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Impact of Flooding on Wheel Shafts and Wheel Bearings in Abraka, and Way Forward

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Abstract

This study aimed at examining the impact of flooding on wheel-bearings and wheel-shaft in Abraka. The empirical and survey research designs were employed for the study. 42 checklists were dropped at the various mechanic workshops to collect data on the number of wheel-shaft and wheel-bearing changed weekly for five years and flood depths were measured for a period of five years. The simple linear regression was employed for data analysis. Findings include that: when the flood depth is at 0.10 feet in January the number of wheel-shaft and wheel-bearings changed is 396 and 220 pcs respectively. When flood depth is at 4.57 feet in August 3749 shafts and 1451 bearings were changed respectively. The regressions analysis showed that the relationship between wheel-shaft and flooding was r = 0.64, and the model was significant at p (0.00) < 0.05. Similarly, regressions analysis showed that the relationship between wheel-bearing and flooding was r = 0.62, and the model was significant at p (0.00) < 0.05. It therefore follows that impairment of wheel-shaft and wheel-bearing significantly depends on flooding events in Abraka. The following recommendations were made: construction of street side channels to drain of flood from the streets; checking the shafts and wheels hubs at regular intervals and re-grease when necessary etc.

Keywords

Abraka, Impacts, Flood, Wheel-Shaft, Wheel-Bearing

1. Introduction

Flooding is one of the major environmental problems that man is confronted with today. Recent studies have shown that apart from the problem of climate change, other factors accountable for flooding in the environment

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include, poor planning, poor drainage system, poor sanitation, topography, surface soil characteristics, etc. [1]. Incidence of flooding in the past and recent times has meant a lot of plague or even death for people both in the developed and the developing world. For this reason researchers have conducted several studies [2]-[13] to show both the impacts of and remedy to flooding; yet, the attitude of the citizenry, especially those in the developing countries such as Nigeria is not environmentally sustainable. This is because they still dump refuse on water channels [14], build houses on water ways [15], and lack the basic information on how to manage/mitigate flood hazards [1] [2] [16].

Another implication of flooding is its ability to destroy properties [17]; and [18] asserted that flooding impacts on transportation industry is at an alarming rate. This is not only because flooding does affect income for the industry, time of travel, inflate cost of travelling; but also because it affects the lower parts of a vehicle. The implication of this is that the number of times a vehicle is to visit the mechanic workshop is increased and consequently the cost of maintenance of such vehicles [19].

In Abraka region, environmental planning is at a crisis point. Houses are built without recognizance of the basic urban planning principles. Furthermore, the area plays host to the delta state university, which in turn pulls in a huge population all year round. The majority of these pulled in population do not have any good sanitary system that will help manage the waste they generate. They thus put their refuse along water ways [20], consequently leading to flooding. Again, there are very few inter connected street side water channels in the area and when it rains, runoff therefore accumulates and flooding is formed. Other factors that lead to flooding in the area include building along water ways, failure to clear debris from existing channels etc.

The fact is that once flood develops, vehicles become vulnerable. This is because, underneath the vehicle is the home of shafts and wheel bearings, as the vehicles pass through these floods some water penetrates the shaft hose and wheel hub (where the wheel bearing is housed) and wash off the grease in there. Once the grease is washed off, friction within the bearings is increase and this leads to impairment of the wheel bearings and shafts. In a similar development when refuse is dumped on flooded areas, sharp objects pierce shaft hose and allow water to penetrate. This washes off the grease and leads to friction and the consequent damage of wheel shafts and bearings. Furthermore, when it is flooded, debris that has been eroded from upland is deposited in the flood water. As the vehicles wheel through them some of the debris (sand) finds their way into the wheel hub and wheel shafts of vehicles and consequently leads to damage of the wheel bearings and wheel shafts.

However, studies on flooding in the area and elsewhere have centred on flood impacts on lives and the environment [13] [21]-[25]; review of the consequences of flooding [12] [26]-[28]; and impacts of flooding on destruction of properties [10] [29]-[33]. This current study is poised to look at impacts of flooding on vehicle wheel shafts and bearings in Abraka.

2. Materials and Methods

Abraka lies between latitudes 5˚46' and 5˚48' North of the equator and longitudes 6˚05' and 6˚08' East of the Greenwich Meridian. It is bounded to the East by Ukwani LGA, to the West by Edo State, to the North by River Ethiope, while to the South by Ugheli North LGA. Abraka has a total land area of about 168.4 km square [34] (see **Figure 1**). The area is located on the tropical belt as designated by the [35] and [36]. Weather in the area is influenced by two air-masses (tropical maritime mT and the topical continental cT) and the presence of the Ethiope River. Average temperature in the area is 32˚C and rainfall ranges from 25.4 mm in January to 457.2 mm in July [37]. This buoyant rainfall amounts in the presence of poor drainage exacerbates the flooding problem in the area.

Abraka population is projected to be 25,123 [38], this is outside the student population. The economic activities of people in Abraka include farming, trading, transportation etc. They engage mainly in cassava farming and palm nut collection for palm oil production and making of soup. Abraka is also a university town that progressed from being a College of Education to Delta State University in 1991, with numerous primary and secondary schools. Because of the university, employment such as teaching, banking, postal service, trading and office works are available in the area. There are a host of other businesses which include computer centre, photography, laundry, hostel (student's accommodation) and housing (for lecturers and other people who can afford it). It has also brought information technology business, and internet browsing, e-mail etc, these thus pulls people into the area. Well sanitation is poor in the area and there are poor drainages too, all of these exacerbate flooding in the area.

In terms of methods of study, the study adopted the survey and the empirical research designs. The population for the study includes 42 mechanics (auto-mobile repairers). 42 mechanics are chosen because that makes up the

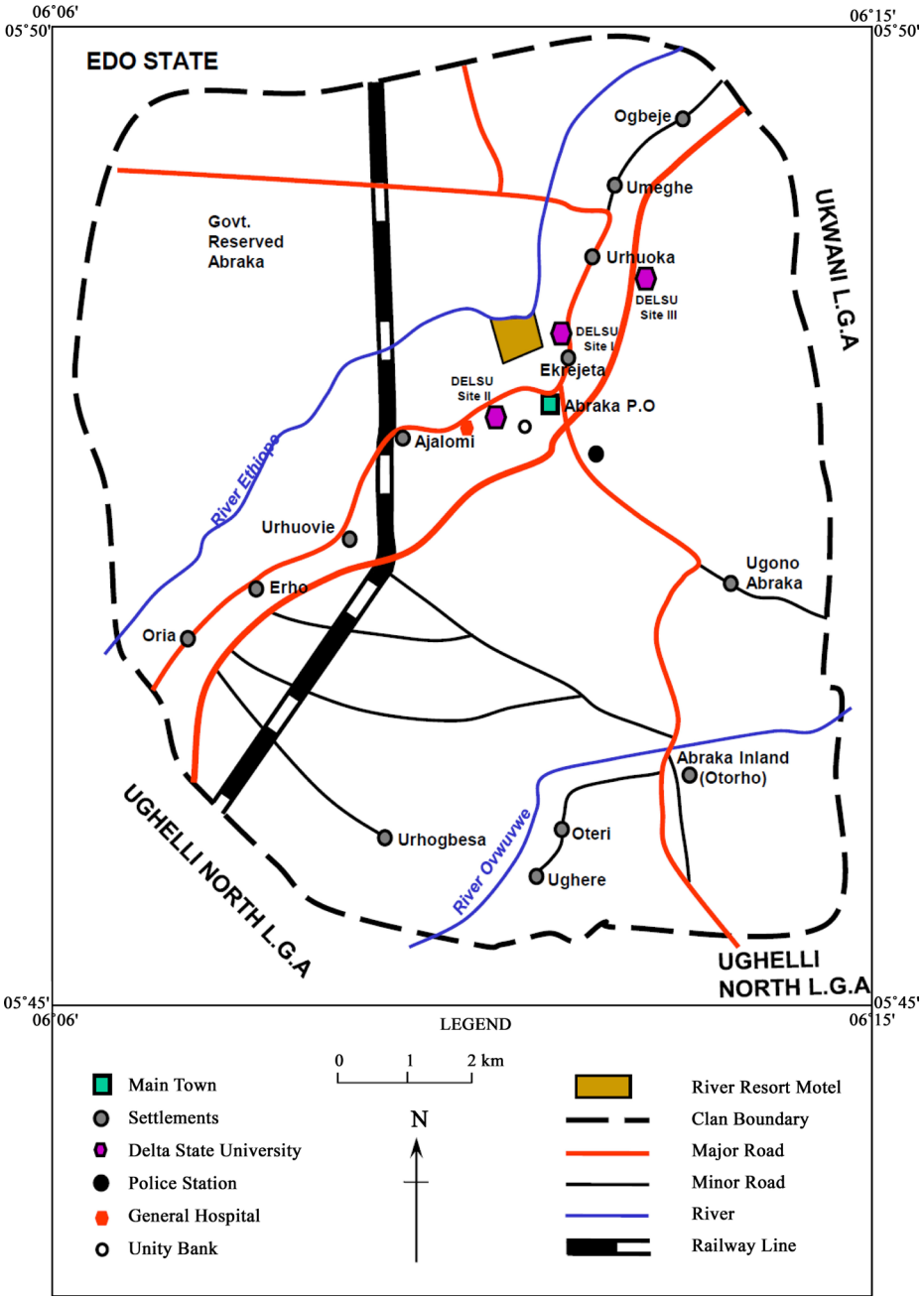

Figure 1. Map of Abraka showing study area.

total population of the mechanics in the study area. After identifying the population, 42 copies of check list were distributed to the mechanics to generate the number of wheel shaft and bearings changed weekly, and for a period of five years. Similarly, to be able measure flood inundations in the area, the area was first stratified into 5 zones using population densities (see **Table 1**). After stratification, calibrated dip stick (measuring ruler), and measuring tape were used for measuring flood depth for a period of five years. This was done to help the researchers establish the occurrence and patterns of flooding in the area. After measuring, the mean monthly flood depths were computed so that the patterns of flooding in the area could be established. This was thereafter compared with the numbers of wheel shaft and bearings changed within the period of measurements.

However, to be able to establish the level of dependence of wheel shaft and wheel bearing on flooding in the area, the simple linear regressions was adopted. This was done in the SPSS version 22 package environment.

3. Results and Discussion

In Table 2, the number of wheel bearings and wheel shafts changed as they correspond to flood depths is shown. In January, when average flood depth is 0.1 ft average number of wheel bearing and wheel shafts changed are 220 and 399.6 respectively. However, when flooding hit its peak (4.57 ft) in the month of august, number of wheel bearings and wheel shafts changed are 1451 and 3749 respectively. From that point wheel shafts and bearings changed continues to move in sympathy with flood depths (see Figures 2-4). Finally in December, while flood depths is at 2.04 ft, average wheel bearing and wheel shaft changed are 178.6 and 2248.4 respectively. It therefore shows that there is a link between flood depths and wheel shafts and bearing damage. However to be able to show the statistical significance of this dependence see Table 3 and Table 4.

In Table 3 the regressions model for wheel-shaft and flood depths is displayed. From the table there exist a

Table 1. The stratified zones used for the study.

Zones	Name of quarter
A	Police station RD
B	Monkey joint
C	Ekrejeta, Bembo, Urhuoka
D	Site 1, 2, 3.
E	General hospital area and Abraka rural

Source: modified after [39].

Table 2. Mean flood depth and the wheel shafts and bearings changed.

Months	Wheel-bearing	Wheel-shaft	Flood-depth
January	220	399.6	0.10028
February	283.25	525	1.625
March	236	2353.2	2.23
April	579	2802	2.125
May	1011.2	1475.2	2.59
June	1099.5	2116.5	3.5
July	897	3229.5	3.85
August	1451	3749	4.5725
September	1701	2418.75	3.67
October	1526.75	3601.5	3.7
November	522.75	3687.5	3.725
December	178.6	2248.4	2.04
Mean	808.8375	2383.846	2.810648

Source: Authors field work.

Table 3. Regressions output for wheel-shaft and flood-depth.

Model summary									
Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				
					R square change	F change	df1	df2	Sig. F change
1	0.644[a]	0.415	0.403	1203.33512	0.415	35.439	1	50	0.000

[a]Predictors: (Constant), flood depth.

Table 4. Regressions output for flood-depth and wheel-bearing.

Model summary									
Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				
					R square change	F change	df1	df2	Sig. F change
1	0.620[a]	0.385	0.372	474.78961	0.385	31.251	1	50	0.000

[a]Predictors: (Constant), flood-depth.

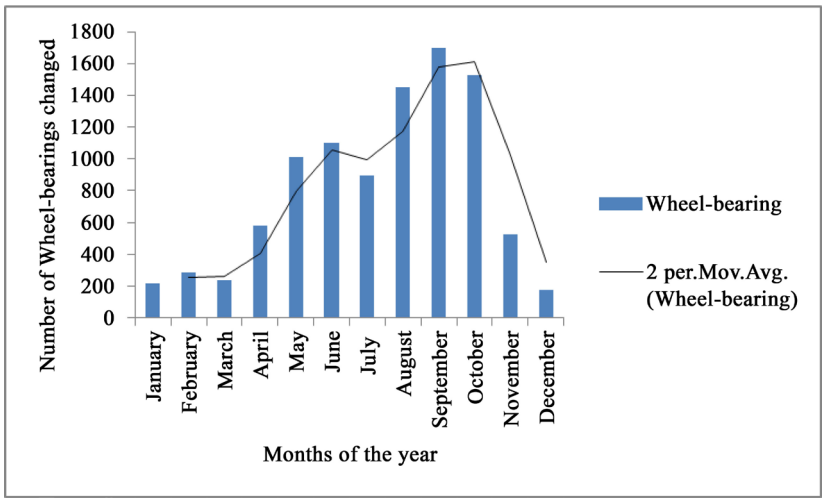

Figure 2. Monthly variation in wheel shafts impairment in Abraka.

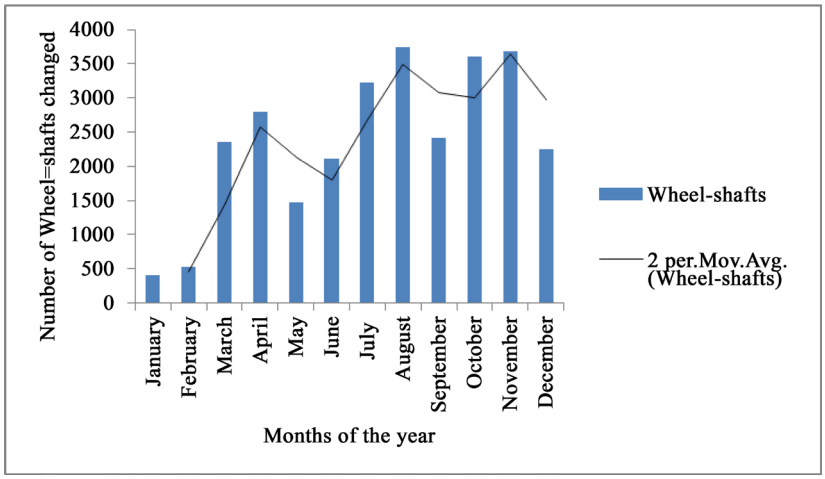

Figure 3. Monthly variation in wheel bearings impairment in Abraka.

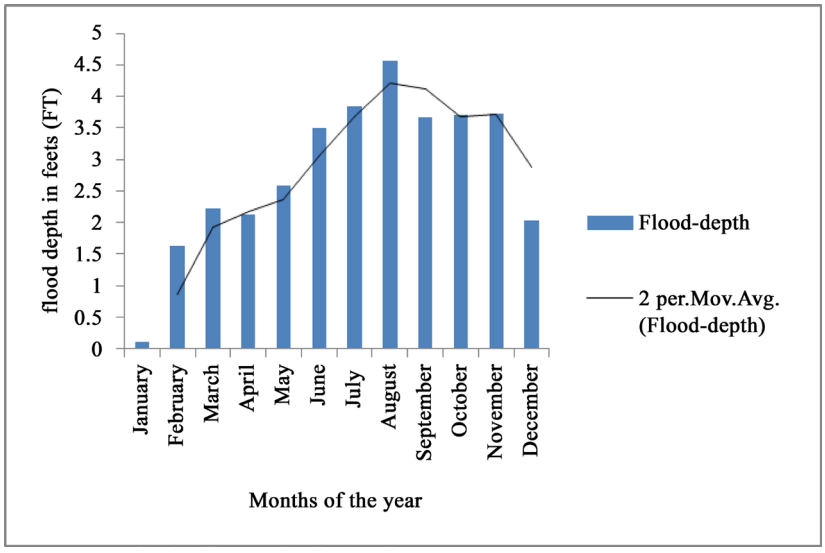

Figure 4. Monthly variation in flood depths in Abraka.

strong positive correlation (r = 0.64) between flooding and number of wheel shafts changed in the five years period. However, flooding could only explain 41.5% of wheel shafts changed, while the other 58.5% of wheel shafts changed could be explained by bad roads, inexperienced driving, rainfall, inferior shafts etc. Furthermore, the model is significant at p (0.00) < 0.05. This shows that wheel-shaft damage in the area is significantly dependent on flooding.

In **Table 4** the regressions model for wheel-bearing and flood depths is displayed. From the table there exist a strong positive correlation (r = 0.62) between flooding and number of wheel bearings changed in the five years period. However, flooding could only explain 38.5% of wheel bearing changed, while the other 61.5% of wheel bearings changed could be explained by bad roads, inexperienced driving, rainfall, inferior bearings, weather parameters such as rainfall and temperature [19] etc. Furthermore, the model is significant at p (0.00) < 0.05. This shows that wheel-bearing damage in the area is significantly dependent on flooding.

4. Conclusion and Recommendations

This study has shown that flooding events occur in Abraka, and that the phenomenon has significant effects on vehicles by affecting the wheel shafts and wheel bearing. Furthermore, it was also made lucid that as flooding increases so does wheel shafts and bearings damage. It therefore follows that there is an urgent need to suggest short and long term strategies that will reduce the incidence of wheel bearings and wheel shafts damage in the area, hence the following recommendations:

1) Car owners should try to check their wheel shafts and wheels hubs at regular intervals and re-grease when necessary. This is because grease helps to lubricate metals and increase their life span. Similarly, shaft hose and wheel oil seal should be replaced immediately they go bad. As it has been proven by [19] that such quick replacements help to maintain wheel shafts and hubs, so that the grease content in them is sustained.

2) As a short term plan, each zone in the area should build a central cars park that will accommodate cars that are owned by people who live in the zone. Such car park shall be built by the inhabitants of the area, and little monthly fee of 500 naira shall be paid. This fee shall be used to both maintain the park and pay security men that shall be employed to guard such parks. This will help reduce the driving of cars along routes that are flooded in the area.

3) This above should be followed by the construction of street side channels to drain off flood from the streets. This can be done through a collaborative effort from both the government and individuals.

4) Waste management should be improved on, in the area. This will help curb the incidence of sharp objects tearing or puncturing shaft hose in the area. Similarly, waste management will help reduce the incidence of waste blocking the existing channels and subsequently reduce flooding problem along he routes of Abraka.

5) Nigeria should present a standard that specifies the type of cars that can be imported in the country by car manufacturing companies. This standard should include protecting beneath the car from water so that paraphernalia such as shafts and hub can be better protected from water.

Finally, flooding is found in this study to have impact on the shafts and wheel bearings of cars. This has impact on the finance of car owners in the area. Way forward from this problem of impacts of flooding on vehicles in Abraka is application of the recommendations listed above.

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