completely changed. Conflict has been found to directly damage roads, bridges, and signage, which poses a long-term infrastructural threat, according to studies [9]. In addition to the physical damage, the operation environment also poses new risks, such as operating in a nighttime travel ban, which can cause all the vehicles to gather during the day, leading to additional congestion and risk; security checkpoints and roadblocks create unpredictable traffic patterns and rear-end collisions; and the increased visibility of military vehicles, humanitarian vehicles, and overloaded goods vehicles can change the typical traffic mix and behavior [7]. The body of work which argues the traditional road safety models do not consider this stress factors embedded in conflicts.

2.3. Accident Impacts and the Data Gap in Fragile Contexts

Despite the multiple impacts of road traffic accidents (RTA), including death, physical injuries, psychological trauma and long-term economic burden for accident victims and their families, literature shows that RTA impacts are poorly documented in North-East Nigeria owing to poor documentation and inadequate data systems particularly in post-conflict settings, which is attributed to a high prevalence of underreporting [10]. Road accidents are responsible for approximately 1.19 million deaths annually in the world, especially in the low and middle-income countries especially in Sub-Saharan Africa, with the incident in Nigeria resulting in number of deaths far exceeding the global average [11]. In addition to causing deaths, accidents have a high economic cost – estimated at 2-3% of Nigeria's GDP per annum and in the household level, these accidents lead to catastrophic health expenditure, loss of income and poverty. Non-fatal injuries, chronic disabilities, and psychological conditions like PTSD, anxiety and depression also burden the public health system, exacerbated by the fragile nature of health systems. In conflict zones of North-East Nigeria, the effects of all of these are exacerbated by the destruction of infrastructure, weak emergency responses and lack of access to trauma care, which increases the risk of accidents and resultant death, thereby perpetuating a vicious cycle of higher risk and worse outcomes for motorists.

Figure 2 shows how road infrastructure deficiencies and conflict-related transport risk factors interact to elevate accident risk and produce severe safety, socio-economic, and public health outcomes for motorists in North-East Nigeria.

2.4. Synthesis and Identified Gap

The literature reviewed clearly identifies the relationships between infrastructure quality and contextual risk factors and adverse accident outcomes as independent. But there is a key synthesis gap.

This study is set to fill this void by conducting an evaluation of the road transport system network on the safety measures of motorist in North-East Nigeria.

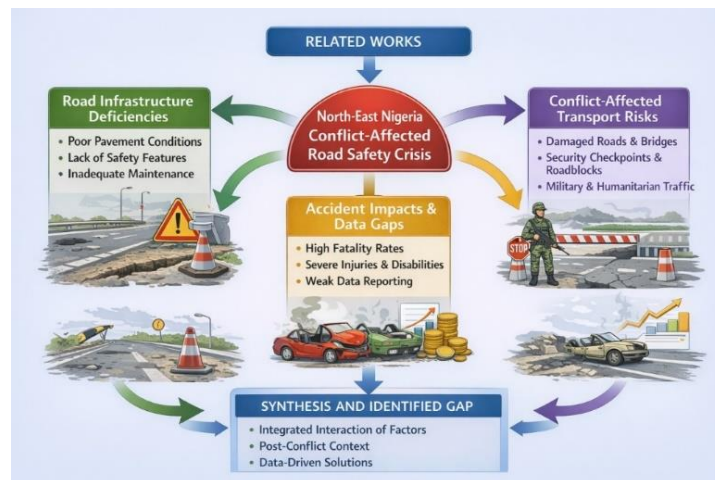


Figure 2. Synthesizing the Related Works

3. MEATHODOLOGY

Research Design: A descriptive survey research design was used in the study. Survey research design refers to a research design that is based on the systematic data collection and analysis from the representative sample of a population through the application of structured research instrument including questionnaires or interviews for specific research needs and goals [12] and [13]. This design type is suitable for research aimed at gathering opinions, attitudes and practices data of people about one phenomenon. This design was selected due to its suitability for obtaining quantitative data on the effectiveness of road safety measures and socio-economic factors that impact the reduction of accidents by motorists. It helps the researcher draw conclusions from the sample to the population and it offers a sound basis for policy recommendations [14], [15].

Area of the Study: The area of the study was the North-East geopolitical zone of Nigeria which covers the states of Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe with a large land mass of 103,630km² inclusive of 4.92° North latitude and 6.26° East longitude. The region is well endowed with a wide variety of topographical features ranging from savannah grasslands to semi-arid areas, mountains and river basins and also represents an important proportion of the Nigeria's landmass. The North-East region has a long road network, which links big commercial and agriculture centres and so is strategically significant. The region, however, has its own problems of poor road infrastructure, insecurity and variance in socio-economic conditions, which all affect the outcomes of road safety.

Population of the Study: The population of the study was key stakeholders in the road transport management and safety enforcement in North-East Nigeria and a total of 788 respondents were selected. The groups include the Federal Road Safety Corps (FRSC); Vehicle Inspection Officers (VIO); Federal Roads Maintenance Agency (FERMA); and National Union of Road Transport Workers (NURTW) as these are selected due to their direct involvement in road safety regulation, enforcement, infrastructure maintenance, and transport operations.

Sample and Sampling Technique: The number of respondents in the study was 508. The sampling technique used for the study was total sample. There was a distribution of the sample as follows: FRSC – 166; VIO – 100; FERMA – 71; NURTW – 171 respondents. The Taro Yamane formula was adopted to determine the sample size (representativeness of the population).

The Study Used the Multistage Sampling Technique: The population was first stratified based on the type of organizations (FRSC, VIO, FERMA, and NURTW). Strata-level key personnel were chosen on purpose on the basis of their knowledge and involvement in road safety and transport management, within each stratum.

Instrument for Data Collection: Data were collected using a structured questionnaire titled: “Road Transport Safety and Network Status Inquiry Questionnaire (RTSNSIQ)”. The instrument 30 questionnaire items. Likert scale was adopted for the measuring the weight of the response options

The instrument was subjected to face validation by three experts: Two lecturers from the Department of Technology Education, Modibbo Adama University, Yola. One senior officer from the Federal Road Safety Corps (FRSC). Corrections and suggestions provided were incorporated into the final version of the instrument.

Reliability of the Instrument: A pilot study was conducted in Plateau State, using respondents from FRSC, VIO, FERMA, and NURTW who were not part of the study area. This was done to avoid bias and contamination of the main study. Cronbach Alpha was to determine internal consistency and 0.87 reliability coefficient was obtained.

Method of Data Analysis: The statistical data obtained were analyzed using descriptive statistical tools, i.e. means and standard deviations to respond to the research questions set and Analysis of Variance (ANOVA) at the 0.05 level of significance to test the hypotheses formulated. The rules of interpreting mean scores were also based on the pre-equipped rating scales that outlined the level of effectiveness, impact, and agreement. The items with a mean of 3.50 and above were considered as indicative of positive responses and those with a mean of less than 3.50 considered negative responses. Hypotheses were tested such that a p-value ≤ 0.05 led to rejection of the null hypothesis, while a p-value > 0.05 led to acceptance. The process is presented in Figure 3.

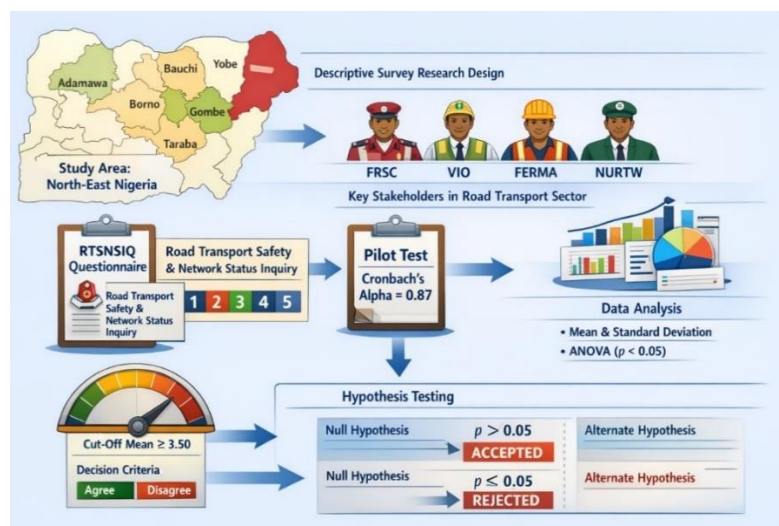


Figure 3. Pictorial presentation of the Methodology

4. RESULTS AND DISCUSSION

4.1. Results

Research Question 1: What is the current condition of road infrastructure in North-East Nigeria?

Table 1. Respondents' Mean and Standard Deviation on the Current Condition of Road Infrastructure in North-East Nigeria

S/N	Items	N = 508		Rmk
		$\bar{x}$	SD	
1	The road surfaces in North-East	2.93	0.36	FG
2	The road signage/markings in North-East	1.02	0.20	VP
3	The accessibility of roads in North-East during adverse weather conditions	2.94	0.32	FG
4	The frequency of road maintenance activities in North-East	1.98	0.18	P
5	The level of congestion experienced on major roads in North-East Nigeria	3.99	0.17	G

6	The safety measures implemented on North-East Nigerian roads	2.06	0.36	P
7	The availability of rest areas along major highways in North-East Nigeria	1.14	0.62	VP
8	The extent of road network coverage in rural areas of North-East Nigeria	1.09	0.47	VP
9	The effectiveness of road lighting systems on major highways in North-East Nigeria	1.07	0.41	VP
10	The responsiveness of authorities to road-related issues in North-East Nigeria	1.09	0.47	VP
	Grand Mean	2.21	0.35	P

KEY: $\bar{x}$ = Mean of respondents, SD = Standard Deviation, Rmk = Remark, G = Good, FG = Fairly Good, P = Poor, VP = Very Poor,

As shown in Table 1, the road infrastructure condition in North-East Nigeria is poor, as reflected by the grand mean of 2.21 (SD = 0.35).

Research Question 2: What are the common risk factors associated with road transport in North-East Nigeria?

Table 2. Respondents' Mean and Standard Deviation on the Common Risk Factors Associated with Road Transport in North-East Nigeria

S/N	Items	N = 508		Rmk
		$\bar{x}$	SD	
1.	Road infrastructure in North-East Nigeria is inadequate for safe transportation	4.02	0.25	Agreed
2.	Poor visibility due to insufficient lighting contributes to road transport risks in North-East Nigeria	3.96	0.19	Agreed
3.	Reckless driving behavior is a prevalent risk factor on roads in North-East Nigeria	4.05	0.23	Agreed
4.	Overloading of vehicles is a common occurrence on roads in North-East Nigeria, posing risks to road safety	3.91	0.47	Agreed
5.	Limited enforcement of traffic laws contributes to road transport risks in North-East Nigeria	3.98	0.12	Agreed
6.	Inadequate maintenance of vehicles increases the likelihood of accidents on North-East Nigerian roads	3.98	0.15	Agreed
7.	Poor road signage exacerbates road transport risks in North-East Nigeria	3.71	0.89	Agreed
8.	Animal encroachments onto roads are a significant risk factor for road transport in North-East Nigeria	3.69	0.92	Agreed
9.	Insufficient emergency response infrastructure exacerbates the consequences of road accidents in North-East Nigeria	3.93	0.50	Agreed
10.	Hazardous road conditions (such as potholes and uneven surfaces) increase the risk of accidents in North-East Nigeria	3.98	0.31	Agreed
	Grand Mean	3.80	0.53	Agreed

As shown in Table 2, the common risk factors associated with road transport in North-East Nigeria had a grand mean of 3.80, the respondents agreed that common risk factors associated with road transport in North-East include poor road infrastructure, inadequate lighting, reckless driving, overloading, weak traffic law enforcement, and inadequate vehicle maintenance. The only item disagreed upon was the adequacy of emergency medical services, suggesting that respondents believe emergency services are lacking.

Research Question 3: What is the impact of road accidents on motorists in North-East Nigeria?

Table 3. Respondents' Mean and Standard Deviation on the Impact of Road Accidents on Motorists in North-East Nigeria

S/N	Items	N = 508		Rmk
		$\bar{x}$	SD	
11.	I have experienced significant physical injuries as a result of a road accident in North-East Nigeria	3.94	0.38	HI
12.	Road accidents in North-East Nigeria have led to considerable financial burdens for me	3.74	0.85	HI
13.	The emotional toll of road accidents in North-East Nigeria has been substantial for me	3.98	0.18	HI
14.	Road accidents in North-East Nigeria have caused disruption to my daily activities	4.00	0.13	HI
15.	I have experienced a decrease in my overall quality of life due to road accidents in North-East Nigeria	3.95	0.33	HI
16.	The frequency of road accidents in North-East Nigeria has made me more cautious while driving	3.98	0.29	HI
17.	Road accidents in North-East Nigeria have negatively affected my confidence in driving	4.17	0.45	MI
18.	I have had to seek medical attention as a result of a road accident in North-East Nigeria	4.09	0.39	HI
19.	Road accidents in North-East Nigeria have caused damage to my vehicle	4.04	0.39	HI
20.	I have missed important commitments due to road accidents in North-East Nigeria	3.02	0.20	MI
	Average Mean	3.60	0.33	MI

KEY: $\bar{x}$ = Mean of respondents, SD = Standard Deviation, Rmk = Remark, HI = High Impact, MI = Moderate Impact, LI = Low Impact,

As shown in Table 3, the respondents' perceptions of the impact of road accidents on motorists in North-East Nigeria indicated that Items 21 - 26, 28, and 29 were rated high impact, with mean scores ranging from 3.74 to 4.09 and standard deviations between 0.13 and 0.85. Items 27 and 30, were rated moderate impact, with mean values between 2.99 and 4.17 and standard deviations ranging from 0.20 to 0.45. The variability in responses across items was generally low, suggesting a shared experience among respondents. The grand mean is 3.60 with a standard deviation of 0.33 indicating that overall, motorists in the region perceive that there is a moderate to high impact of road accidents on them in terms of physical damage, emotional distress, and financial burden.

Hypothesis 1 is that the mean responses for FRSC, VIO, FERMA and NURTW personnel for the current condition of the road infrastructure are not different in North-East Nigeria.

Table 4. ANOVA on the Current Condition of Road Infrastructure

	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.	REMARK
Between Groups	0.242	3	0.081	3.451	0.016	Rejected
Within Groups	11.769	504	0.023			
Total	12.010	507				

As shown in Table 4, the ANOVA conducted to test Hypothesis 1 indicated that the between-groups sum of squares is 0.242 with 3 degrees of freedom, and a within-groups sum of squares of 11.769 with 504 degrees of freedom. The ANOVA result shows a calculated F-value of 3.451 with a significance level (p-value) of 0.016. Since the p-value is less than the 0.05 alpha level, the null hypothesis is rejected.

Table 5. Scheffe Post Hoc Test of Comparison on the Current Condition of Road Infrastructure in North-East Nigeria

(I) Respondents	(J) Respondents	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
FRSC	VIO	.03509	.01934	.350	-.0192	.0893
	FERMA	-.04103	.02167	.311	-.1018	.0198
	NURTW	.00314	.01665	.998	-.0436	.0498
VIO	FRSC	-.03509	.01934	.350	-.0893	.0192
	FERMA	-.07611*	.02371	.017	-.1426	-.0096
	NURTW	-.03195	.01924	.431	-.0859	.0220
FERMA	FRSC	.04103	.02167	.311	-.0198	.1018
	VIO	.07611*	.02371	.017	.0096	.1426
	NURTW	.04417	.02157	.243	-.0163	.1047
NURTW	FRSC	-.00314	.01665	.998	-.0498	.0436
	VIO	.03195	.01924	.431	-.0220	.0859
	FERMA	-.04417	.02157	.243	-.1047	.0163

*. The mean difference is significant at the 0.05 level.

As shown in Table 5, the Scheffé post hoc test revealed that the significant difference is specifically between VIO and FERMA personnel (mean difference = -0.076, $p = 0.017$), indicating that these two groups hold significantly different perceptions of road infrastructure condition. All other pairwise comparisons were non-significant, suggesting broad consensus across the remaining groups.

Hypothesis 2: There is no significant difference in the mean response of FRSC, VIO, FERMA, and NURTW personnel on the common risk factors associated with road transport in North-East Nigeria.

Table 6. ANOVA on the Common Risk Factors Associated with Road Transport

	Sum Of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	0.529	3	0.176	2.461	0.062	Accepted
Within Groups	36.106	504	0.072			
Total	36.635	507				

The ANOVA results presented as shown in Table 6 assess hypothesis two which indicated that the between-groups sum of squares is 0.529 with 3 degrees of freedom, and the within-groups sum of squares is 36.106 with 504 degrees of freedom, leading to a mean square between groups of 0.176 and a mean square within groups of 0.072. The resulting F-statistic is 2.461, with a significance (p -value) of 0.062. Since the p -value is greater than the α -value of 0.05, the null hypothesis is accepted.

Hypothesis 3: There is no significant difference in the mean response of FRSC, VIO, FERMA, and NURTW personnel on the impact of road accidents on motorists in North-East Nigeria.

Table 7. ANOVA on the Impact of Road Accidents on Motorists

	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	0.055	3	0.018	0.034	0.008	Rejected
Within Groups	8.131	504	0.542			
Total	8.187	507				

As shown in Table 7, the ANOVA results for Hypothesis 3 reveal that the between-groups sum of squares is 0.055 with 3 degrees of freedom, while the within-groups sum of squares is 8.131 with 504 degrees of freedom. The computed F-value is 0.034, and the corresponding p -value is 0.008. Since the p -value is less than the 0.05 significance level, the null hypothesis is rejected.

Table 8. Scheffe Post Hoc Test on the Impact of Road Accidents on Motorists

(I) RESPONDENTS	(J) RESPONDENTS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
FRSC Officials	VIO Personnel	.00500	.49391	1.000	-1.5461	1.5561
	FERMA Staff	-.10833	.56234	.008	-1.8743	1.6576
	NURTW Personnel	.05357	.46148	1.000	-1.3957	1.5028
VIO Personnel	FRSC Officials	-.00500	.49391	1.000	-1.5561	1.5461
	FERMA Staff	-.11333	.53770	.997	-1.8019	1.5753
	NURTW Personnel	.04857	.43112	1.000	-1.3053	1.4025
FERMA Staff	FRSC Officials	.10833	.56234	.008	-1.6576	1.8743
	VIO Personnel	.11333	.53770	.997	-1.5753	1.8019
	NURTW Personnel	.16190	.50808	.991	-1.4337	1.7575
NURTW Personnel	FRSC Officials	-.05357	.46148	1.000	-1.5028	1.3957
	VIO Personnel	-.04857	.43112	1.000	-1.4025	1.3053
	FERMA Staff	-.16190	.50808	.008	-1.7575	1.4337

The Scheffe Post Hoc Test results as shown in [Table 8](#) indicate that there are no statistically significant differences between the respondents. The comparison between FRSC officials and FERMA staff ($p = 0.008$) and FERMA staff and NURTW personnel ($p = 0.008$) shows significant difference. These significant differences suggest that FERMA staff perceive the impact of road accidents differently compared to both FRSC officials and NURTW personnel.

4.2. Discussion of Findings

The results of the study showed that the general state of roads in North-East Nigeria is very poor. This corroborates previous findings [\[16\]](#) which reported that the majority of the roads in the area were poorly maintained and poorly surfaced, leaving them to be neglected for extended periods of time without any rehabilitation by relevant authorities. In a similar way, it was found in [\[17\]](#) that infrastructural decay, especially the roads have had a significant impact on agricultural trade, education and health delivery. The evidence revealed that in the rural areas farmers are very much affected with their transportation to the market place as there are impassable roads particularly during rainy season. Furthermore, insecurity has been linked to the decline of road infrastructure which is also a major concern in the region [\[18\]](#) which adds to the vulnerability and hinders mobility.

The study also found that the common risk factors in road transport in North-East Nigeria are poor infrastructure of the roads, poor lighting, reckless driving, overloading of vehicles, poor enforcement of traffic laws and poor maintenance of vehicles. This is in accordance with [\[19\]](#) that pointed out the deteriorated road surfaces, lack of road signage and livestock encroachment on highways are the top three factors that cause road traffic collisions in the region. As well, in [\[20\]](#) it is reported that reckless driving behaviors, multi-carload trips, and lack of enforcement of traffic violations are significant risk factors for crashes on roads in North-Eastern. Inadequate vehicle maintenance and poor lighting conditions were found to be major safety hazard for road users and further support is found in [\[21\]](#).

It also showed that the road collisions experienced by motorists in North-East of Nigeria have moderate impact. While not always deadly, traffic accidents are an ongoing toll on health care systems and the economy and social functions. Many crash victims, as evidenced in [\[22\]](#), [\[23\]](#) end up with chronic physical impairments, which decrease productivity and have a negative impact on household livelihoods. In addition, even if death does not occur, road traffic accidents can put a financial burden on families who

are impacted, such as through medical and repair costs, as well as loss of income, and affect socio-economic status [24], [25].

5. CONCLUSION

This study proves that the extraordinary effects on motorists – high fatality rates, severe injury and massive socio-economic costs – are not just random occurrences in this broken ecosystem but are a certain and predictable outcome of it. The study thus calls attention to the need for more specific measures to ensure road safety in the North-East, which may not be applicable for the rest of the country. A multi-faceted approach that takes the local context into account is needed to address this endemic issue, which must include targeted infrastructure rehabilitation as well as specific policy measures in enforcement, road traffic and post-crash response. The overall objective of improving the safety of North East roads is a public health, economic recovery and sustainable development challenge for the region.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Michael Ubale Cyril	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	
Haruna Gwana Bawa	✓	✓			✓	✓		✓	✓	✓		✓		
Stephen Zira Kumazhege		✓			✓	✓			✓	✓	✓			
Eric Borba Enoch					✓	✓			✓	✓		✓		

C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

Conflict of Interest Statement

The authors state that they have no conflict of interest in connection with this paper.

Informed Consent

All participants gave informed consent before participation in the study. All participants were well informed about the aim of the research and confidentiality and anonymity assured.

Ethical Approval

Ethical clearance of the study has been obtained from the concerned institutional ethics committee and has been carried out in ethical standards of social scientific research.

Data Availability

All data used in this study can be obtained by contacting the corresponding author on reasonable request.

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