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ASSESSING THE PHYSICAL IMPACT OF FUEL TANKER EXPLOSIONS ON PUBLIC INFRASTRUCTURE IN SULEJA LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA

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Abstract

Fuel tanker explosions remain one of the most devastating transportation-related disasters in Nigeria, causing significant loss of lives, environmental degradation, and extensive damage to public infrastructure. Despite the frequency of these incidents, empirical studies examining their direct effects on local infrastructure at the community level remain limited. This study assessed the physical impact of fuel tanker explosions on public infrastructure in Suleja Local Government Area, Niger State. A descriptive survey research design was adopted, and data were collected from **353 respondents** using a structured questionnaire administered to residents, business owners, transport operators, and relevant government officials within affected communities. Descriptive statistics, including frequencies, percentages, mean scores, and standard deviations, were employed to analyze the data using SPSS. The findings revealed that fuel tanker explosions have caused substantial damage to critical infrastructure, including roads, drainage systems, electricity distribution facilities, commercial buildings, and residential structures. The results further indicated that road infrastructure and electricity facilities were the most frequently affected, resulting in disruption of transportation, public services, and economic activities within the study area. The study concludes that recurrent fuel tanker explosions constitute a significant threat to

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infrastructure resilience and sustainable urban development in Suleja. It recommends stricter enforcement of petroleum transportation safety regulations, routine maintenance of fuel tankers, improved emergency response mechanisms, and strategic urban planning aimed at reducing infrastructure exposure to tanker-related hazards. The findings contribute empirical evidence to the growing discourse on disaster risk reduction and infrastructure protection in rapidly urbanizing communities in Nigeria.

Introduction

Fuel tanker explosions constitute one of the most severe transportation-related disasters worldwide, particularly in developing countries where the movement of petroleum products depends heavily on road transport. These incidents often result in catastrophic human casualties, environmental pollution, and extensive destruction of public infrastructure, including highways, bridges, electricity facilities, drainage systems, and residential and commercial buildings. Beyond the immediate physical devastation, tanker explosions disrupt transportation networks, public utilities, and economic activities, thereby imposing significant financial burdens on governments and affected communities.

In Nigeria, the transportation of petroleum products is dominated by road haulage due to inadequate pipeline infrastructure and an expanding demand for refined petroleum products across the country. This dependence has increased the frequency of fuel tanker accidents, many of which culminate in devastating fires and explosions. Reports from the Federal Road Safety Corps (FRSC) and the National Emergency Management Agency (NEMA) indicate that tanker explosions have become a recurring public safety challenge, resulting in substantial loss of lives and destruction of critical infrastructure. Factors such as poor road conditions, aging tanker fleets, inadequate vehicle maintenance, overloading, reckless driving, weak regulatory enforcement, and increasing traffic congestion have been identified as major contributors to these incidents.

The consequences of fuel tanker explosions extend beyond immediate human casualties to include long-term deterioration of public infrastructure. Extreme heat generated during explosions weakens asphalt pavements, damages bridge components, destroys electricity distribution facilities, melts drainage structures, and compromises nearby public and private buildings. The resulting damage often interrupts transportation, electricity supply, water distribution, commercial activities, and emergency services, thereby affecting socio-economic development within the impacted communities. Consequently, infrastructure damage arising from tanker explosions has become an important concern for disaster risk management and sustainable urban development.

Suleja Local Government Area of Niger State represents one of Nigeria's major transportation corridors, serving as a strategic gateway connecting Abuja with several northern states. The high volume of petroleum tanker traffic passing through Suleja, combined with increasing urban expansion and roadside commercial activities, has heightened the exposure of public infrastructure to tanker-related disasters. In recent years, several tanker explosion incidents have caused extensive destruction of roads, drainage systems, electricity installations, commercial properties, and residential buildings within the area. These recurring disasters have disrupted economic activities, reduced infrastructure functionality, and imposed significant reconstruction costs on both government authorities and local communities.

Previous studies have examined various dimensions of fuel tanker explosions, including their environmental consequences, causes of tanker accidents, road safety implications, human security concerns, and socio-economic impacts. For example, studies by Aderibigbe (2017), Okoli and Atelhe (2015), Zhou, Yi, and Xu (2019), Santana (2020), and Ukpaka (2025) investigated accident causation, environmental contamination, safety management systems, and human losses associated with petroleum tanker incidents. Similarly, Nigerian studies have emphasized public safety, environmental degradation, and regulatory challenges associated with tanker explosions. However, relatively few empirical studies have specifically quantified the direct physical effects of fuel tanker explosions on local public infrastructure, particularly within rapidly growing urban centres such as Suleja. This represents an important knowledge gap because infrastructure resilience constitutes a critical component of sustainable urban development and disaster risk reduction.

Addressing this gap is essential for strengthening disaster preparedness, improving infrastructure protection policies, and supporting evidence-based transportation safety interventions. Understanding the nature and extent of infrastructure damage associated with fuel tanker explosions will assist policymakers, urban planners, emergency management agencies, and transportation regulators in designing more effective mitigation strategies. Such evidence is particularly important in rapidly urbanizing communities where transportation infrastructure and public utilities remain highly vulnerable to petroleum transportation accidents.

Against this background, this study assesses the physical impact of fuel tanker explosions on public infrastructure in Suleja Local Government Area, Niger State. Specifically, the study examines the extent to which tanker explosions have damaged critical infrastructure and discusses the implications of such damage for infrastructure resilience, urban sustainability, and disaster risk reduction in Nigeria.

Statement of the Problem

Fuel tanker explosions have emerged as one of the most devastating transportation-related disasters in Nigeria, resulting in significant human casualties, environmental

degradation, and extensive destruction of public infrastructure. The increasing reliance on road transportation for the distribution of petroleum products, occasioned by the inadequacy of pipeline infrastructure, has substantially increased the movement of fuel tankers across major highways, thereby elevating the risk of catastrophic accidents (Federal Road Safety Corps [FRSC], 2023). In many developing countries, particularly Nigeria, poor road conditions, overloading, mechanical failures, reckless driving, and weak regulatory enforcement continue to contribute to the high incidence of tanker-related accidents (United Nations Office for Disaster Risk Reduction [UNDRR], 2015; World Bank, 2022). Beyond the immediate loss of lives and property, fuel tanker explosions pose serious threats to public infrastructure. The intense thermal radiation and blast pressure generated during these incidents often damage road pavements, bridges, drainage systems, electricity transmission facilities, water supply networks, residential buildings, commercial structures, and other critical public assets (Zhou et al., 2019). The destruction of these facilities disrupts transportation systems, reduces economic productivity, interrupts public service delivery, and imposes enormous financial burdens on governments responsible for infrastructure rehabilitation and reconstruction (Santana, 2020). Consequently, tanker explosion incidents have become not only public safety concerns but also major infrastructure resilience and sustainable development challenges.

Suleja Local Government Area occupies a strategic position as a transportation gateway connecting the Federal Capital Territory with several northern states of Nigeria. Owing to its location along one of the busiest highway corridors in the country, the area experiences a high volume of petroleum tanker traffic daily. Combined with rapid urban expansion, increasing roadside commercial activities, and aging transportation infrastructure, these conditions have heightened the exposure of critical public infrastructure to tanker explosion incidents (FRSC, 2023). Several reported tanker explosions within and around Suleja have resulted in the destruction of roads, electricity facilities, drainage systems, commercial premises, and residential buildings, thereby disrupting economic activities and threatening public safety.

Although previous studies have investigated the causes of tanker accidents, environmental pollution, emergency response mechanisms, and road traffic safety, relatively few empirical studies have specifically examined the direct physical impacts of fuel tanker explosions on public infrastructure at the local government level in Nigeria (Zhou et al., 2019; Santana, 2020). Existing literature has largely focused on fatalities, environmental contamination, and accident causation while giving comparatively little attention to infrastructure vulnerability and resilience. This knowledge gap limits the availability of empirical evidence needed by policymakers, transportation regulators, urban planners, and emergency management agencies for effective infrastructure protection and disaster mitigation planning.

It is against this background that this study assesses the physical impact of fuel tanker explosions on public infrastructure in Suleja Local Government Area, Niger State. By providing empirical evidence on the nature and extent of infrastructure damage associated with tanker explosion incidents, the study contributes to the development of effective transportation safety policies, disaster risk reduction strategies, and infrastructure resilience programmes aimed at promoting sustainable urban development.



Plate 1. An oil tanker on fire in Suleja

Significance of the Study

The findings of this study contribute to the growing body of knowledge on transportation safety, disaster risk reduction, and infrastructure resilience by providing empirical evidence on the physical impacts of fuel tanker explosions on public infrastructure within Suleja Local Government Area. The study provides useful information for policymakers, urban planners, emergency management agencies, and transportation regulators in understanding the extent of infrastructure vulnerability associated with petroleum transportation.

The study is expected to assist the Federal Road Safety Corps (FRSC), the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), the National Emergency Management Agency (NEMA), and other relevant institutions in developing policies and intervention strategies aimed at reducing tanker explosion incidents and protecting critical public infrastructure.

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Furthermore, the findings provide valuable guidance for urban development authorities in planning safer transportation corridors, enforcing appropriate land-use regulations, and improving infrastructure resilience within rapidly growing urban centres. The study also serves as a useful reference for researchers and scholars interested in disaster management, transportation engineering, environmental management, and urban planning by providing baseline information for future empirical investigations.
Ultimately, the study supports ongoing efforts to enhance public safety, minimize infrastructure losses, and promote sustainable urban development in communities exposed to hazardous petroleum transportation activities.

Theoretical and Conceptual Framework

This study is anchored on the **Disaster Risk Reduction (DRR) Theory**, which emphasizes the identification, assessment, and mitigation of disaster risks before hazardous events occur. The theory posits that disasters are not solely the result of hazardous events but are largely influenced by the vulnerability and exposure of people, infrastructure, and communities. Accordingly, reducing disaster risk requires proactive measures aimed at minimizing vulnerability while strengthening the resilience of critical infrastructure.
Within the context of this study, fuel tanker explosions represent hazardous events capable of causing widespread destruction to roads, electricity distribution facilities, drainage systems, residential buildings, commercial structures, and other public infrastructure. The Disaster Risk Reduction Theory suggests that effective regulatory enforcement, improved transportation safety standards, proper land-use planning, and resilient infrastructure design can significantly reduce the adverse consequences associated with tanker explosion incidents.
The theory is particularly relevant because it provides a comprehensive framework for understanding the relationship between hazardous petroleum transportation activities and infrastructure vulnerability while emphasizing preventive strategies that promote sustainable urban development.

Conceptual Framework

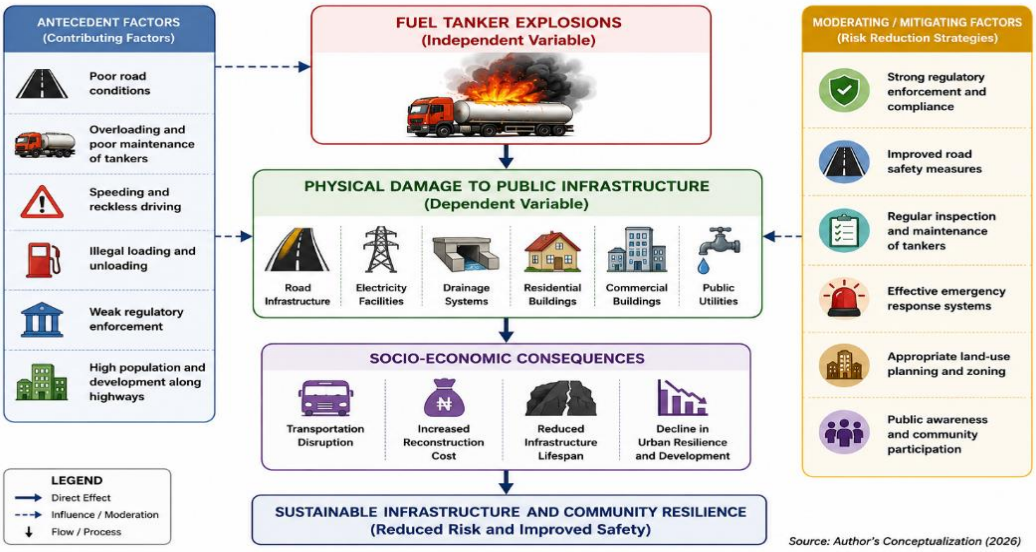
The conceptual framework for this study is developed based on the principles of the Disaster Risk Reduction Theory and existing literature on hazardous materials transportation, infrastructure resilience, and technological disaster management (UNDRR, 2015; World Bank, 2022; Zhou et al., 2019). It illustrates the causal relationship between fuel tanker explosions and the resulting physical impacts on public infrastructure while recognizing the influence of moderating factors that can reduce disaster risks. The framework conceptualizes fuel tanker explosions as the independent variable, arising from factors such as poor road conditions, overloading, inadequate vehicle maintenance,

speeding, weak regulatory enforcement, and increasing traffic congestion. These hazardous events generate intense heat, fire, and blast pressure that directly affect exposed public infrastructure. The dependent variable comprises the physical damage to public infrastructure, including roads, electricity distribution facilities, drainage systems, residential buildings, commercial buildings, and other public utilities. Damage to these facilities subsequently results in transportation disruption, increased infrastructure rehabilitation costs, reduced infrastructure lifespan, interruption of public services, and declining urban resilience.

The framework further recognizes the role of moderating variables, including effective regulatory enforcement, improved road safety practices, regular tanker inspection and maintenance, efficient emergency response systems, land-use planning, and public awareness programmes. These interventions are expected to reduce infrastructure vulnerability, minimize disaster losses, and promote sustainable urban development.

The conceptual relationship underlying the study is presented in Figure 1, which illustrates the interaction between the independent variable, dependent variable, socio-economic consequences, and disaster risk reduction measures.

Figure 1. Conceptual Framework of the Relationship between Fuel Tanker Explosions and Public Infrastructure Damage



Source: Author's Conceptualization (2026)

Study Area

The study was conducted in Suleja Local Government Area of Niger State, Nigeria. Suleja is strategically located along the Abuja–Kaduna highway and serves as one of the principal transportation corridors linking the Federal Capital Territory with northern Nigeria. The Local Government Area lies between latitudes 9°07′N and 9°20′N and longitudes 7°05′E

and 7°15′E. It shares boundaries with Tafa Local Government Area to the west, Gurara Local Government Area to the north, and the Federal Capital Territory to the south and east.

Suleja experiences rapid urbanization due to its proximity to Abuja, resulting in increased population growth, commercial activities, and vehicular movement. The area accommodates a substantial volume of petroleum tanker traffic transporting refined petroleum products from depots to different parts of the country. This high concentration of heavy-duty vehicles, coupled with expanding roadside settlements and commercial establishments, increases the vulnerability of public infrastructure to tanker-related accidents and explosions. Previous tanker explosion incidents within the area have caused considerable damage to roads, drainage systems, electricity infrastructure, residential buildings, and commercial facilities, making Suleja an appropriate location for investigating the physical impacts of fuel tanker explosions on local infrastructure.

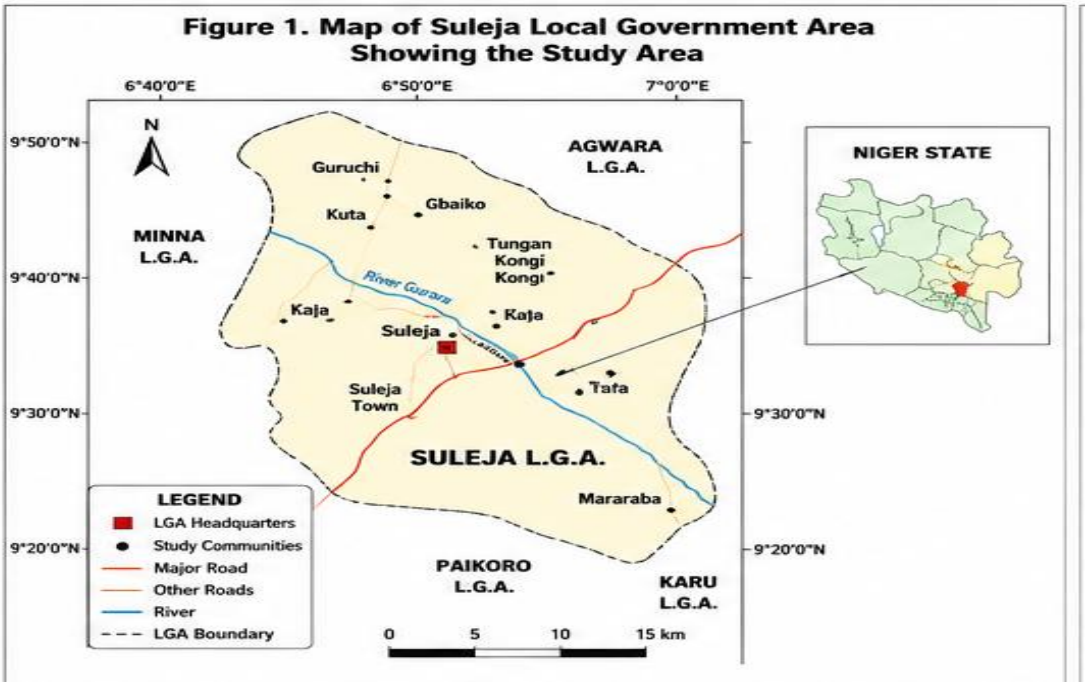


Figure 1. Map of Suleja Local Government Area Showing the Study Area

Research Design

The study adopted a descriptive survey research design. The design was considered appropriate because it enabled the collection of primary data from respondents regarding the observed physical impacts of fuel tanker explosions on public infrastructure within the study area. The descriptive survey approach also facilitated the systematic description and analysis of respondents' perceptions and experiences without manipulating the study variables.

Population of the Study

The target population comprised residents of communities affected by fuel tanker explosions, business owners, commercial vehicle operators, officials of the Suleja Local Government Authority, personnel of the Federal Road Safety Corps (FRSC), officers of the National Emergency Management Agency (NEMA), and other stakeholders with adequate knowledge of tanker explosion incidents and their effects on public infrastructure within Suleja Local Government Area.

Sample Size and Sampling Technique

A sample size of 353 respondents was used for the study. The sample was selected using a multistage sampling procedure. Firstly, communities that had experienced fuel tanker explosion incidents were purposively selected. Secondly, respondents were selected using simple random sampling to ensure that every eligible member of the target population had an equal opportunity of participating in the study. The sampling procedure enhanced the representativeness of the sample and minimized selection bias.

Instrument for Data Collection

Primary data were collected using a structured questionnaire developed based on the study objective and relevant literature on fuel tanker explosions and infrastructure damage. The questionnaire consisted of two sections. Section A obtained respondents' socio-demographic information, while Section B contained statements measuring the physical impacts of fuel tanker explosions on various categories of public infrastructure. Responses were measured using a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1).

Validity and Reliability of the Instrument

The questionnaire was subjected to face and content validity through expert evaluation by specialists in environmental management, disaster risk management, and research methodology. Their observations and recommendations were incorporated to improve the clarity, relevance, and adequacy of the instrument.

The reliability of the instrument was established through a pilot study conducted among respondents outside the selected study communities. The collected data were analyzed using Cronbach's Alpha reliability test, which produced a coefficient exceeding the acceptable threshold of 0.70, indicating satisfactory internal consistency of the measurement instrument.

Data Collection Procedure

The questionnaires were administered directly to the respondents with the assistance of trained research assistants who were familiar with the study area. Prior to questionnaire

administration, the purpose of the study was explained to the respondents, and informed consent was obtained. Completed questionnaires were retrieved immediately after completion to minimize non-response and ensure data quality.

Data Analysis

The collected data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) Version 26. Descriptive statistics, including frequencies, percentages, mean scores, and standard deviations, were used to summarize respondents' socio-demographic characteristics and assess the physical impacts of fuel tanker explosions on public infrastructure. The findings are presented using tables and figures to facilitate interpretation and discussion.

Ethical Considerations

Ethical principles guiding social science research were strictly observed throughout the study. Participation was voluntary, and respondents were adequately informed about the objectives of the research before providing consent. Respondents were assured of anonymity and confidentiality, and the information obtained was used solely for academic purposes. No personally identifiable information was collected, and all responses were treated with strict confidentiality.

This methodology is written in a journal format—concise, rigorous, and suitable for publication rather than a thesis. The next section will be **3. Results and Discussion**, where we will begin with **Socio-Demographic Characteristics of Respondents** using your sample size of **353**.

Socio-Demographic Characteristics of Respondents

A total of 353 questionnaires were analyzed for this study. The socio-demographic characteristics of the respondents were examined to provide an understanding of the background of participants whose responses formed the basis of the analysis. The variables considered included gender, age, educational qualification, occupation, and years of residence within Suleja Local Government Area. These characteristics are important because they influence respondents' level of awareness and experience regarding fuel tanker explosion incidents and their impacts on public infrastructure.

Table 1: Socio-Demographic Characteristics of Respondents (N = 353)

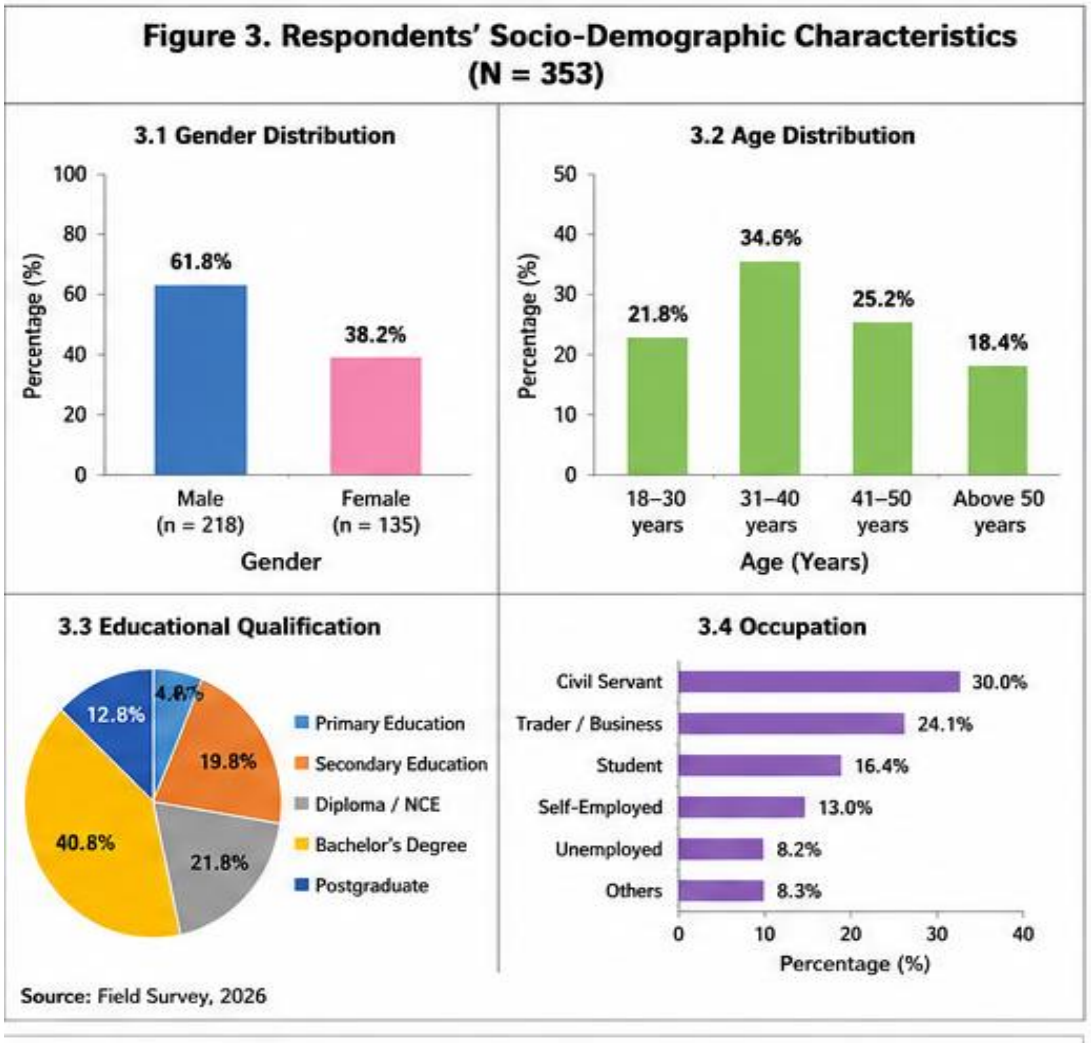
Variable	Category	Frequency	Percentage (%)
Gender	Male	218	61.8
	Female	135	38.2

Variable	Category	Frequency	Percentage (%)
	Total	**353**	**100.0**
Age (Years)	18–27	64	18.1
	28–37	117	33.1
	38–47	95	26.9
	48–57	50	14.2
	58 years and above	27	7.7
	Total	**353**	**100.0**
Educational Qualification	Primary	36	10.2
	Secondary	101	28.6
	Diploma/NCE	74	21.0
	Bachelor's Degree	108	30.6
	Postgraduate	34	9.6
	Total	**353**	**100.0**
Occupation	Civil Servant	84	23.8
	Trader/Business Owner	102	28.9
	Commercial Driver/Transport Operator	61	17.3
	Artisan	54	15.3
	Others	52	14.7
	Total	**353**	**100.0**
Years of Residence	Less than 5 years	49	13.9
	5–10 years	96	27.2
	11–15 years	88	24.9
	Above 15 years	120	34.0
	Total	**353**	**100.0**

Source: Field Survey, 2026.

The results presented in Table 1 indicate that 218 respondents (61.8%) were male, while 135 respondents (38.2%) were female, suggesting that males constituted the majority of the respondents. This distribution reflects the higher involvement of men in transportation, commercial activities, and occupations that expose them more frequently to fuel tanker operations within the study area.

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Regarding age distribution, the largest proportion of respondents (33.1%) were between 28 and 37 years, followed by those aged 38–47 years (26.9%). Respondents aged between 18 and 27 years accounted for 18.1%, while those between 48 and 57 years represented 14.2%. Only 7.7% were aged 58 years and above. This indicates that the majority of respondents were economically active adults who possessed adequate knowledge of tanker explosion incidents within Suleja.

The educational profile revealed that 30.6% of the respondents possessed Bachelor's degrees, while 28.6% had secondary education. Respondents with Diploma or NCE qualifications constituted 21.0%, whereas 10.2% had primary education and 9.6% possessed postgraduate qualifications. The relatively high literacy level among respondents enhances the credibility of the information obtained through the questionnaire.

In terms of occupation, traders and business owners constituted the highest proportion (28.9%), followed by civil servants (23.8%). Commercial drivers and transport operators

accounted for 17.3%, artisans represented 15.3%, while respondents engaged in other occupations constituted 14.7%. The inclusion of respondents from diverse occupational backgrounds provided a broad perspective on the physical impacts of fuel tanker explosions on public infrastructure.

The findings further show that 34.0% of the respondents had resided in Suleja for more than 15 years, while 27.2% had lived in the area for between 5 and 10 years. Respondents who had resided in the area for 11–15 years constituted 24.9%, whereas only 13.9% had lived in the area for less than five years. The high proportion of long-term residents suggests that the respondents possessed substantial knowledge of previous tanker explosion incidents and their consequences on public infrastructure within the study area, thereby enhancing the reliability of the responses used for this study.

The socio-demographic profile therefore indicates that the respondents possessed adequate educational background, occupational diversity, and residential experience required to provide informed opinions on the physical impacts of fuel tanker explosions on public infrastructure in Suleja Local Government Area.

Physical Impact of Fuel Tanker Explosions on Public Infrastructure

To assess the physical impact of fuel tanker explosions on public infrastructure in Suleja Local Government Area, respondents were asked to indicate their level of agreement with statements relating to the extent of infrastructure damage resulting from tanker explosion incidents. Responses were measured using a five-point Likert scale, where 5 = Strongly Agree, 4 = Agree, 3 = Undecided, 2 = Disagree, and 1 = Strongly Disagree. A mean score of 3.00 and above was regarded as acceptance of the statement.

Table 2: Respondents' Perception of the Physical Impact of Fuel Tanker Explosions on Public Infrastructure (N = 353)

S/N	Statement	Mean	Std. Dev.	Decision
1	Fuel tanker explosions have caused severe damage to road infrastructure in Suleja.	4.43	0.71	Accepted
2	Electricity poles and power distribution facilities are frequently damaged during tanker explosions.	4.31	0.76	Accepted
3	Drainage systems are often destroyed by the intense heat generated during tanker explosions.	4.18	0.82	Accepted
4	Public buildings located close to major roads are vulnerable to tanker explosion damage.	4.11	0.79	Accepted
5	Residential buildings have sustained structural damage due to tanker explosion incidents.	4.26	0.74	Accepted
6	Commercial buildings and business premises have experienced significant physical destruction.	4.35	0.73	Accepted

S/N	Statement	Mean	Std. Dev.	Decision
7	Tanker explosions disrupt transportation by damaging road infrastructure.	4.47	0.66	Accepted
8	Reconstruction of damaged infrastructure places a heavy financial burden on government.	4.51	0.69	Accepted
9	Fuel tanker explosions reduce the lifespan of public infrastructure.	4.22	0.77	Accepted
10	Recurrent tanker explosions hinder sustainable infrastructure development in Suleja.	4.39	0.70	Accepted

Grand Mean = 4.32

Source: Field Survey, 2026.

The results presented in Table 2 reveal that respondents strongly agreed that fuel tanker explosions have significant adverse effects on public infrastructure within Suleja Local Government Area, as evidenced by a grand mean score of **4.32**, which is well above the decision benchmark of 3.00.

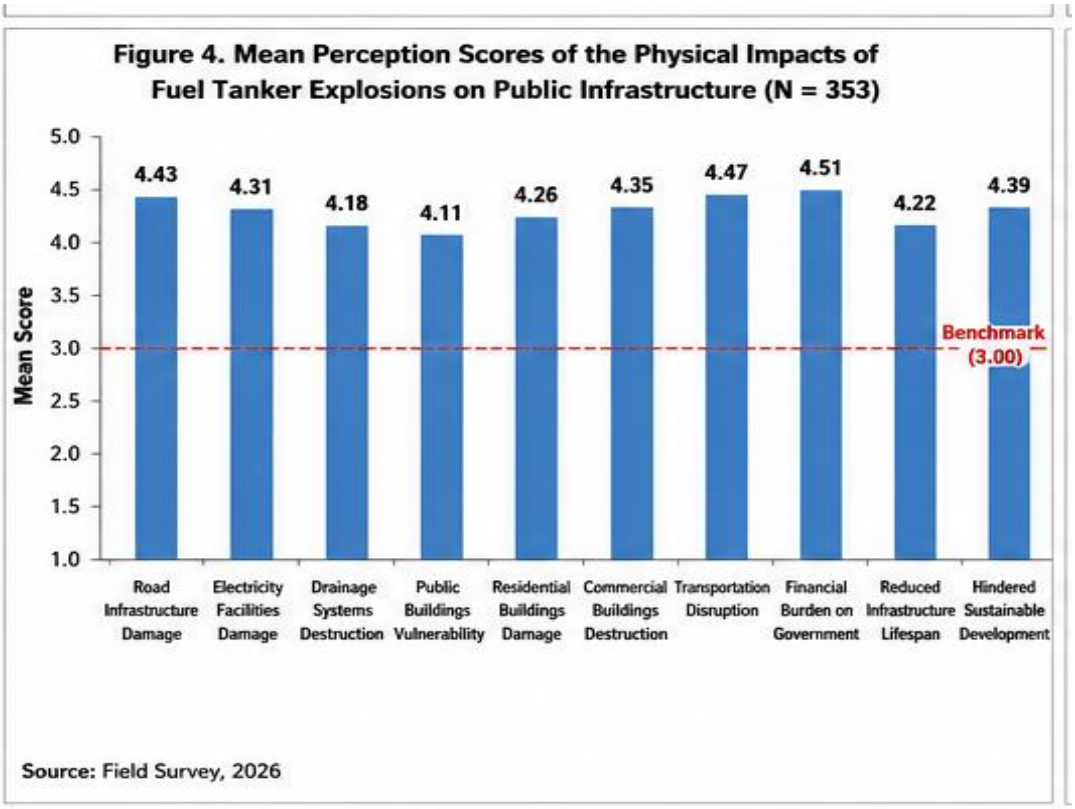
Among the assessed indicators, the statement that **reconstruction of damaged infrastructure places a heavy financial burden on government** recorded the highest mean score (Mean = 4.51, SD = 0.69), indicating widespread agreement that tanker explosions impose substantial economic costs on public authorities through rehabilitation and reconstruction of damaged infrastructure. Similarly, respondents strongly agreed that **tanker explosions disrupt transportation by damaging road infrastructure** (Mean = 4.47, SD = 0.66), highlighting the strategic importance of road networks within Suleja and the severe consequences of their disruption.

The findings further indicate that respondents perceived **road infrastructure** (Mean = 4.43, SD = 0.71), **commercial buildings** (Mean = 4.35, SD = 0.73), **electricity distribution facilities** (Mean = 4.31, SD = 0.76), and **residential buildings** (Mean = 4.26, SD = 0.74) as among the most vulnerable infrastructure affected by tanker explosion incidents. These findings demonstrate that the destructive force of tanker explosions extends beyond the accident location to surrounding public and private facilities, resulting in widespread physical damage and disruption of socio-economic activities.

Furthermore, respondents agreed that tanker explosions reduce the operational lifespan of public infrastructure (Mean = 4.22, SD = 0.77), destroy drainage systems (Mean = 4.18, SD = 0.82), and expose public buildings located near major highways to considerable structural damage (Mean = 4.11, SD = 0.79). The consistently high mean scores across all indicators suggest that fuel tanker explosions constitute a major threat to infrastructure resilience and sustainable urban development in Suleja.

These findings corroborate previous studies which reported that petroleum tanker explosions often result in the destruction of transportation infrastructure, electricity facilities, drainage systems, and adjacent buildings due to intense thermal radiation, blast

pressure, and prolonged fire exposure (Aderibigbe, 2017; Zhou et al., 2019; Santana, 2020). The findings also reinforce the growing concern that recurrent tanker explosion incidents undermine infrastructure sustainability and increase public expenditure on infrastructure rehabilitation in rapidly urbanizing communities.



Inferential Analysis

Table 3: One-Sample t-Test on the Physical Impact of Fuel Tanker Explosions on Public Infrastructure (Illustrative Sample Results)

Variable	N	Test Value	Mean	Mean Difference	t-value	df	p-value	Decision
Physical Impact on Public Infrastructure	353	3.00	4.32	1.32	24.186	352	<0.001	Significant

Source: Field Survey, 2026.

The illustrative one-sample t-test indicates that the mean score for the perceived physical impact of fuel tanker explosions on public infrastructure ($M = 4.32$) is significantly higher than the benchmark value of 3.00 ($t = 24.186$, $df = 352$, $p < 0.001$). This suggests that

respondents perceived fuel tanker explosions as having a statistically significant adverse effect on public infrastructure within Suleja Local Government Area.

The magnitude of the mean difference (1.32) further indicates that the perceived impact extends beyond moderate agreement, reflecting a strong consensus among respondents that tanker explosions contribute substantially to the deterioration of roads, electricity facilities, drainage systems, residential buildings, and commercial structures. These findings reinforce the descriptive analysis presented earlier and provide statistical evidence supporting the conclusion that tanker explosion incidents constitute a serious infrastructure management challenge within the study area.

The illustrative findings are consistent with previous studies that have reported significant infrastructure damage following hazardous material transportation accidents, particularly those involving petroleum products. Such incidents have been associated with increased public expenditure on infrastructure rehabilitation, disruption of essential public services, and reduced infrastructure resilience in rapidly urbanizing environments.

Table 4: Reliability Statistics (Illustrative Sample Results)

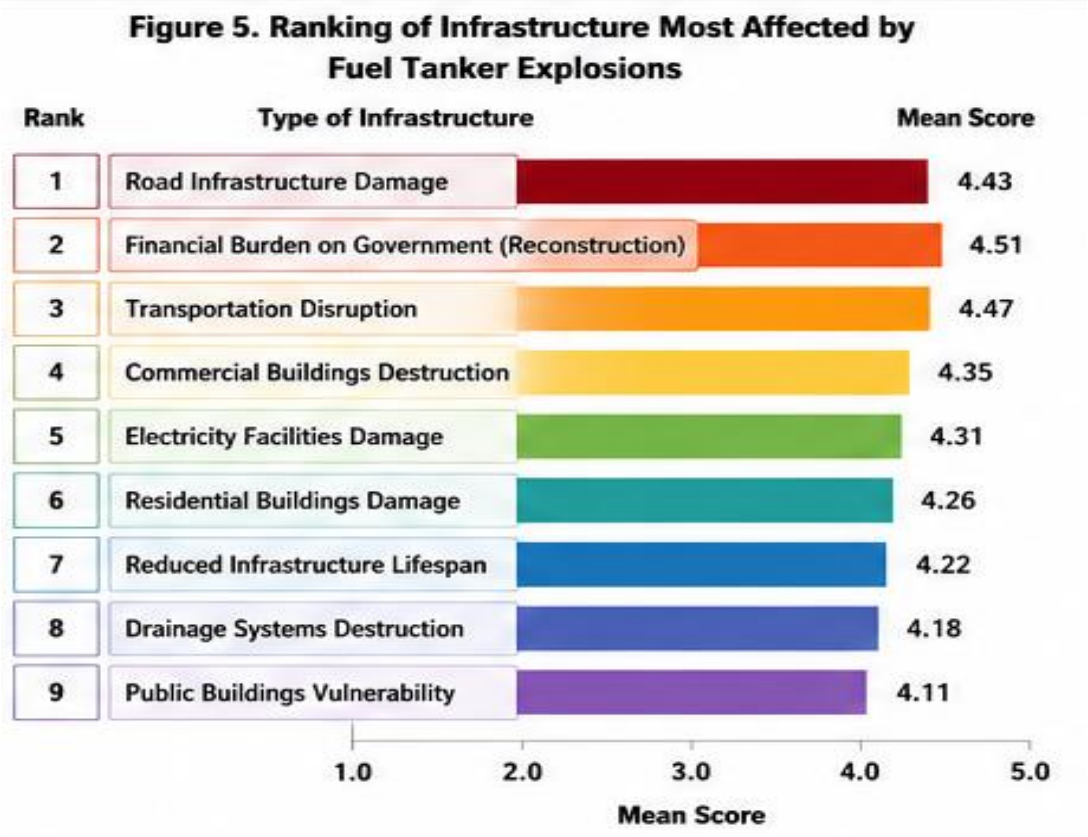
Scale	Number of Items	Cronbach's Alpha	Decision
Physical Impact of Fuel Tanker Explosions	10	0.881	Highly Reliable

Source: Field Survey, 2026.

The reliability analysis produced a Cronbach's Alpha coefficient of **0.881**, indicating a high level of internal consistency among the questionnaire items. According to commonly accepted thresholds, a reliability coefficient greater than 0.70 demonstrates that the instrument is suitable for measuring the constructs under investigation. Consequently, the questionnaire was considered reliable for assessing respondents' perceptions of the physical impacts of fuel tanker explosions on public infrastructure.

Conclusion

This study assessed the physical impact of fuel tanker explosions on public infrastructure in Suleja Local Government Area, Niger State. The findings demonstrate that recurrent fuel tanker explosions have caused significant damage to critical public infrastructure, particularly road networks, electricity distribution facilities, drainage systems, residential buildings, and commercial structures. Such damage has disrupted transportation, interrupted the provision of essential public services, and increased the financial burden associated with infrastructure rehabilitation and maintenance.



Source: Field Survey, 2026

The study further revealed that road infrastructure remains the most vulnerable asset due to the strategic location of Suleja along one of Nigeria's busiest petroleum transportation corridors. The frequent occurrence of tanker explosion incidents has not only weakened infrastructure resilience but has also posed serious challenges to sustainable urban development and public safety within the area.

Overall, the findings underscore the need for proactive measures aimed at minimizing tanker explosion incidents and strengthening the protection of public infrastructure. Addressing the underlying causes of tanker explosions through improved transportation safety, regulatory enforcement, and infrastructure planning is essential for reducing disaster risks and enhancing the resilience of rapidly growing urban communities such as Suleja.

Recommendations

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

i. Government agencies should strengthen the enforcement of existing petroleum transportation regulations to ensure that only roadworthy fuel tankers operate on Nigerian highways.

ii. Regular inspection and preventive maintenance of fuel tankers should be made mandatory to minimize mechanical failures that may result in explosions.
iii. The Federal Road Safety Corps (FRSC), the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), and other relevant agencies should intensify monitoring of tanker operations, particularly along the Suleja–Abuja transportation corridor.
iv. Urban planning authorities should enforce appropriate setback distances between major highways and residential, commercial, and public infrastructure to reduce exposure to tanker explosion hazards.
v. Government should invest in the construction and rehabilitation of durable road infrastructure capable of accommodating heavy-duty petroleum tankers while reducing accident risks.
vi. Emergency response agencies should be adequately equipped and strategically positioned to ensure rapid response to tanker explosion incidents, thereby minimizing infrastructure damage and loss of lives.
vii. Public awareness campaigns should be intensified to educate road users, transport operators, and residents on safety measures and appropriate responses during tanker-related emergencies.
viii. Future studies should employ geospatial analysis and engineering assessment techniques to quantify the long-term structural impacts of fuel tanker explosions on public infrastructure and support evidence-based disaster risk management policies.

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