Original Research Article

Causes of Cement Trucks Accidents on the Major Routes Connecting Obajana Cement Plant and Rivers State in Nigeria

Abstract

This study was conducted to ascertain the causes of cement trucks accidents on the three major routes (Routes 1, 2 & 3) connecting Obajana Cement Plant and Rivers State in Nigeria. Data were obtained from questionnaire administered to all truck drivers plying the three designated routes and analyzed using descriptive and inferential statistics. Results obtained showed that all the drivers are male, majority of which had first degree or its equivalent for Route 1 (45%) and senior secondary certificate for Route 2 (54.5%) and Route 3 (52.2%). Majority (37.5%) of drivers plying Route 1 have been driving for ≥10 years on that route. For Route 2, majority (52.6%) have been driving for 4-6 years, while for Route 3, majority (39.1%) have been driving for 7-9 years. Majority of the drivers (77.2%) agreed that they have been involved in accident with the company's trailer along these routes, with highest (45.1%) of the accidents occurring at 61-80 KPH, often with the road barrier, at bad portions of the road and involving the front of the vehicle, with tyre rupture, as the commonly reported vehicle-related problem at the time of accident. Statistically significant relationship was established between driving experience and road accidents. However, no statistically significant relationship was found between ages, educational qualification, routes travelled and road accidents. The study concluded that environmental factor particularly bad road, vehicle-related problems most especially tyre rupture and brake failure, and human error in form of dangerous driving are the leading causes of most accidents involving Dangote cement trucks on the roads connecting Obajana Cement Plant and Rivers State in Nigeria.

Keywords: Road accidents, Cement truck, Obajana cement plant, Truck routes, Transportation, Nigeria

1. Introduction

Transportation either of persons or goods is central to urbanization and the smooth running of any society, as it helps to situate customers and merchandise together, make overpass of distant interval achievable in space and time, and makes ingress to resources in obscure locale possible among other things. Indeed, transport is a dominant precondition that guarantees the development of a state in all ramifications (Oni and Okanlawon, 2006). When persons and goods are not moved efficiently, there will be a decline in productivity, wastage in effort and wealth stock, and compromises in safety which will put the condition of living under severe threat (Siyan et al., 2019). Transport is so important for local and international trade, prompting countries to allot great attention to this sector, as countries now are as advanced in proportion to their transport sector (Farah, 2016).

Urban centres and areas with more economic activities have a more comprehensive transport network comprising roads and vehicles of all sorts. The ever-growing population, increasing trade and commerce place increased demand on road transit base; with many roads network failing, especially when overused or overstretched (Siyan et al., 2019). The implication is that incidence of road clashes would increase in proportion to the quantum of vehicles plying the

road except where measures are put to guarantee the safety of motorists and amblers. Accident is inexorable, as it is not an argument of if it will happen but when. Hence, we have bodies established to broaden the mastery of road safety statutes.

Road accident is a grave concern for human safety globally, with over a million dying on the road yearly, of which over 50% are vulnerable users (WHO, 2009). The global health body further informed that more accident's fatality occurs on the roads in Africa than anywhere else in the world. Nigeria the most populous country in Africa is encumbered with this reality as it grapples with its growing population and the need to meet-up development-wise with other nations. Onyemaechi and Ufoma (2016) averred that road crashes are in ascendency in Nigeria and it is the foremost explanation for deformities and third leading validation of deaths. Siyan et al. (2019) in their survey of accidents data in Nigeria from 1960 - 2017 reported that the crashes and causalities figures are over one million during that time. The Federal Road Safety Corp of Nigeria (FRSC) reported 3,947 crashes and 1,758 deaths; 2080 crashes and 1,033 deaths, and 2,656 crashes and 1,076 deaths within the first three quarters of 2020 alone, which they attributed to unsafe driving behaviour and utilizing fake tyres (FRSC, 2020).

According to FRSC, heavy duty trucks are a nightmare on Nigerian roads (FRSC, 2010). Dare et al. (2009) report on accidents in Nigeria from 1999 – 2002 fingered heavy-duty vehicles and trailers, which are of low quality and sometimes driven by underage drivers (< 30), as the cause of 90% of accidents. The FRSC 2010 report put the figure of heavy-duty vehicles crashes from 2007-2010 between 4.53 - 7.84 trucks per day, and their occurrences were blamed on bad roads, risky driving behaviour and unacceptable state of vehicles (FRSC, 2010). According to Blower and Woodrooffe (2012), some of the commonest types of truck accidents include rear end, sideswipes, lane departures, crossing-path collisions, pedestrian involved accidents, vehicle rollover, head-on collision, single trailer accidents and under-run accidents. Still, Farah (2016) opined that road transits is particularly suitable in Nigeria for the reason that it is supple and has various corridor characteristics which are fitting for a country with large land mass and history of interstate trade. Also, Olanrewaju (2013) posited that for now reliance on trucks for conveyance of merchandise in Nigeria cannot be stopped, even with its association with accidents of lethal nature, as this could cripple critical sectors of the state's fragile economy within days.

Highway-related crashes result in economic losses and lost in productivity, besides emotional, physical and social consequences arising from injuries (Onyemaechi and Ufoma, 2016; Farah, 2016; Siyan et al., 2019). In 2012 alone, road crashes caused over 4,000 deaths and an estimated loss of $8.0b which is about 3% of the nation's GDP, putting the health and economic costs far above HIV/AIDS (NRSS, 2013). Farah (2016) put the cost of heavy good vehicles (trucks and trailers) related accidents in Nigeria as at 2011 to $0.602 billion/annum which is colossal. The FRSC (2010) report revealed that for any tanker/trailer crash in the period from 2007 to 2010, at least a life was lost. The FRSC listed the Lokoja-Okene road, Onitsha-Enugu, Benin-Agbor, among the hot spots of trailer crashes in Nigeria between 2007 and 2010 (FRSC, 2010). The same report revealed that human error in form of dangerous driving accounted for most crashes involving heavy-duty trucks in the years under review.

Dangote Cement plc is the leading force in the Nigerian cement industry. Obajana Cement Plant is the prime cement plant in Africa with a 13.25mt capacity supported by a fleet of 2370 trailers, and is feed by a limestone reserve from Obajana. For conglomerate with fleets of trailers bossing the haulage business, issues of accidents associated with these trailers are subjects of scrutiny.

Dangote trailer ferry cements from their biggest plant in Obajana to the South-South market via Abuja-Benin highway to the east-west road or the Enugu-Port Harcourt highway to Port Harcourt. These routes are the economic arteries of southern Nigeria. Since Dangote cement trailers are heavy-duty vehicles, conveying several metric tonnes of cement to Rivers State, and for now no alternative route exist to their use, it is thus imperative to study the factors linking them to frequent involvement in road crashes so as to proffer solutions.

2. Materials and methods

2.1 Study population

A total of 147 trailer drivers supplying cement to Rivers State from Obajana Cement Plant formed the study population. The drivers were tabbed based on their preferred route of travelling. They were thus grouped into three: Route 1 (Lokoja-Ewu-Esan-Agbor-Onitsha/Owerri Expressway-Port Harcourt), Route 2 (Obajana Cement Plant-Lokoja-Okene-Ajaokuta-Itobe-Ankpa-Uromi-Enugu-Expressway-Port Harcourt), and Route 3 (Obajana Cement Plant-Lokoja-Okene-Benin-Warri-East-West Road-Port Harcourt). Only Dangote cement trailer drivers designated to supply cement to Rivers State, who use a particular route over half the time they transport cement to the state and who have experienced or witnessed accident involving the company's trailer on these routes were included.

2.2 Sample size

A sample size of 108 trailer drivers was calculated from the study population using Taro Yamane's formula.

$$n = \frac{N}{1 + N(e^2)} \qquad (1)$$

where n is the sample size, N is the study population (147), and e is the margin of error (5%). Therefore, a total number of one hundred and eight (108) copies of questionnaire were administered to Dangote cement trailer drivers designated to supply cement to Rivers State who met the inclusion criteria in Section 2.1. Among the copies of questionnaire retrieved, 101 copies were valid representing 93.5% while 7 copies were invalid representing 6.5%. The distribution of the retrieved 101 valid copies of questionnaire was as follows: Route 1 (40), Route 2 (38) and Route 3 (23).

2.3 Data collection tool

A semi-structured questionnaire sectioned into three: Section A with 10 questions bordering on socio-demographic characteristics, Section B had 6 questions on driving behaviour and Section C had 9 questions on causes of road traffic accident.

2.4 Statistical analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 20, for inferential statistics such as Chi-Square and Analysis of Variance (ANOVA) to establish any notable relationship ($p \leq 0.05$).

3. Results

3.1 Socio-demographic characteristics

Table 1 presents socio-demographic characteristics of the drivers. All the drivers surveyed are male. Majority of the drivers plying Route 1 (50%) and Route 3 (69.6%) were aged 31-40 years while the least number (10%) and (13%) for Route 1 and Route 3 respectively, were aged 41-50

years. For Route 2, majority of the drivers (47.4%) are aged 41-50 years while the least number (5.3%) are aged 31-40 years. Majority of the drivers had educational training: 87.7%, 100% and 95.7% for Route 1, Route 2 and Route 3, respectively. Among the drivers with educational qualification grouped under Route 1, majority (45%) have BSc or its equivalent, while the least number (2.5%) have primary education. For drivers in Routes 2 and 3, majority (54.5%) and (52.2%) have their highest qualification as senior secondary, while the least (2.6%) have master degree for Route 2 and (4.5%) have HND/BSc for Route 3. On marital status, 100% (Route 2), 82.5% (Route 1) and 60.9% (Route 3) are married. Majority of the drivers in Route 1 (72.5%) admitted to taking alcohol while majority in Route 2 (65.8%) and Route 3 (91.3%) did not admit to taking alcohol. All the drivers in Route 3 (100%) and majority in Route 1 (95.0%) and Route 2 (57.9%) admitted to smoking cigarette. All the drivers in Route 2 (100%) and majority in Route 1 (85.4%) and Route 3 (82.6%) did not admit to smoking hemp. Preponderance of the drivers in Route 2 (52.6%) admitted to tramadol use, while majority in Routes 1 and 3 (92.5%) and (95.4%) respectively did not admit to using the drug. Most drivers 37.5% (Route 1), 52.6% (Route 2) and 39.1% (Route 3) have been driving for ≥10 years, 4-6 years and 7-9 years respectively, while the least drivers 7.5% (Route 1), 10.5% (Route 2), and 26.1% (Route 3) have been driving for <1 year, 1-3years, and 1-3years, respectively.

Table 1: Socio-demographic characteristics of cement trailer drivers

Variable	**Option**	**Route 1**		**Route 2**		**Route 3**	
		Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Sex	Male	40	100	38	100	23	100
	Female	0	0	0	0	0	0
Age	<20	0	0	0	0	0	0
	21-30	11	27.5	0	0	4	17.4
	31-40	20	50	4	10.5	16	69.6
	41-50	4	10	18	47.4	3	13.0
	51-60	5	12.5	10	26.3	0	0
	>60	0	0	6	15.8	0	0
Level of Education	Quranic school	3	8.6	0	0	0	0
	Primary	1	2.9	8	21.1	9	40.9
	Junior Secondary	2	5.7	4	10.5	0	0
	Senior Secondary	11	31.4	20	52.6	12	54.5
	HND/BSc.	18	51.4	5	13.2	1	4.5
	Master	0	0	1	2.6	0	0
Marital Status	Single	5	14.2	0	0	9	39.1
	Married	33	82.5	38	100	14	60.9
	Widow	2	4.9	0	0	0	0
	Divorced	0	0	0	0	0	0
Smoking cigarette	Yes	38	95.0	22	57.9	23	100
	No	2	5.0	16	42.1	0	0
Smoking hemp	Yes	5	14.6	0	0	4	17.4
	No	35	85.4	38	100	19	82.6
Tramadol use	Yes	3	7.5	20	52.6	1	4.6

	No	37	92.5	18	47.4	22	95.4
Years in driving	<1	3	7.5	0	0	0	0
	1-3	12	30	4	10.5	6	26.1
	4-6	0	0	20	52.6	8	34.8
	7-9	10	25	6	15.8	9	39.1
	≥10	15	37.5	8	21.0	0	0

3.2 Accident involvement

Table 2 shows the distribution of drivers involved in road accident while driving Dangote Cement trailers. Most drivers 77.5% (Route 1), 65.8% (Route 2) and 95.7% (Route 3) agreed that they have been involved in accident with the company's trailer.

Table 2: Distribution of trailer drivers involved in road accident

Involved in accident	**Route 1**		**Route 2**		**Route 3**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Yes	31	77.5	25	65.8	22	95.7
No	9	22.5	13	34.2	1	4.3

3.3 Driving speed at the time of accident

Figure 1 shows the driving speed as at the time of accident. Most drivers along Route 1 (45.1%) had accident while driving at 61-80 KPH and the least reported (6.5%) were driving at 81-100 KPH when the accident occurred. Majority of drivers on Route 2 (48%) did not know at what speed they were driving when the accident happened and least reported accidents (12%) occurred at 21-40 KPH. Majority of accidents along Route 3 (50%) occurred at 81-100 KPH and the least reported accidents (4.5%) occurred at 0-20 KPH and 101-120 KPH. Only drivers along Route 3 reported accidents at the least speed of 0-20 KPH and that of over 121 KPH.

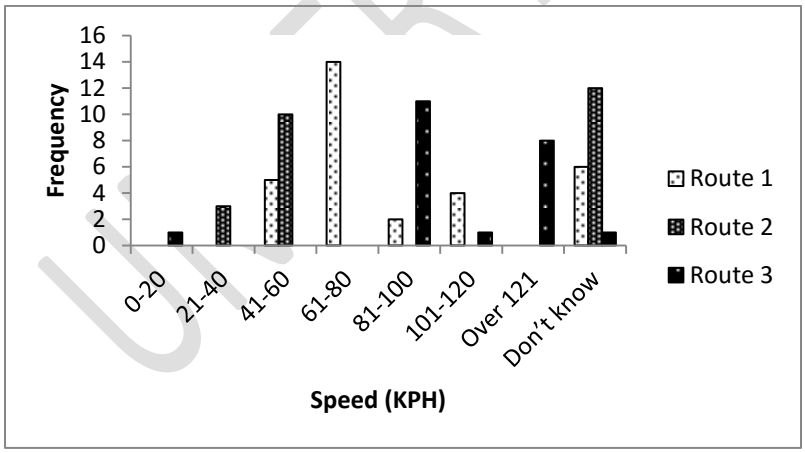

Figure 1: Driving speed as at the time of accident

3.4 Objects collided with during accident

Figure 2 shows the objects the drivers collided with when they had an accident. Majority of drivers in Route 1 (32.3%) collided with the road barrier, while those in Route 2 had more

collision with lorry (24%) and those in Route 3 had more collision with bus (31.8%). Drivers on Route 1 had the least collision (6.5%) with lorry, those on Route 2 (4%) with animal and tree, while those on Route 3 (4.5%) had with traffic officer.

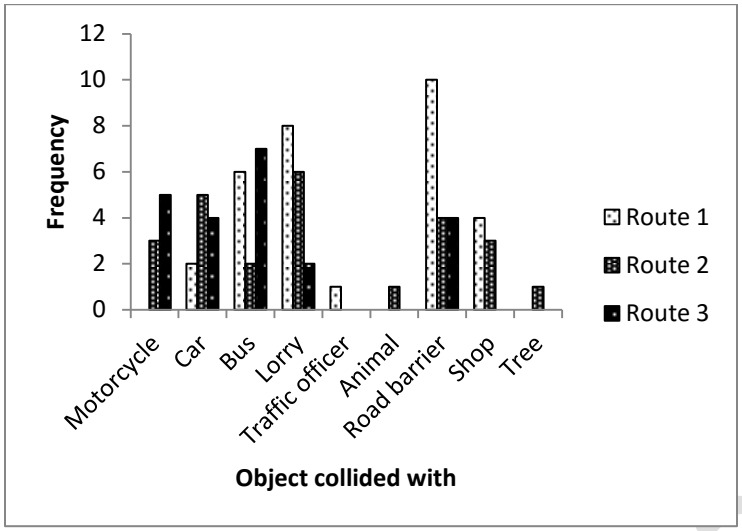

Figure 2: Objects collided with during accident

3.5 Parts of vehicle involved in accident

Figure 3 shows the part of the vehicular involved in the accident. Majority of the vehicles 87.1%, 100% and 90.9% for Routes 1, 2 and 3 respectively involved the front of the trailer. The least involved parts of the vehicle are back, left and right side of the vehicle with 6.4% collisions for Route 3 and 9.1% for Route1.

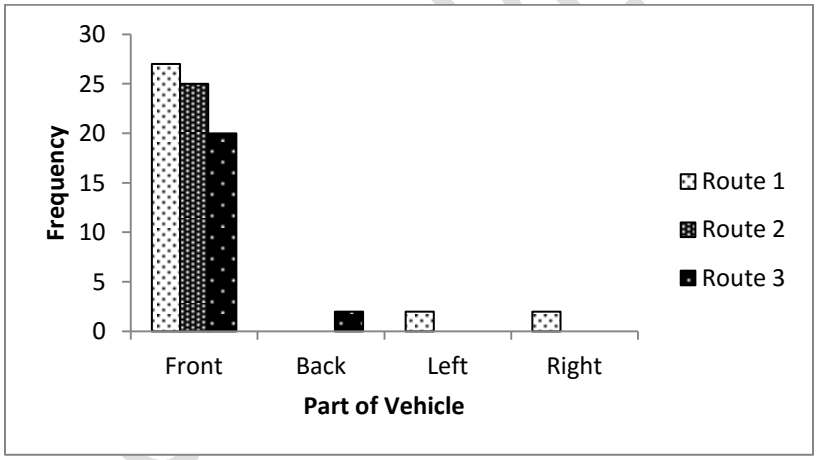

Figure 3: Part of vehicle involved in the accident

3.6 Condition of the road where accident occurred

Figure 4 shows the state of the road where the accident occurred. Majority of the drivers on Route 1 (48.4%), Route 2 (60%) and Route 3 (72.7%) reported the state of the road to be broken. For Routes 1, 2 and 3, the least accident occurred on narrow road (3.2%), asphalt (40%) and clay (4.5%), respectively.

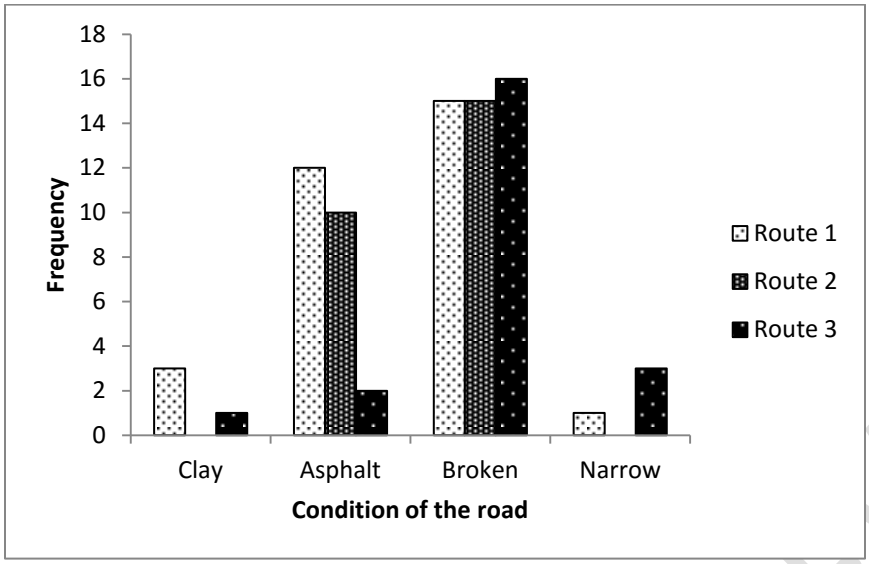

Figure 4: Condition of the road where the accident occurred

3.7 Causes of road accident

Figure 5 shows the cause of accidents. Majority of the drivers (32.2%, 44% and 81.8% for Routes 1, 2 and 3, respectively) reported that bad road was the cause of their accidents. The next frequently reported was vehicle related conditions (16.1%, 20% and 22.7% for Routes 1, 2 and 3, respectively). Drivers on Route 1 reported overloaded vehicle (3.2%) as the least cause of accident, those on Routes 2 and 3 reported animals on the road (4%) and low experience (4.5%) as the least causes of their accidents, respectively.

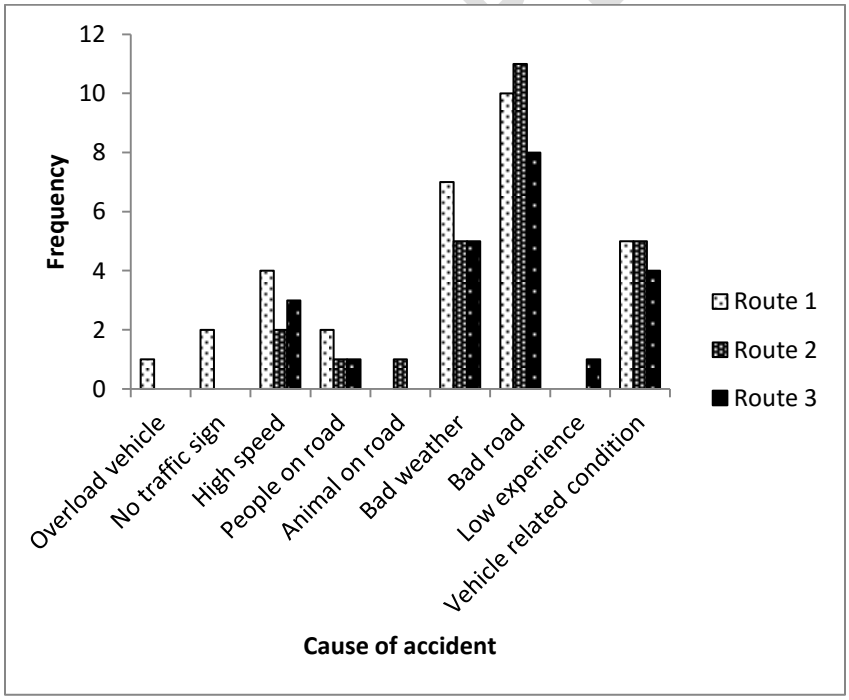

Figure 5: Cause of accidents

3.8 Vehicle problem at the time of accident

Figure 6 shows the vehicle problems at the time of accident. The commonest reported vehicle-related problem was tyre rupture having the percentage of 35.6%, 40% and 36.4% for Routes 1, 2 and 3, respectively. The least reported vehicle problem was overload (3.2%) for Route 1, and steering system (4.5%) for Route 3. For Route 2, defective brake, headlight and machine fault where jointly reported as the least vehicle problem with percentage of 20% each.

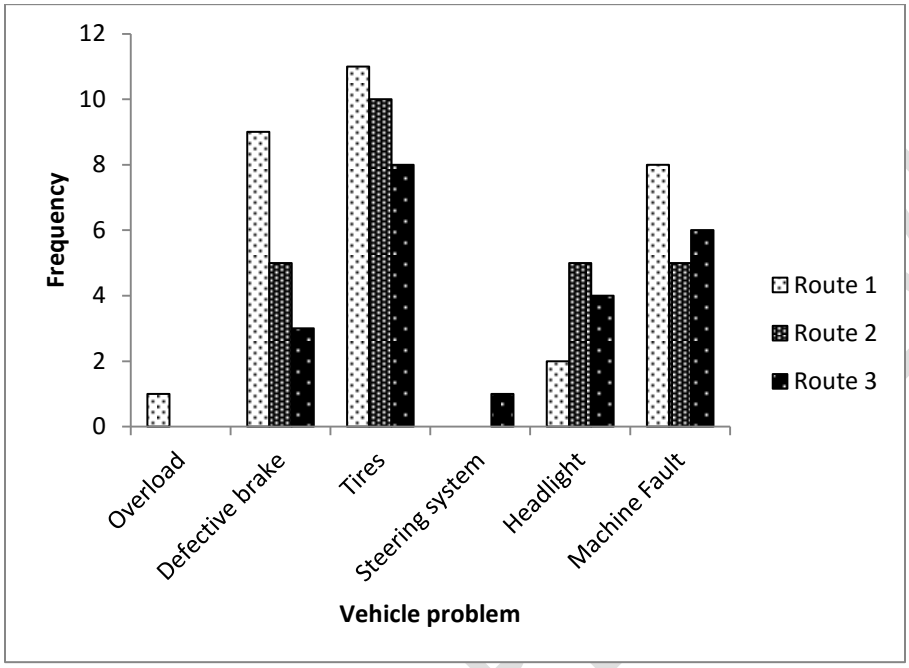

Figure 6: Vehicle problem at the time of accident

3.9 Day of the week accident occurred

Figure 7 shows the days of the week the accident occurred. Majority of the accidents on Route 1 occurred on Sunday (37.8%) and the least on Monday (6.4%). For Routes 2 and 3, majority of accidents occurred on Saturday (60% and 40.9%, respectively), while the least for Route 2 was on Wednesday (40%) and for Route 3 was on Tuesday (4.5%).

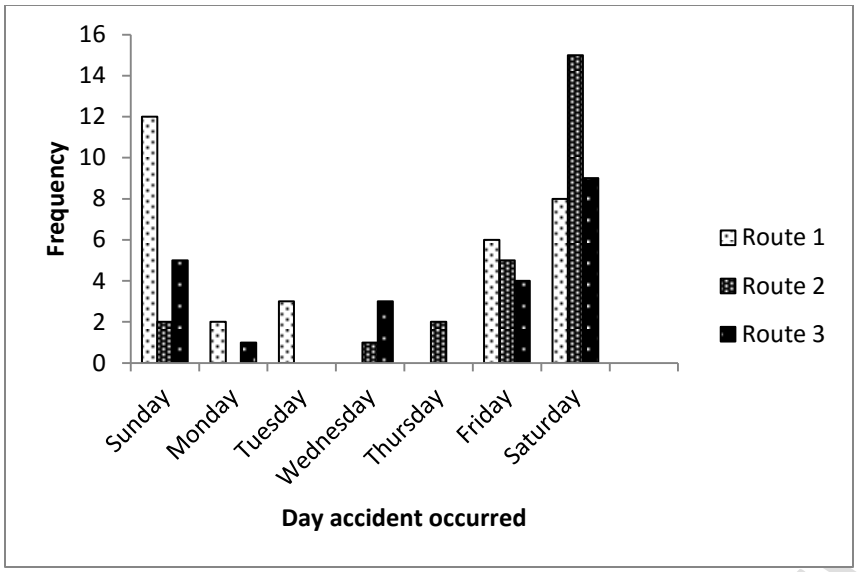

Figure 7: Day accident occurred

3.10 Statistical analysis

The results of the Chi-Square and ANOVA tests carried out show that there is no notable correlation between age and road accident ($p=0.273>0.05$), between level of education and road accident ($p=0.290>0.05$), and between routes travelled and road accident ($p=0.809>0.05$), along the major routes of transport from Obajana Cement Plant to Rivers State. However, a notable correlation was found between driving experience and road accident along the major routes of transport from Obajana Cement Plant and Rivers State ($p=0.027<0.05$).

4. Discussion

The trailer drivers used for this study were grouped into three depending on their preferred routes from the cement plant to Rivers State, designated as Route 1 (Obajana-Lokoja-Ewu-Esan-Agbor-Onitsha/Owerri Expressway-Port Harcourt), Route 2 (Obajana-Lokoja-Ajaokuta-Itobe-Ankpa-Enugu Expressway-Port Harcourt) and Route 3 (Obajan-Lokoja-Okene-Benin-Warri-Via East-West Road-Port Harcourt). The socio-demographic characteristics of the drivers show that all the drivers surveyed are male. Majority of the drivers plying Route 1 and Route 3 were aged 31-40 years while those on Route 2 were aged 41-50 years. Minority of the drivers plying Route 1 and Route 3 were aged 41-50 years while those on Route 2 were aged 31-40 years. The mean age of the drivers is approximately 40 years. Nghishihange (2018) reported the mean age of drivers involved in accidents as 38 years. According to Niazi (2016), persons aged 21-40 are economically active and are very much prone to road accidents. Zhang (2014) reported that drivers between ages 25 and 39 were more involved in accidents. However, no notable relationship was established between drivers' age and road accidents in the present study.

Majority of the drivers have some form of educational trainings. For Route 1, majority of the drivers have BSc or its equivalent while majority of drivers on Routes 2 and 3 have senior secondary certificate. This shows preponderance of the drivers are literate and ought to be familiar with road safety standards. Niazi (2016) reported that a higher percentage of drivers without educational training (69%) had been involved in road accidents. However, no notable relationship was found between drivers' level of education and road accidents in this work.

Most drivers plying Routes 1, 2 and 3 have been driving for ≥10 years, 4-6 years and 7-9 years, respectively. Confidence of driving increases with experience or number of years driven on the road (Niazi, 2016). Driving experience and familiarity with a particular route can help to reduce road accidents if all safety standards are adhered to and the elements of weather are favourable. In this study, a statistically notable correlation was found between driving experience and road accidents. Zhang (2014) established that the bulk of the truck-related crashes and fatality for mine workers occurred within the driver's first five years of working within their current job which presupposes that accident reduces with more experience on the job or that inexperience on the job leads to more accidents.

The objects the drivers collided with in accidents included road barrier, lorry, animal, tree and traffic officer in order of frequency. Anebonam *et al*. (2019) opined that obstruction on the road do lead to accidents in Nigeria. According to Ndikom (2008), excessive checkpoints by security, monitoring and revenue collecting officials as well as road blocks and diversion are contributing factors to road accidents in Nigeria.

The maximum speed limit stipulated for vehicles is 60 KPH (FRSC, 2010). Preponderance of the drivers were driving above the stipulated limit at the time of accident. Speed limit violation on highways is much more than within the city for all categories of vehicles because of drivers' perception of low risk.

Majority of the trailer accidents on all three routes involved front collision. The back, left and right parts of the vehicle were not frequently involved. Niazi, (2016) likewise stated that front of vehicles was the major part involved in collisions. According to Blower and Woodrooffe (2012), some of the commonest types of trailer accidents include rear end, sideswipes, lane departures, crossing-path collisions, pedestrian involved accidents, vehicle rollover, head-on collision, single trailer accidents and under-run accidents.

This study established that majority of the accidents happened during the weekends while Monday recorded the least. FRSC (2010) report made evident that the highest accidents involving trailers were recorded on Saturday, with Friday also following closely and Sunday was second to the last before Monday on days with the least accident rate. It could be that because weekend often experience lower traffics, the drivers are tempted to exceed the stipulated speed limit as they consider the road less congested with an erroneous perception of lower risk of accidents. Blower and Woodrooffe (2012) affirmed that truck drivers plying the highway are more prone to drive at high speed for cities with less congested highways. Niazi, (2016) reported Friday as day with most accidents and Sunday with the uttermost.

The causes of road accidents in a decreasing order of frequency were found to be bad road, vehicle-related conditions, bad weather, high speed, people on the road, no traffic sign, overloaded vehicle, low experience and animal on road. Ndikom (2008) explained that abundant potholes, bad curves and failed portions of roads on Nigerian highways make accidents rampant. Jamal *et al*. (2020) reported that sudden lane change was the utmost cause of highway crashes in Saudi Arabia. Farah (2016) similarly reported that trailer accidents in Nigeria were caused by bad roads, over speeding and wrong overtaking by drivers plus barriers on the highways. The present study showed that no statistical notable difference exists between the route plied and road accidents. This may be due to the fact that all three routes have bad roads.

The commonest reported vehicle related problem was tyre burst. Defective brake, headlight, overload and machine fault were also blamed. Anebonam *et al*. (2019) listed brake malfunction and tyre rupture as reasons for accidents on roads in Anambra State. As reported by Niazi (2016), brake failure accounted for majority of road accidents. Ndikom (2008) affirmed that mechanical malfunction and vehicular faults either due to age or deficit in maintenance are reasons vehicles are prone to wreckage in Nigeria. FRSC (2010) report consistently listed brake malfunction and tyre burst/violation among the vehicular faults leading to trailer wreckage on Nigerian roads. For Ipingbemi (2008), road crashes in Nigeria can be averted via measures which should include providing subsidies for motor tyres, which would discourage drivers from buying second tier and refurbished tyres which have been contributing to road accidents in Nigeria.

Majority of the drivers surveyed reported the conditions of the road at points of accidents as broken. Agbonkhese *et al*. (2013) reported that road condition is a contributing factor for road crashes in Nigeria, particularly when the design is poor and it is poorly maintained, and also blamed environmental factors such as sunlight, rain and fog.

The FRSC listed the Lokoja-Okene road, Onitsha-Enugu, Benin-Agbor among the hot spots of trailer crashes in Nigeria between 2007 and 2010 (FRSC, 2010). The same report revealed that human error in form of dangerous driving accounted for most crashes involving heavy-duty trucks in the years under review. Akpoghomeh (2012) put the figure at 73%, of which traffic violation, reckless driving and failure in control, accounted for 60%. Badejo (2011) opined that the extant traffic laws are antiquated and should be amended and the FRSC be made more functional through more funding and training, to reduce the accidents and loss of lives and properties on Nigerian roads. The present study revealed environmental factor, bad road in particular, vehicle-related problems most especially tyre rupture and brake failure, and human error in form of dangerous driving as the causes of most crashes involving Dangote cement truck.

4. Conclusion

This study surveyed Dangote cement truck drivers supplying cement to Rivers State from Obajana Cement Plant using either Obajana-Lokoja-Ewu-Esan-Agbor-Onitsha/Owerri Express-Port Harcourt designated as Route 1, Obajana-Lokoja-Ajaokuta-Itobe-Ankpa-Enugu Express-Port Harcourt as Route 2, and Obajan-Lokoja-Okene-Benin-Warri-Via East-West Road-Port Harcourt as Route 3. Environmental factor particularly bad road, vehicle-related problems most especially tyre rupture and brake failure, and human error in form of dangerous driving were identified as the leading causes of accidents involving Dangote cement trucks along these routes. The study showed no notable nexus between ages, level of education, routes travelled and road accident. However, a statistical notable correlation was found between driving experience and road accident.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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