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Analysis of Freight Vehicle Crashes in Lokoja, Kogi State, Nigeria

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Abstract

Freight vehicle crashes are typically associated with high severity because over half of truck crashes end in fatalities or serious injuries. The study analysed freight vehicle crashes in Lokoja, Kogi State, Nigeria. Data on freight vehicles involved in road traffic crashes and casualties (2014 to 2021) were obtained from the Federal Road Safety Corps (FRSC) office, Kogi State Command. The data were summarised using frequency distribution tables, simple percentages, and charts, while hypotheses were tested using One-Way Analysis of Variance (ANOVA) and Simple Linear Regression Analysis. The analysis of the freight vehicle composition in road traffic crashes showed that heavy-duty trucks (trailers, tankers, and containers) have the highest (94%) share. Light-duty trucks (freight tricycles, pick-ups, and small vans) recorded a share of 4%, while medium-duty trucks (lorries, tippers) constituted the least proportion (2%). The analysis also revealed that only 48.1% of the variation in traffic casualties can be explained by freight vehicle crashes. However, freight vehicle crashes significantly predict traffic casualties, $F(1, 95) = 87.032$, $P < .001$. Therefore, for every unit increase in freight vehicle crashes, the traffic casualties increased by 2.076 in the study area. Continuous drivers' enlightenment and strict enforcement of traffic rules by relevant authorities were recommended to reduce the risk of freight vehicle crashes in the study area.

Keywords: Casualties, Composition, Freight Vehicles, Injured, Killed, and Traffic Crashes.

Introduction

The flow of people and goods defines urban traffic. Freight traffic is often ignored when discussing the issues associated with urban transportation because it accounts for a very small percentage of total traffic in cities. Nonetheless, it is by no means of little significance given that a portion of urban road traffic consists of freight vehicles, which are crucial to the smooth operation of the urban economy (Rodrigue, Comtois & Slack, 2024). For people to survive in urban environments, the flow of goods and services is crucial. Essential components of a city's quality of life are the availability of goods such as raw materials, finished products, farm produce, building materials, construction, and industrial materials, among others.

Transportation is growing along with urban areas and industries. Thus, the volume of freight transport in urban areas has increased and forms an integral part of urban movements. For example, Eurostat (2022) reported that European road freight transport increased by 6.5% from 2020 to 2021, due to a sharp increase in all types of operations. Even after the economic crisis in the United States in 2007, the volume of freight increased steadily, reaching about 16.3 billion tons in 2019, and is projected to grow by 36% by 2029 (American Trucking Associations, 2019). In the same vein, since 2015, the volume of road cargo in Korea has increased by 1.2% yearly, and the volume of all cargo vehicle traffic has increased by 3.2% annually. In particular, there is a noticeable increase in the volume of heavy cargo vehicles above 8.5 tons on the road. In contrast to the 1.7% growth in traffic for small vehicles and the 6.9% increase for medium-sized trucks, the volume of heavy trucks and trailers increased by 11.1% (Park & Park, 2022). It is estimated that freight transport in China will grow at an average annual rate of 2% between 2021 and 2035 (Zeng et al., 2022). Africa is no exception, with 90% of freight moved on the road (Havenga, 2015). As observed by Atomode (2017a), the number of cargo vehicles has increased over the years in Nigeria to meet the growing demand for their services. The failure of the rail system and poor performance of inland waterways have immensely contributed to the dominant use of freight vehicles for intra-city and inter-city movement of goods and services in the country. According to Onokala and Olajide (2020), approximately 90% of import traffic, 85% of export traffic, and almost 90% of domestic goods movement are attributed to roads.

All over the world, truck traffic safety on the roadway is deteriorating due to the rise in truck traffic (Park & Park, 2022; Umar & Bashir, 2020). In other words, the increasing volume of freight traffic has led to increasing concerns about road safety in urban areas. For this reason, Jin et al. (2019) noted that in addition to causing more congestion, freight traffic greatly raised the danger of injury and fatality for road users. Similarly, Kibar, Celik, and Aytac (2018) reported that the high volume of freight traffic had increased traffic crashes on Turkish roads. This is mainly because freight vehicles have a significant impact on traffic due to their larger dimensions (generally) and lower performance compared to passenger vehicles. Therefore, crashes involving trucks may result in a higher number of casualties compared to smaller vehicles, since trucks are larger and have different means of operation (Al-Kaisy & Jung, 2005). More than half of truck crashes result in fatalities or serious injuries, making freight vehicle crashes mostly linked with high severity (Umar & Bashir, 2020).

Over the years, researchers have given road freight traffic safety significant attention. For example, Wen, Du, Chen, and Zhao (2022) conducted a study on factors affecting injury severity in overloaded truck-related crashes on mountainous highways in China. The study used data from 2010 to 2015 and developed a logit model to examine the effects of roadway, environmental, accident, vehicle, and temporal characteristics. It was revealed that fixed variables (single curve, rollover, autumn, and winter factors) increased the risk of serious consequences, while random variables (freeway, broadside hitting, impaired braking performance, spring, and evening) decreased death risks.

Doustmohammadi's (2019) study in Alabama found that speed and fatigue were the most likely factors causing urban truck-related crashes, as identified through statistical analysis using logit and probit regression models. Likewise, Moomen et al. (2019) analysed factors influencing truck crashes on downgrades in Wyoming using binary logistic regression. Key factors included crest curves, crash type, driveways, speed limit, weather, lighting, road conditions, driver gender, and age. In addition, Taylor, Russo, and James (2018) conducted a comparative analysis of factors affecting freight-involved and non-freight crashes on the I-10 corridor in Arizona. The study used crash data from six years to evaluate safety performance. Crash prediction models using integrated data were developed and several roadway-crash, vehicle-, and person-related characteristics connected to collision frequency and severity were found.

In Nigeria, Olagunju (2010) reported that 4,017 tankers/trailers crashes were reported on Nigerian highways between 2007 and June 2010, with an average of 1,148 cases per year and 96 crashes per month, resulting in 4076 deaths, 12,994 injuries, and 17,070 overall casualties.

Similarly, Olawole and Olapoju (2018) analysed tanker crashes in Nigeria from 2007 to 2010, using data from the Federal Road Safety Commission and National Bureau of Statistics. Findings showed variations by state and an upward trend, with persistent clustering in two states. Furthermore, Umar and Bashir's (2020) study found that 52.8% of truck drivers in Kano have been involved in an accident at least once in their professional careers, with 80% under 40. Factors such as weekly mileage, driving time, napping at the wheel, and co-driver presence were significant predictors of injury-related crashes. In a study on the consequences of freight vehicles on transport corridors in Kogi state, Nigeria, Adetunji (2015) found that freight vehicles cause 22% of road traffic crashes, resulting in injuries and deaths, with Okene-Lokoja route having the highest number of crashes.

A review of the existing literature revealed that research on freight traffic crashes in Nigeria is limited to highways, with more attention on heavy-duty trucks (tankers, trailers and container trucks). In other words, research on urban freight crashes involving all categories of freight vehicles is few, despite an avalanche of studies on the incidence of road traffic crashes, casualties and causes in the country. However, to manage and plan for safety effectively, it is crucial to separate road traffic crashes into different vehicle categories. This is because urban roads are used by several transport modes, each of which has a unique set of travel behaviours and thus has different effects on traffic safety. Thus, an understanding of road freight vehicle crashes is necessary for developing effective interventions. It is on this note that this research focuses on all categories of freight vehicle traffic crashes and casualties in Lokoja, Kogi State, Nigeria. The causes of freight vehicle crashes and the spatiotemporal distribution of the crashes were also examined.

The Study Area

Lokoja, the capital of Kogi state, is located on the western bank of the Niger River, close to its confluence with the Benue River, between latitude 7^0 45' 27.56" and 7^0 51' 04.34" N and between longitude 6^0 41' 55.64" and 6^0 45' 36.58" E. (Adeoye, 2012) (Figure 1). It is about 160 km south of the federal capital territory, Abuja, and straddles the strategic roads to at least five geopolitical zones out of the six such zones in the country. In other words, Lokoja's geographic location as a nodal town in the middle belt of Nigeria makes it a gateway connecting the northern part with the southern part of the country. As a result, a substantial share of the town's traffic flow is made up of freight and passenger traffic. Traffic congestion and crashes related to urban transportation are made worse by the rise in vehicle traffic in Lokoja without corresponding improvements to the town's road infrastructure (Ukoje, 2016; Atomode & Majekodunmi, 2016; Folorunsho, Atomode & Uwandu, 2022). Notable freight routes in Lokoja include; Okene-Lokoja-Abuja Road, Lokoja-Obajana-Kabba Road, and the Lokoja-Ajaokuta Road which connect the town to other settlements within and outside Kogi State. Also important is the Murtala Mohammed Road, which is a township road connecting arterial and collector roads in the town. With Lokoja's strategic location as one of the most important linkages for goods transit across Nigeria, highway safety and mobility, particularly for freight traffic, are major concerns.

In recent times, Lokoja witnessed unprecedented physical expansion in the outskirts of the town especially around Ganaja, Felele, and Zango, where new residential neighbourhoods are being developed without commensurate provision of infrastructural facilities (Ukoje, 2016). The core area is dominated by nucleated mixed land use with high residential densities in Kabawa, Cantonment, Karaworo, Adankolo, and Gadumo, among other places. Away from the center, the peripheral areas (Felele, Nataco, Crusher, Zariagi, Zango and Ganaja Village) display a linear and dispersed settlement pattern (Atomode and Jalija, 2022). Generally, it is a common feature for residential, commercial and educational land uses to border highways in the study area. As a result, there is an increased flow of pedestrian as well as vehicular traffic on the roads, increasing the chances and severity of road traffic crashes (Adetunji, 2014).

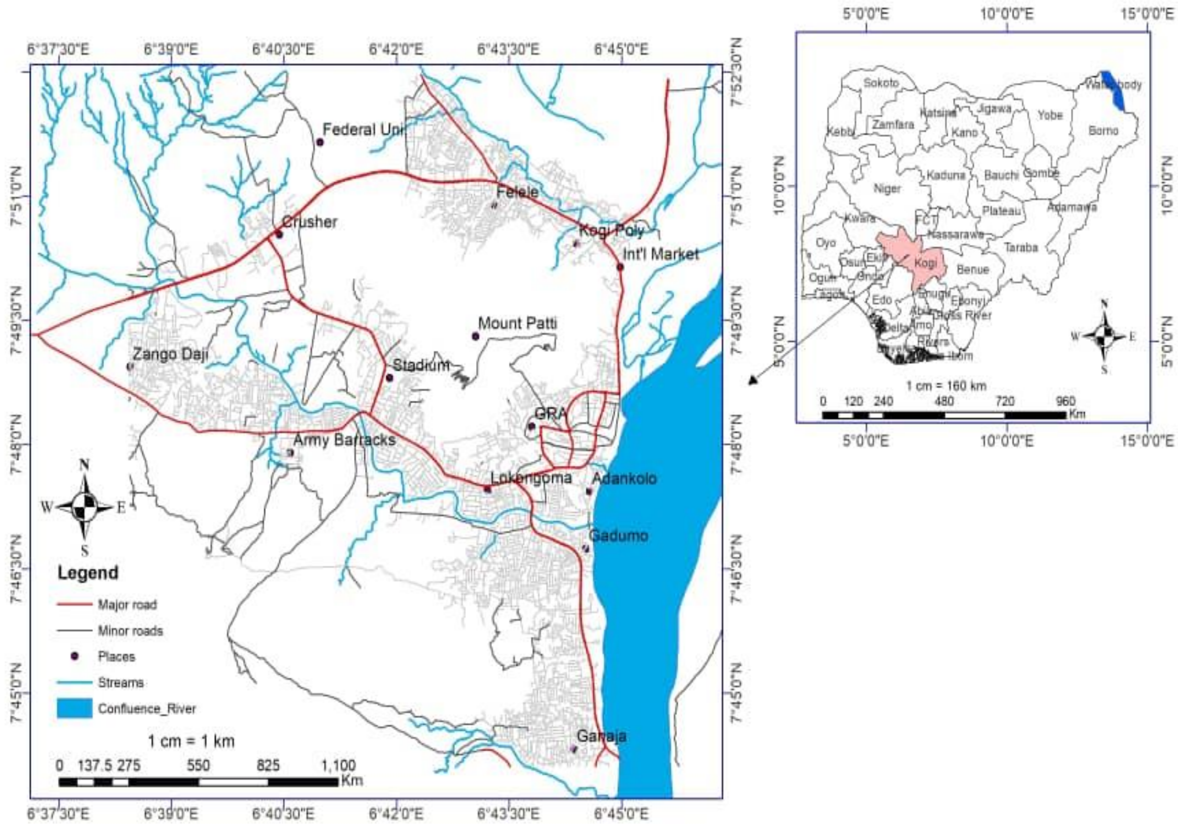

Figure 1: Road Network of Lokoja (Adapted and Modified from Atomode and Jalija, 2022)

Methods

This study made use of road traffic crashes data (2014-2021) obtained from the archive of the Federal Road Safety Corps, Kogi Command. The choice of 2014-2021 was premised on the fact that different types of vehicles involved in traffic crashes were clearly recorded in the incident register, unlike the preceding years. The number of crashes and casualities, as well as the date, route, causes and vehicles involved, were sorted out from the data obtained. Frequency distribution tables, simple percentages, and charts were used to summarize the data obtained.

One-way ANOVA was used to test the hypothesis that "there is no yearly differences in the occurrences of freight traffic crashes and casualties in the study area". The number of freight traffic crashes and casualties represents the dependent variables, while the years represent the independent variable. In addition, Simple Linear Regression analysis was employed to assess the degree to which the variations in freight traffic casualties were associated with freight vehicle crashes. This was done by testing the hypothesis that "the number of freight traffic casualties in the study area is independent of freight traffic crashes". The number of freight traffic casualties represents the dependent variable, while the number of freight traffic crashes represents the independent variable. The regression model is given by:

$$Y = a + bx + e \qquad (1)$$

Where;
Y = dependent variable (freight traffic casualties)
a = constant
b = the regression coefficients which determines the contribution of the independent variable.

x = independent variable (freight traffic crashes)
e = residual or stochastic error (which reveals the strength of bx)

Results and Discussion

Composition of Freight Vehicles in Traffic Crashes in the Study Area

Freight vehicles are often classified as light, medium, or heavy duty based on Gross Vehicle Weight (Yoon, 2005). Small trucks, pickups, and small vans are considered light-duty trucks in this study, whereas tippers and lorries are classified as medium-duty trucks. Trailers, tankers, and container trucks are classified as heavy-duty trucks and are typically used to transport large items for inter-city delivery. Small trucks are mostly utilized for intra-urban commodities transportation and re-distribution of goods to end customers inside urban centres, whereas medium trucks are often used for transporting building materials such as gravel, stones, and sand, among others (Nwoye & Oni, 2016; Atomode, 2017b).

The analysis of the composition of freight vehicles in road traffic crashes is presented in Figure 2. The finding reveals that trucks, trailers, tankers, and containers (heavy trucks) have the highest share of about 94% of the freight vehicle crashes. This is followed by pick-ups and delivery vans (small trucks) with a share of about 4%, while medium trucks (tippers, trucks, tow trucks, etc.) recorded the least share of 2% during the studied period. The findings imply that heavy-duty trucks are substantially more likely to be involved in freight vehicle crashes. This is because, aside from the size and weight of these vehicles, they are capable of running at a high typical speed. This means they need more time and distance to stop or avoid road hazards. Due to their height, freight vehicles also have large blind spots (areas) where the drivers cannot see another vehicle when it pulls up next to them, or cannot see people or objects directly in front or behind it. As observed by Umar and Bashir (2020), heavy vehicle drivers are more likely to experience serious traffic crashes with high casualties because the weight of their vehicles extends the braking distance.

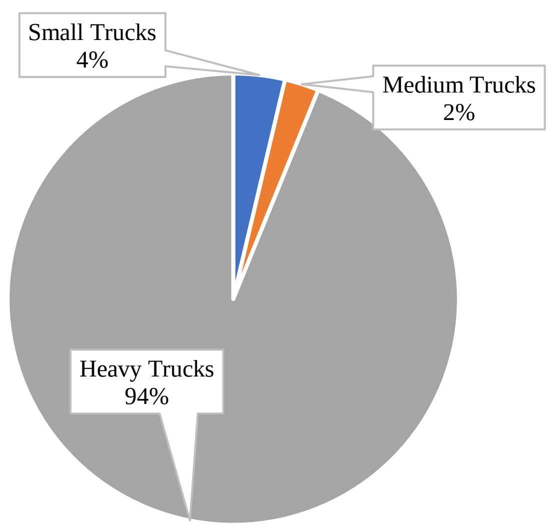

Figure 2: Composition of Freight Vehicle Crashes (2014 - 2021)

Spatial Distribution of Freight Vehicle Crashes in Lokoja

According to Asaju, Ewiolo, and Ajala (2021), traffic crashes varied geographically, with more frequent occurrences at specific locations that may be categorized as black spots. The assertion is correct for the study area as shown in Table 2. The finding reveals that about 88% of freight traffic crashes occur at the peripheral (outskirts) areas of Lokoja, such as Zango, Felele, Nataco, Crusher, Ganaja Village, Zariagi and Army Barracks. On the other hand, about 12% of the freight traffic crashes in the study area occur in core areas. The roads (such as Lokoja-Okene, Lokoja-Ajaokuta, Lokoja-Abuja roads) in the peripheral areas of Lokoja are characterized by highways with lesser chaotic traffic. Hence, drivers increase vehicles' speed and are thus more susceptible to traffic crashes when compared to lower speed in the urban core areas (such as, Post Office, Kabawa, Cantonmenet, Adankolo, etc.,). Wang, Yi, Chen, Zhang, and Qiang (2021) discovered that low-severity accident clusters occurred predominantly in urban centers in Harbin. The majority of high-severity traffic crashes clusters were found in suburban regions (Wang et al., 2021). Similarly, Yan, Chen, Wang, Zhang, and Zhao (2021) discovered that traffic flow on the freeway is quite high and vehicle speed is very rapid, making it more dangerous than regular low-speed urban and rural roadways. As a result, the freeway is a common location of severe road traffic crashes.

Table 2: Distribution of Freight Traffic Crashes Across Locations in the Study Area

Locations	Frequency	%
Core	30	12
Peripheral	214	88
Total	**244**	**100**

Further findings in Table 3 show that about 82% of the freight traffic crashes in the study area occurred on the Okene-Lokoja-Abuja Road, while the Township (Murtala Mohammed Road) and Lokoja-Ajaokuta Roads account for the remaining 18% of the traffic crashes in equal proportion (9% each). The high proportion of freight vehicle crashes recorded on Okene-Lokoja-Abuja High Way could be connected to the high volume of freight traffic coupled with the fact that it is a major route linking the northern part of Nigeria to the southern part. Besides, the road serves as a major route used by prominent large-scale industries (such as Dangote Cement Factory, Obajana, and Unicane Industries Limited, Jamata) in Lokoja region for the movement of raw materials and finished goods. The outcome is consistent with Adetunji (2015) study, which reported that the Okene-Lokoja route had the highest number of freight vehicle-related traffic crashes in Kogi State. Similarly, a comparative analysis of factors affecting the frequency and severity of freight-involved and non-freight crashes on a major freight corridor freeway was carried out by Taylor et al (2018). The study revealed that roads with a high percentage of freight traffic had more severe outcomes for freight crashes, but not for non-freight crashes.

Table 3: Distribution of Freight Traffic Crashes Across Major Roads in the Study Area

Major Roads	Frequency	%
Okene-Lokoja-Abuja Road	200	82
Lokoja-Ajaokuta Road	22	9
Murtala Mohammed (Township) Road	22	9
Total	**244**	**100**

When considering the segment of the roads commonly associated with freight vehicle crashes in the study area, the finding in Table 4 shows that 31% occur at dangerous bends and steep slopes, while 20% and 9% occur at road intersections and road bridges, respectively. Other road segments (speed bumps, damaged portions of the roads, road construction/repair, and diversion sections, among others) account for 40% of freight vehicle crash occurrences. The intricacy of these road segments, along with insufficient traffic signals, affects drivers' visual recognition ability, resulting in drivers' maloperation of vehicles. These road segments are often characterized as accident black spots, which are regarded as critical areas for traffic accident prevention by relevant agencies (Yan et al., 2021). For example, Wang, Luo, and Chen (2019) observed that trucks are highly prone to run off the road or even tumble down a cliff if there is a small radius bend and the driver does not take adequate precautions in time, which can lead to serious consequences.

Table 4: Distribution of Freight Traffic Crashes Across Major Roads in the Study Area

Road Segment	Frequency	%
Intersections	50	20
Bend and Slope	75	31
Bridges	21	9
Others	98	40
Total	**244**	**100**

Temporal Distribution of Freight Traffic Crashes and Casualties in the Study Area

The yearly distribution of freight traffic crashes and casualties is presented in Figure 3. During the period of study, a total of 244 freight vehicle crashes were recorded. The crashes resulted in 141 fatalities and 490 injuries, altogether totaling 631 freight traffic casualties from 2014 to 2021. The highest (21%) number of freight vehicle crashes was recorded in the year 2021, while the year 2015 had the highest (22%) freight traffic casualties. On the other hand, year 2014 had the lowest (5%) number of freight vehicle crashes, while year 2016 recorded the lowest (3%) freight traffic casualties in the study area (Figure 5).

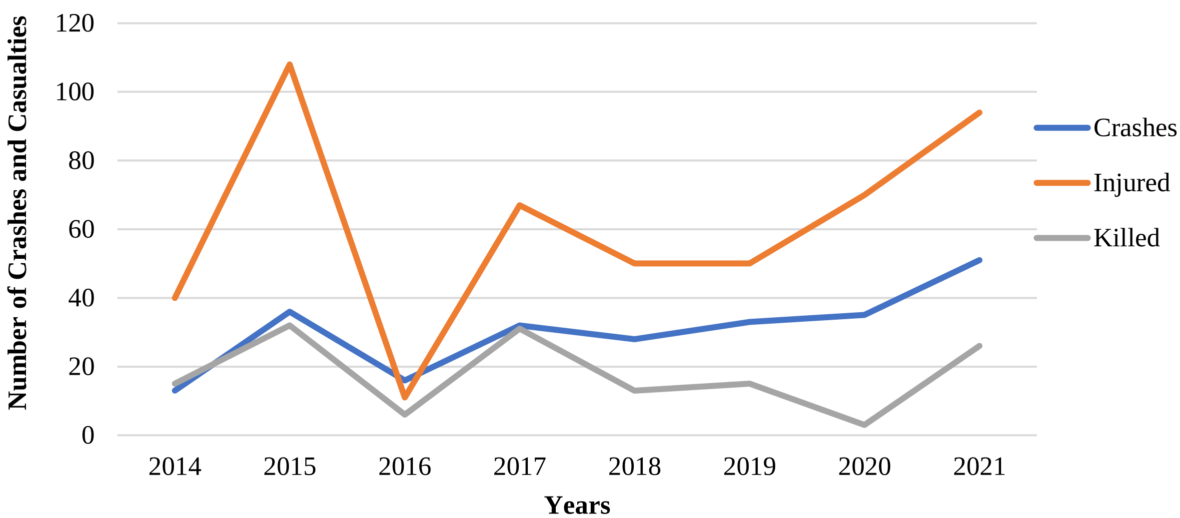

Figure 3: Trend of Freight Vehicle Crashes and Casualties (2014-2021)

Further data analysis demonstrates an annual rate of rise or decline in freight vehicle crashes and injuries recorded over the study period (Table 5). From 2014 to 2015, freight vehicle crashes increased by 64%, while the number of individuals injured and killed increased by 63% and 53%, respectively. By 2016, there has been a significant reduction in freight vehicle crashes (125%), injuries (882%), and fatalities (433%). This was followed in 2017 by an increase in the number of crashes involving freight vehicles (50%), injuries (84%) and fatalities (81%). In contrast, freight vehicle crashes decreased by 14% in 2018 compared to the previous year, while the number of individuals injured and killed decreased by 34% and 138%, respectively.

Table 5: Percentage Change in Yearly Distribution of Freight Vehicle Crashes and Casualties in the Study Area

Year	Crashes	% change over previous period	Injured	% change over previous period	Killed	% change over previous period
2014	13	-	40	-	15	-
2015	36	64	108	63	32	53
2016	16	-125	11	-882	6	-433
2017	32	50	67	84	31	81
2018	28	-14	50	-34	13	-138
2019	33	15	50	0	15	13
2020	35	6	70	29	3	-400
2021	51	31	94	26	26	88

From 2019 to 2021, there was a consistent increase in the proportion of freight vehicle crashes. For example, a 15% rise from the previous year was reported in 2019, a 6% increase in 2020, and a 31% increase in 2021. There was no change in the number of individuals injured between 2018 and 2019. The number of individuals injured in freight vehicle crashes increased by 29% and 26% in the years 2020 and 2021, respectively. However, the trend of percentage change in the number of fatalities from 2019 to 2021 differed from that of people injured and freight vehicle crashes. For example, while there was a 13% rise in 2019 compared to the previous year, there is a 400% reduction between 2019 and 2020. Following that, a rise of 88% was observed for the year 2021 over the previous year. In summary, with the exception of 2020 (when the number of fatalities did not follow the same pattern as the number of injuries and freight vehicle crashes), freight vehicle crashes displayed the same rippling pattern as the number of persons injured and killed. According to Asaju et al. (2021), this undulating pattern may be related to inconsistencies in road safety intervention programs and approaches to road traffic management.

In addition, a One-Way Analysis of Variance (ANOVA) was employed to test if there was a significant yearly variation in the number of freight vehicle crashes and casualties in the study area during the studied period. The results of the One-Way ANOVA showed that there was no significant difference in the number of yearly freight traffic crashes ($F(7,95) = 1.778$, $P = .102$) at .05 alpha level. In contrast, there was a significant difference in the number of yearly casualties resulting from freight vehicle crashes ($F(7,95) = 2.169$, $P = .045$), at .05 alpha level in the study area during the period of study (Table 6). This implies that, while there is no significant difference in the number of freight traffic crashes during the years of study, the number of casualties differs significantly.

Table 6: One-Way ANOVA Results of Yearly Variation in Freight Traffic Crashes and Casualties in Lokoja, 2014 -2021

ANOVA					
Crashes					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	83.500	7	11.929	1.778	.102
Within Groups	590.333	88	6.708		
Total	673.833	95			
Casualties					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	889.240	7	127.034	2.169	.045
Within Groups	5154.250	88	58.571		
Total	6043.490	95			

Furthermore, the monthly distribution of freight vehicle crashes and casualties in Lokoja metropolis is presented in Figure 4. The months of December and January were the most prone to freight traffic crashes and casualties in the study area. December accounts for 14% of freight traffic crashes and 13% of casualties, while January accounts for 11% of the recorded freight traffic crashes and 12% of casualties. February, on the other hand, had the lowest reported cases of freight traffic crashes (4%) and casualties (3%). The months of December and January, respectively, coincide with the end and beginning of the year, which connotes the yuletide and are therefore characterized by high freight traffic. The rush to meet the supply of goods during these months could predispose freight vehicles to a high incidence of crashes and casualties.

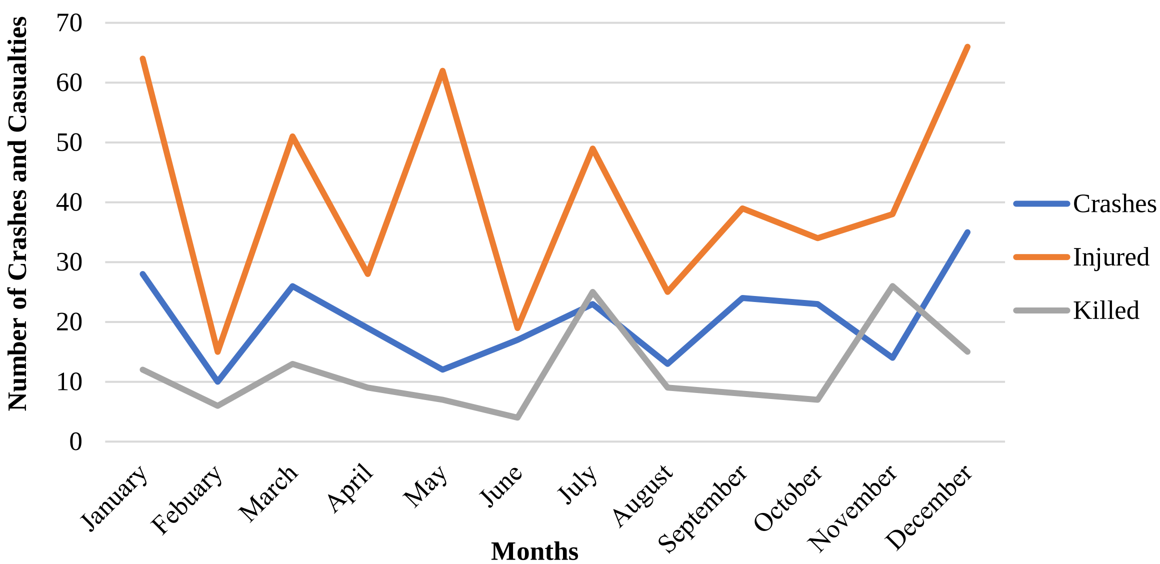

Figure 4: Monthly Distribution of Freight Traffic Crashes and Casualties

In terms of seasonal variation in freight traffic crashes and casualties during the study period, Figure 5 reveals that the wet season recorded higher traffic crashes and casualties than the dry season. About 54% and 52%, respectively, of freight traffic crashes and casualties occurred in the wet season compared to about 46% and 48% in the dry season. Further findings also show that the casualty-to-crash ratio in the dry season stood at about 2.70 to 1, compared to about 2.48 to 1 in the wet season. This implies that for every incidence of freight traffic crash, about 2.70 and 2.48 casualties are recorded in the dry and wet seasons, respectively. The increased incidence of freight crashes and casualties during the rainy season might be linked to the wet, slick roads and reduced visibility, particularly during rainy. These variables, according to Atomode (2019), contribute to the high number of traffic crashes involving freight vehicles during the wet season.

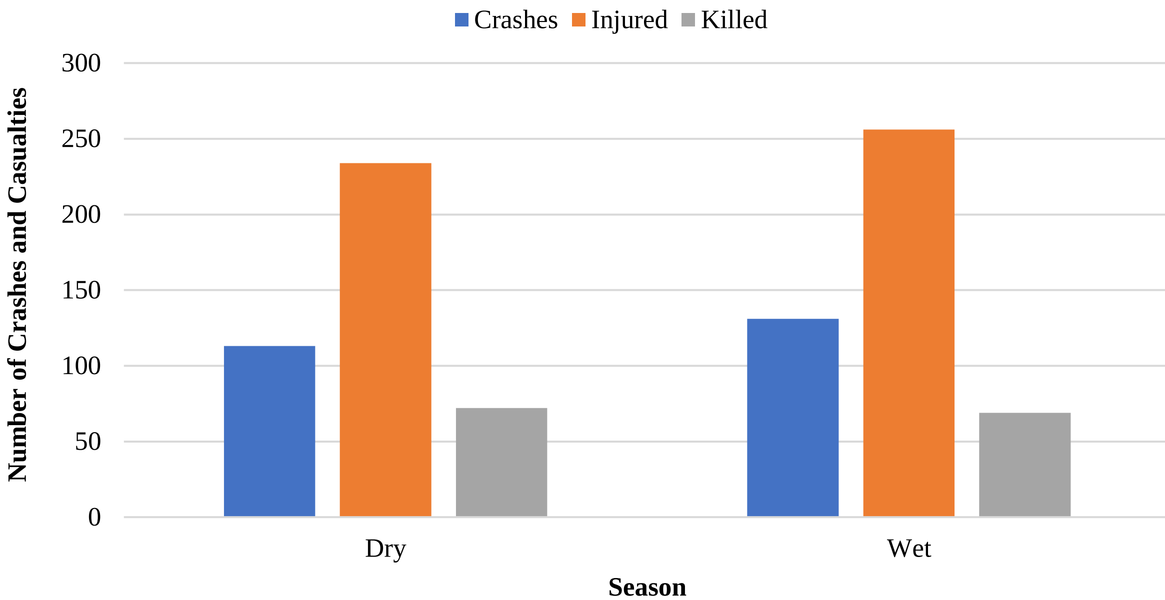

Figure 5: Seasonal Distribution of Freight Traffic Crashes and Casualties

Relationship between Freight Vehicle Crashes and Casualties in the Study Area

Simple Linear Regression statistical technique was used to examine the relationship between freight vehicle crashes and casualties in the study area. The summary statistics of the model is presented in Table 7. A moderate level of prediction of the dependent variable (casualties) was indicated by the value of the correlation coefficient (R), 0.69. The coefficient of determination (R^2) value of 0.481 indicated the model only explained 48.1% of the total variation in the casualties. It therefore means that 51.9% of the variation is still unexplained. In other words, the total casualties in the study area are a function of several other variables aside from freight traffic crashes. The F-ratio in the ANOVA table was used to test whether the overall regression model was a good fit for the data (Table 7). The table reveals that the independent variable (freight traffic crashes) significantly predicts the dependent variable (casualties), $F(1, 95) = 87.03$, $P < .001$. Since the P-value is less than 0.05, the regression model is a good fit for the data. The null hypothesis that 'the number of freight traffic casualties in the study area is independent of the number of freight traffic crashes is hereby rejected. This implies that traffic casualties are dependent on traffic crashes. The unstandardized coefficients in the coefficient table indicate how far freight vehicle crashes vary with the number of traffic casualties when all other variables are held constant (Table 7). Therefore, for every 1 increase in the number of freight vehicle crashes, traffic casualties increase by 2.08. The equation to predict traffic casualties from freight vehicle crashes, therefore, becomes:

$$\text{Traffic Casualties} = 1.295 + 2.076\ (\text{freight vehicle crashes}) \quad (2)$$

Table 7: Regression Results of the Relationship between Freight Vehicle Crashes and Casualties

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.693[a]	.481	.475	5.778

a. Predictors: (Constant), Crashes

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2905.442	1	2905.442	87.032	.001[b]
	Residual	3138.047	94	33.383		
	Total	6043.490	95			

a. Dependent Variable: Casualties
b. Predictors: (Constant), Crashes

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.295	.817		1.585	.116
	Crashes	2.076	.223	.693	9.329	.001

a. Dependent Variable: Casualties

Causes of Freight Vehicle Crashes in the Study Area

As observed by Yan et al. (2021), understanding the characteristics and root causes of traffic crashes can help prevent the occurrence of similar mistakes and strengthen preventative measures in road transportation enterprises. Findings in Figure 8 reveal that speed violation constitutes 31%, while loss of control and brake failure account for 32% (16% each) of the causes of freight traffic crashes in the study area. Other causes of freight traffic crashes include; wrongful overtaking (9%), sign light violation (7%) and route violation (6%) dangerous driving (4%), Fatigue (3%), tire burst (2%), dangerous driving (2%), dangerous overtaking (1%), and use of phone (1%). The result of the analysis shows that drivers' behaviours (speed violation, loss of control, wrongful overtaking, sign light violation, route violation, dangerous driving, fatigue, dangerous driving, dangerous overtaking and use of phone) cumulatively account for the major (84%) causes of freight traffic crashes. This is a concern since various variables contribute to the length of time it takes a vehicle to stop or slow down. Truck responses to sudden circumstances are influenced by the truck's speed, cargo weight, and weather conditions.

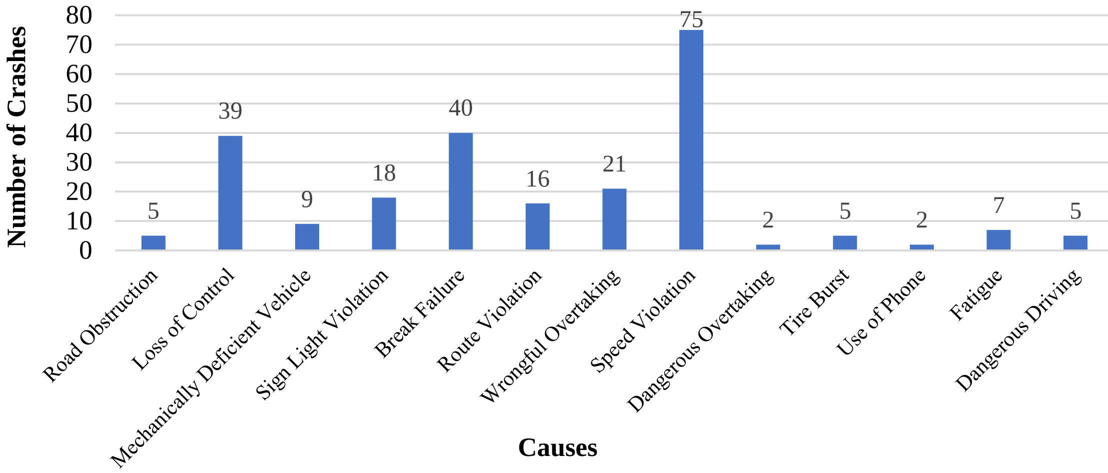

Figure 6: Common Causes of Freight Traffic Crashes in Lokoja

The findings of this research are similar to those obtained in a study of characteristics and causes of major road traffic crashes involving commercial vehicles in China by Yan et al. (2021). The study found that the majority of the crashes were directly caused by the driver's speeding, fatigued driving and vehicle failure. In a similar study, Poku, Bandoh, Kenu, Kploanyi, and Addo-Lartey, (2020) examined factors contributing to road crashes among commercial vehicle drivers in the Kintampo North Municipality, Ghana, in 2017. The study discovered that drinking and driving, changing lanes without signaling, bribing a police officer, exceeding the maximum speed limit, and bribing the Driver and Vehicle Licensing Authority (DVLA) for a driving license were all related to involvement in road traffic crashes. Likewise, Jin et al. (2019) reported that driving error accounted for 92.3% of truck crashes in Florida, making it the most common crucial factor.

Conclusion and Recommendations

This study examined road freight vehicle crashes and casualties in Lokoja from 2014 to 2021. The spatial and temporal distribution of freight traffic crashes and casualties, as well as common causes of freight traffic crashes, were examined. The study found that heavy-duty trucks (trucks, trailers, tankers and containers) have the highest (94%) share of freight traffic crashes. Further analysis revealed that about 88% of freight traffic crashes occur at the peripheral areas of Lokoja, such as Zango, Felele, Nataco, Crusher, Ganaja Village, Zariagi and Army Barracks. Moreover, while there was no significant difference in the number of yearly freight traffic crashes, a significant difference was found in the number of casualties resulting from freight vehicle crashes in the study area during the period of study.

The findings of this study give valuable insights and suggestions that transportation stakeholders, including policymakers and researchers, may use to establish appropriate regulations that will help reduce road freight vehicle crashes. The study revealed that it is critical to split road traffic crashes into freight and passenger components in order to efficiently manage and plan for safety. This is because urban roads are utilized by a variety of transportation modes, each of which has its own set of travel behaviours and hence has a varied impact on traffic safety. As a result, the research recommended that analysis of freight vehicle crashes data will aid in the creation of educational and preventative campaigns targeted at reducing road traffic crashes in the study area. Continuous drivers' enlightenment and strict enforcement of traffic rules by relevant authorities were also recommended to reduce the risk of freight vehicle crashes.

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