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Evaluating the Causes of the Road Failure of Onitsha-Enugu Expressway, Southeastern Nigeria.

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ABSTRACT
Considering the persistence of road failure along the Onitsha -Enugu expressway and many other roads in the southeastern Nigeria, this work was conceived with the aim of evaluating the causes of the road failure in other to help marshal out effective and efficient measures of tackling this problem of road failure. The study adopted a survey design which employed the use of a well structured questionnaire to gather information on the causes and effects of the road failure. To determine the sample size, volumetric analysis was used and the data so generated was analyzed using One-way Analysis of Variance and Post HOC test. The ANOVA shows the variation among the causes is not significantly different while the Post HOC test ranked the causative factors treated. The work thus concluded that all the factors listed contribute to the failure of the road with inadequate maintenance, mismanagement by the government and old age of the road pavement being the major factors. The work therefore recommends that there should be Quality Determination for materials during construction, Effective Maintenance Programme (routine or preventive maintenance, periodic maintenance, and disaster maintenance or major repairs of our roads) and Establishment of an Active Maintenance Crew.

INTRODUCTION
Background to the Study
A road pavement is supposed to be a continuous stretch of asphalt lay for a smooth ride or drive. Visible cracks, potholes, bulges and depressions may punctuate such smooth ride. The punctuation in smooth ride is generally regarded as road failure. Road Failure could be defined as a discontinuity in a road pavement resulting in cracks, potholes, bulges and depressions (Aigbedion 2007). According to FMW&H (1992), failed roads are characterized by potholes, polishing / pavement surface wash, block and longitudinal cracks, drainage collapse, depressions / sinking of roadway, over flooding of the carriageway, gullies and trenches, rutting and raveling all of which are evident along the Onitsha -Enugu expressway under study confirming it's failure.
Field observations and laboratory experiments carried out by Adegoke–Anthony and Agada (1980), Mesida (1981), and Ajayi (1987) showed that road failures can arise from inadequate knowledge of the geotechnical characteristics and behavior of residual soils on which the roads are built and non-recognition of the influence of geology and geomorphology during the design and construction phases. Thus the treatment of troublesome materials like clays are not been considered by the construction engineers which may be problematic. This was also supported by the works of Gidigasu (1983), Graham and Shields (1984), Akpokodje (1986), Alexander and Maxwell (1996), Jegede (1997), Gupta and Gupta (2003) and Ajani (2006).
Momoh et al (2008) and Adiat et al (2009) in their study of failed highway pavements using geophysical methods, found that some geological factors influence road failure such as the near surface geologic sequence, existence of geological structures like fractures and faults, presence of laterites, existence of ancient stream channels, and shear zones. The collapse of concealed subsurface geological structures and other zones of weakness controlled by regional fractures and joint systems along with silica leaching which has led to rock deficiency are known to contribute to failures of highways and rail tracks (Nelson and Haigh, 1990). The geomorphological factors are related to topography and surface/subsurface drainage system.
Other factors considered by some researchers and scholars include: Faulty Design and Poor Road Construction as in the works of Paul and Radnor (1976), Abynayaka (1977), World Bank (1991), UNESCO (1991), FMWH (1995), Jain and Kumar (1998)**;** Poor Maintenance according to John and Gordon (1976), Oglesby and Garry (1978), TRRL (1991); and Traffic Effects and Human Impacts on the Roads according to AASHTO (1976), ANSMWH (1998), FMWH (1995) and Ibrahim (2011).
A typical example of road whose failure bugs the mind of regular users is Enugu-Onitsha Express Road. Almost every section of the road has failed, resulting to the following:

- Loss of lives and properties, human injuries etc. through accidents.
- Retardation of the rate of economic growth and development in affected areas.
- Environmental pollution and degradation.
- Impedance of human movement and the flow of economic activities.
- Encourages armed robbery along affected areas.

Having established that many factors are responsible for road failures, it becomes necessary to ascertain the specific factors causing the road failure or the more pressing factors behind the failure of the road as this will make it easy to strategize the solutions for solving the problem of road failure.

AIM AND OBJECTIVES

The aim of this work is to evaluate the causes of the road failure of Onitsha-Enugu expressway. To achieve this aim the following objectives will be pursued:

1. to sample the road users and construction engineers in order to gather their opinion on the prevalent causes of the road failure,
2. to analyze the opinion of the road users and the construction engineers so collected the significant causes of the road failure and
3. to suggest some solutions for the mitigation of road failure and the associated effects.

DESCRIPTION OF THE STUDY AREA

The Onitsha-Enugu Expressway under study is situated within longitude 6°45ˡE to 7°30ˡE and latitude 6°00ˡN to 6°30ˡN. For clarity of the location, see Fig.1 (the Map of Nigeria showing the study area) and Fig. 2 (Extract Modified by Author from Map of Old Anambra State Showing the Road Under Study).

Fig. 1.1: Map of Nigeria Showing the Study Area.
(Source: http://www.ngex.com/nigeria/places/states/enugu.htm).

Geology

The Onitsha/Enugu Expressway is sitting on Anambra basin of the Southeastern Nigeria it cuts across the following geologic formations:

Ameki Formation (Nanka Sand, Umunya Shale and other units), Imo Shale, Nsukka Formation, Ajalli Sandstone, Mamu Formation and Nkporo/Enugu Shale (which underlies Mamu Formation and is gradationally seen immediately after the New market Flyover in Enugu).

RESEARCH METHODOLOGY

The study adopted a survey design which employed the use of a well structured questionnaire to gather information on the causes of the road failure and impacts of the road failure on the road users. This in turn was collated into data which was analyzed using some statistical tools. The questionnaire was structured into three sections, (Sections A, B and C). Section A was geared towards ascertaining information on personal data which

provides the background information to determine whether the respondents can offer reliable information necessary for the study. It comprises questions on age, sex, educational attainment, nationality and occupation. Section B was hinged on how long the respondent has been using the road and through which means. Section C is the main target of the questionnaire survey treating issues on the impact of the road failure on health of the road users and economy of the area.

To determine the sample size for the questionnaire distributed, the population of the road users must be ascertained, and to this effect, a target population of users passing through the failure points was sought. To determine the number of users passing through at least a point of failure on the road, a volumetric analysis of the vehicles and other automobiles using the road was conducted. After a field observation, it was noticed that some variations exists which include:

- Variation in volume of traffic at the 3 major cities cut across by the road (Enugu, Awka and Onitsha)
- Variation in the volume of traffic at different times of the day (like in the morning hours, afternoon and evening hours) having the peak periods at mornings and evenings for Mondays to Fridays and afternoon and evenings on Saturdays.
- Variation in volume of traffic across the week days.
- At nights especially from 10:30pm till 4.30am the traffic volume tends to zero.

In order to accommodate these variations the volumetric analysis was done in form of automobile count for 3 months in the three major cities cut across by the roadway at Omagba Geust Hall near Borromew Round about in Onitsha, At ABS bus-stop near Aroma junction in Awka and at Ekochin Bus-stop near Ninth Mile Flyover in Enugu. Each month lasted for 7 days running through the 7days of the week from Monday to Sunday at the different cities selected, 7 days in each city that is 21 days in all.

Due to the difficulty in the counting of the first 2 days, and to ensure accuracy, the video camera method was adopted. Here a video camera was mounted at a stationary point focusing the roadway and after like two hours, based on the capacity of the camera, it will be withdrawn and the counting done in a more relaxed state at home. This way, every automobile that passed the point of focus within the coverage time was covered not minding its speed. Also two hours was taken in the morning, afternoon and evening respectively for the counting to accommodate the volume variations within the different hours of the day. After the whole analysis, and calculations the result is as below:

- ❖ Population passing through at least one point of failure for the whole 21 days = 2,268, 840 persons
- ❖ Population passing through at least a failure point on the road per day = 108, 048 persons for 24 hrs.
- ❖ Population passing through at least a failure point on the roadway per hour = 4, 502

According to Nwanna (1981) If the population is a few hundreds, a 40% sample will do, if many hundreds, a 20% sample will do, if a few thousand, a 10% sample will do, for several thousands, 5% sample, if up to hundred thousand or more, 0.5% or 0.25% can do, it can be fewer considering the circumstances surrounding the research and the nature of the population (homogeneous or heterogeneous).

Thus considering the size of the population, a 0.25% sample was adopted. The 0.25% of the total population passing through at least a point of failure on the roadway per day was calculated (0.25% of 108, 048) to be 270.12. Thus 270 questionnaires were distributed to people to source for information on the subject matter at locations where the proper respondents could be found considering the fact that they cannot fill it while the vehicle are moving. For the purpose of increasing the reliability of the respondents and authenticity of data, due to the inability of the researcher to reach out to the road users or access them while the vehicle is moving, the opinion pool was conducted at the Enugu-Awka motor parks at Onitsha, Enugu-Onitsha motor parks at Awka, and Awka-Onitsha motor parks at Enugu, the purpose being to capture the actual road users for respondents.

RESULTS AND DISCUSSION

Presentation, Analyses and Discussion of Questionnaire Data

Before the questionnaire was adopted as an authentic and reliable tool for data generation, a reliability test was done as follows:

Reliability Test and Item Analysis Using Likert Scale Analysis by Coding

Table 1: Case Processing Summary

		N	%
Cases	Valid	270	100.0
	Excluded	0	.0
	Total	270	100.0

Source: Author's Field Work (2012).

Table 1 shows the number of respondents used for the field survey which is 270 persons/respondents. None of the respondents was excluded in the analysis.

Table 2: Reliability Statistics Table

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.993	.993	30

Table 2 shows the reliability of the research tool which could be interpreted thus, a value less than 0.6 implies weak tool and value more than 0.6 is an indication of strong and reliable research tool. In this research, the value of Cronbach's Alpha is 0.993 which implies the tool is reliable and can be used for research purpose. The last column of table 4.4 shows the number of questions used in the field survey tool, questionnaire.

Table 3: Item Statistics

	Mean	Std. Deviation	N	Decision
Q6	2.8519	.50305	270	
Q7	4.7815	1.34980	270	
Q8	3.5630	1.36666	270	
Q9	2.2667	.62417	270	
Q10	3.2667	1.06446	270	
Q11a	2.4556	1.25394	270	Agree
Q11b	2.6593	1.38050	270	Agree
Q11c	2.6000	1.32013	270	Agree
Q11d	2.2741	1.41121	270	Agree
Q11e	2.3593	1.34986	270	Agree
Q11f	2.5407	1.37294	270	Agree
Q11g	2.3000	1.27996	270	Agree
Q12a	2.2370	1.30886	270	Agree
Q12b	2.4741	1.42380	270	Agree
Q13a	2.4667	1.41579	270	Agree
Q13b	2.2741	1.26096	270	Agree
Q13c	2.4963	1.28690	270	Agree
Q14a	2.2333	1.17644	270	Agree
Q14b	3.0889	1.25231	270	Agree
Q14c	2.4852	1.42917	270	Agree
Q15a	2.2111	1.32037	270	Agree
Q15b	2.3259	1.18748	270	Agree
Q16a	1.9444	1.25275	270	Agree
Q16b	1.5963	.91456	270	Agree
Q16c	1.8259	1.26259	270	Agree
Q16d	1.9667	1.19276	270	Agree
Q17a	2.5963	1.47972	270	Agree
Q17b	3.1370	1.25832	270	Disagree
Q17c	3.7889	1.21479	270	Disagree
Q17d	3.2556	1.57509	270	Disagree

Source: Generated from Statistical Analysis of Authors Fieldwork Data.

Table 3 shows the mean response of each question in the questionnaire. Based on the coding values used, the last column shows the decision for each question to be either agree or disagree. The decision is disagree if the mean response is less than mean of the coding value and agree if the mean response is greater than mean of coding values.

Table 4: Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means (Grand Mean)	2.611	1.596	4.781	3.185	2.995	.415	30
Item Variances	1.610	.253	2.481	2.228	9.804	.222	30

Source: Generated from Statistical Analysis of Authors Fieldwork Data.

Table 5: Alternative Cronbach's Alpha if Item Deleted

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q6	75.4704	1180.406	.396	.991
Q7	73.5407	1120.911	.792	.991
Q8	74.7593	1111.589	.888	.992
Q9	76.0556	1157.042	.870	.991
Q10	75.0556	1138.737	.758	.992
Q11a	75.8667	1111.462	.973	.992
Q11b	75.6630	1107.258	.927	.992
Q11c	75.7222	1107.391	.970	.992
Q11d	76.0481	1103.533	.947	.992
Q11e	75.9630	1105.456	.970	.992
Q11f	75.7815	1104.127	.968	.992
Q11g	76.0222	1111.382	.953	.992
Q12a	76.0852	1109.149	.958	.992
Q12b	75.8481	1100.813	.969	.992
Q13a	75.8556	1101.299	.969	.992
Q13b	76.0481	1111.444	.967	.992
Q13c	75.8259	1109.074	.976	.992
Q14a	76.0889	1117.397	.961	.992
Q14b	75.2333	1112.291	.964	.992
Q14c	75.8370	1100.129	.972	.992
Q15a	76.1111	1110.389	.934	.992
Q15b	75.9963	1116.361	.965	.992
Q16a	76.3778	1119.864	.870	.992
Q16b	76.7259	1142.609	.823	.991
Q16c	76.4963	1119.091	.872	.992
Q16d	76.3556	1119.048	.926	.992
Q17a	75.7259	1097.181	.969	.992
Q17b	75.1852	1119.616	.869	.992
Q17c	74.5333	1129.135	.781	.991
Q17d	75.0667	1096.226	.917	.992

Source: Generated from Statistical Analysis of Authors Fieldwork Data.

Table 5 shows the value of Cronbach's Alpha if one of the items is deleted. In the table, none of the items has value greater than the computed Alpha value if deleted which implies all questions are significant in the research and the research tool is reliable for the research purpose.

Presentation of Questionnaire Data.

Table 6: Occupation of The Respondents

Occupation	Total Number
Civil Servants	56
Commercial Driver	52
Academicians	23
Students	101
Businessmen	26
Others	12

Source: Generated from Authors Fieldwork Data.

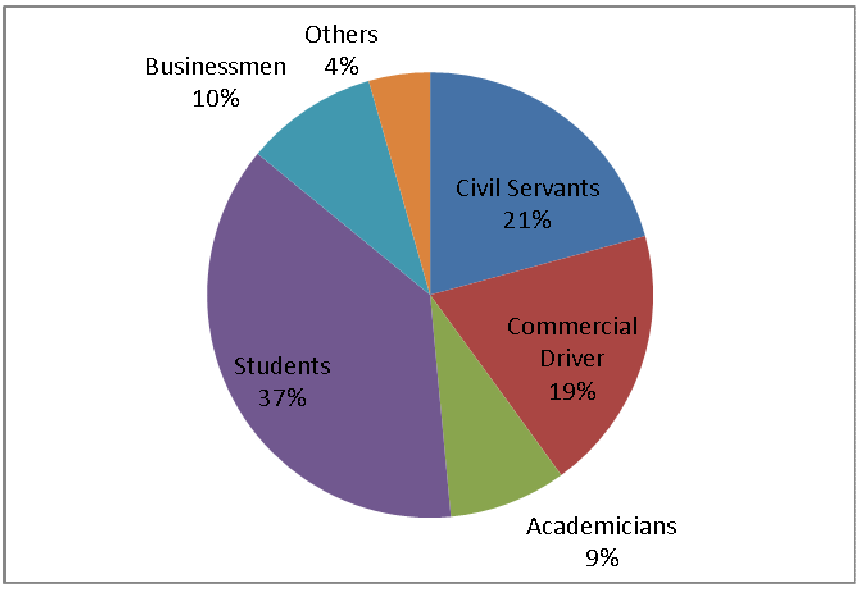

Figure 2: Pie Chart Showing Occupation of the Respondents in Percentages

In as much as we work very hard to design a questionnaire with questions that will help tackle the issue of the research, there is need to also have a sound quality and good quantity of respondents who will enhance the drive for authentic data towards accuracy. Figure 2 is a Pie Chart showing the occupation of the respondents as percentages of the total population of the respondents as recorded in Table 6. 37% of the respondents were students, 21% civil servants, 19% commercial drivers,110% businessmen, 9% academicians and 4% has their occupation not included in the list of occupations presented. The implication of this is that majority of the respondents will read the questions easily and understand it better considering that about 60% of the respondents are students, civil servants and academicians many of which have their own vehicles. Having a reasonable percentage of commercial drivers also adds to the reliability and authenticity of the data generated from the questionnaire this agrees with the reliability test done earlier.

Table 7: Educational Attainment of Respondents

Level of Education	Number Respondents
Primary	18
Secondary	72
Tertiary	175
None	5

SOURCE : Author's Fieldwork (2012)

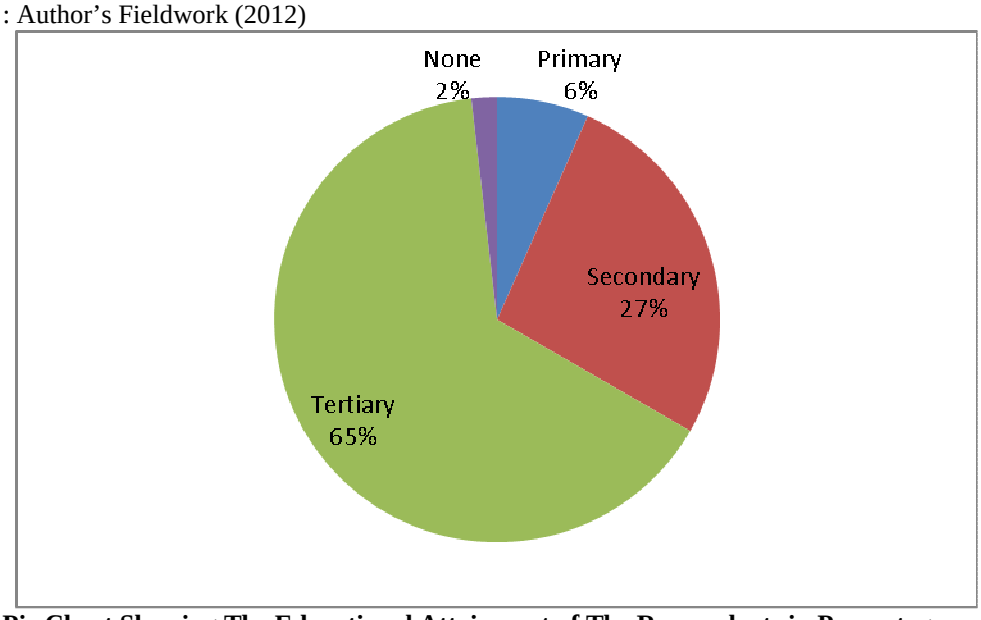

Figure 3: Pie Chart Showing The Educational Attainment of The Respondents in Percentages.

The level of education of the respondents is one of the key factors in determining the rationality of answers they will be able to give. Figure 3, is a percentage presentation of the information contained in Table 7. 65% of the respondents passed through the university, while 27% of the respondents passed through secondary school. Only about 6% were just primary school leavers while 2% of the respondents could not indicate there educational status. The implication of this is that the data generated from the questionnaire survey will be highly reliable considering the educational status of the respondents involved. That is the respondents will be able to read and understand the questions contained in the questionnaire and provide very rational answers which will be dependable for drawing conclusions and taking decisions on the subject matter this also agrees with the reliability test result earlier presented.

Table 8: Age of Respondents

Age	Percentage Response
18-24years	96
25-45years	84
46-64years	62
65years & Above	23

SOURCE : Author's Fieldwork (2012)

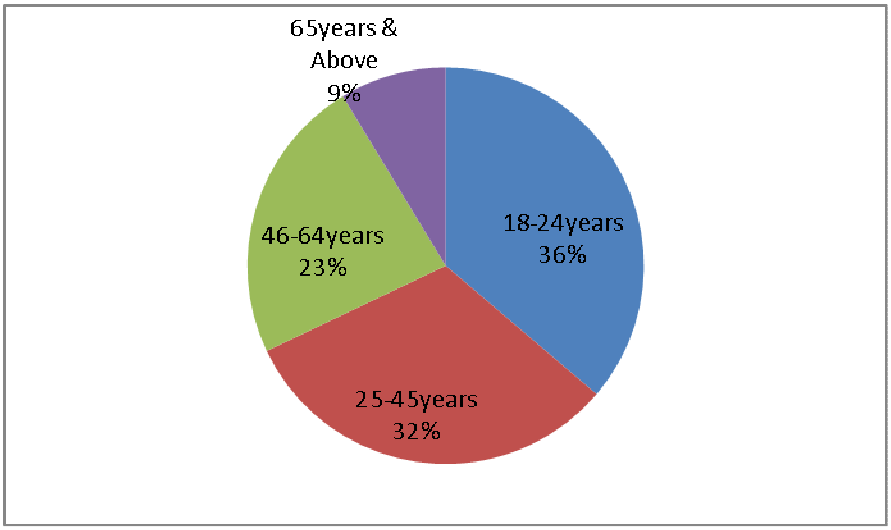

Figure 4: Pie Chart Showing the Age of Respondents in Percentages

Table 8 contain the age distribution of the respondents within certain specified age brackets. These age brackets of the respondents were arranged according to their percentages of the total population in Figure 4. 36% of the respondents fell within the age bracket of 18-24years, 32% fell into the age bracket of 25-45years, 23% are between 46-64years and only 9% were above 65years. Considering the earlier discussions about the educational status of the respondents, it is clear that many of the respondents are young graduates with about 68% been in the most active stage of their lives and over 80% falling into the age bracket of the Nigerian labour force (18-64years). The respondents by their ages are ripe / matured enough to reason the causes and effects (economic, health and environmental) of the road failure as contained in the questionnaire.

Table 9: Frequency of Road Usage by the Respondents

How Often	**Number Of Respondents**
Daily	86
2-4 Times A Day	121
Once A Week	23
Inconsistently	10
Periodically	18
None	12

Source : Author's Fieldwork (2012)

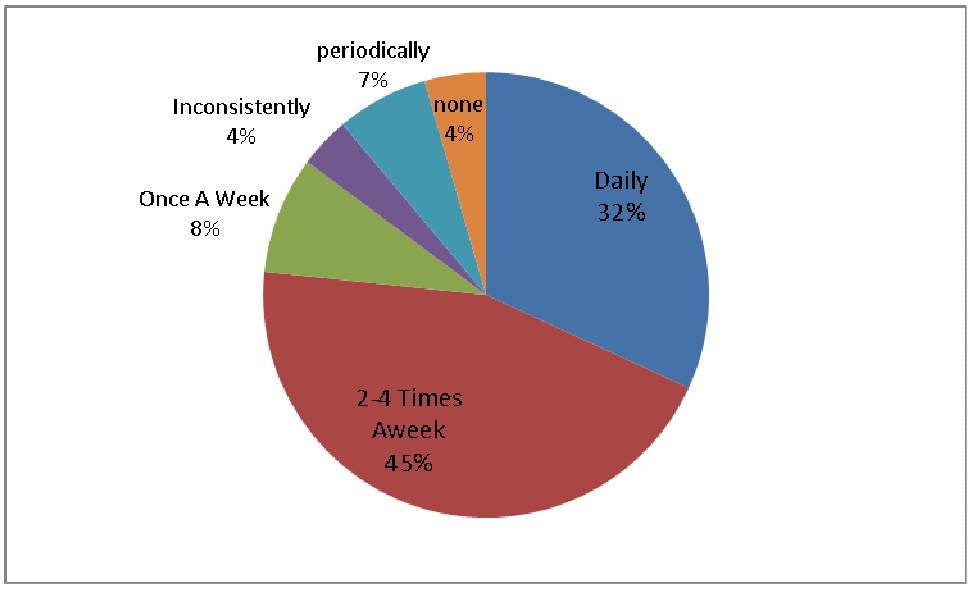

Figure 5: Pie Chart Showing Frequencies of the Road Usage by the Respondents in Percentages

The frequencies of road usage as recorded in Table 9 and presented in percentages in Figure 5, showed that 32% of the respondents use the road daily, 45% use the road 2-4 times a week, 8% use the road once a week, 7% use the road periodically, 4% use the road inconsistently while 4% did not indicate their degree of usage of the road. Seeing that over 80% use the road at least once a week, with about 50% of this fraction using it daily, it implies that the respondents must have enough knowledge of the road, its problems and the effects of the road failure, thus can make reasonable contributions. This is in accordance with the result of the reliability test and the description of figures 4.2 and 4.3.

Table 10: Rate of Repairs of Vehicles Plying the Route

How Often	Number of Respondents
Very Often	54
Not Regularly	20
Rarely	18

Source : Author's Fieldwork (2012)

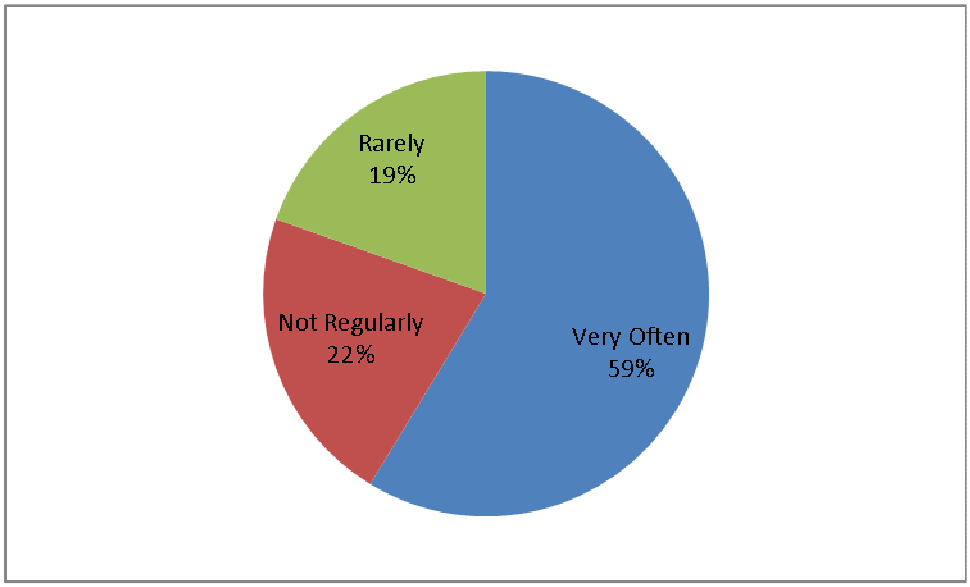

Figure 6: Pie Chart Showing the Rate of Repairs of Vehicles Plying the Route in Percentages

Table 10 shows the rate of vehicle repairs by vehicle owners. It should be noted that this question is optional thus out of a total number of 270 questionnaires received only 92 respondents reacted to this question and they to be the only vehicle owners or drivers using the road among the respondents. Figure 6 expressed the content of Table 10 In percentages from which it can be clearly seen that 59% of the drivers and vehicle owners who are respondents said that they repair their vehicles very often, 22% repairs their vehicles not regularly while only

19% said they rarely repair their vehicles what this implies is that most vehicles plying the route undergo regular repairs which goes to say that the bad nature of the road is negatively affecting the efficiency and serviceability of the vehicles using the road. Even the few persons that said they rarely repair their vehicles may likely be using the road rarely. This supports the responses given to questions 12a and 12b in the questionnaire as can be seen in Table 11 were most of the respondents agreed that the bad state of the road negatively affects the life span and efficiency of vehicles.

Table 11: Percentage Distribution of Number of Respondents with respect to their opinions for questions 11a to 17d

Issues Raised		SD		D		N		SA		A	
11a	Bad nature of the soil is a factor of the road failure	18	7%	45	17%	58	21%	70	26%	79	29%
11b	Poor construction materials is a factor of the road failure	14	5%	86	32%	62	23%	10	4%	98	36%
11c	Stress from heavy vehicles is a factor of the road failure	21	8%	58	21%	64	24%	46	17%	81	30%
11d	Old age of the road pavement is a factor of the road failure.	36	13%	28	10%	15	6%	86	32%	105	39%
11e	Incompetence of the contractors is a factor of the road failure.	22	8%	53	20%	20	7%	80	30%	95	35%
11f	Failure on the side of the government is a factor of the road failure.	29	11%	58	21%	18	7%	90	33%	75	28%
11g	Inadequate maintenance is a factor of the road failure.	18	7%	53	20%	6	2%	108	40%	85	31%
12a	The road failure affects the life span of the vehicles	22	8%	40	15%	18	7%	112	41%	78	29%
12b	The road failure affects the efficiency of the vehicles	28	10%	56	21%	31	11%	56	21%	99	35%
13a	The road failure affects cost of commodities negatively	40	15%	32	12%	26	10%	88	33%	84	31
13b	The road failure affects the quality of perishable goods	18	7%	41	15%	30	11%	89	33%	92	34%
13c	The road failure causes massive destruction of goods.	22	8%	50	19%	41	15%	76	28%	81	30%
14a	The bad nature of the road aggravates certain body illness	19	7%	19	7%	54	20%	92	34%	86	32%
14b	The bad nature of the road causes miscarriages	51	19%	40	15%	92	34%	56	21%	31	11%
14c	The bad nature of the road retards the movement of safety vehicles	41	15%	29	11%	39	14%	72	27%	89	33%
15a	The bad nature of the road increases dust particles in the air especially during dry seasons.	25	9%	39	15%	2	1%	106	39%	98	36%
15b	The bad nature of the road contaminates the air and increase the carbon dioxide content of the atmosphere due to burning of more fuel.	19	7%	24	9%	62	23%	86	32%	79	29%
16a	The bad nature of the road increases the rate of accidents.	25	9%	18	7%	0	0	101	37%	126	47%
16b	The bad nature of the road increases the loss of lives and properties	6	2%	14	5%	2	1%	91	34%	157	58%
16c	The bad nature of the road encourages robbery at bad spots	23	9%	13	5%	18	7%	56	21%	160	59%
16d	The bad nature of the road reduces travel comfort for road users.	17	6%	13	5%	46	17%	62	23%	132	49%
17a	The government is to be blamed for the road failure.	40	15%	49	18%	36	13%	52	19%	93	35%
17b	The contractors are to be blamed for the road failure.	18	7%	129	48%	46	17%	26	9%	51	19%
17c	The road users are to be blamed for the road failure.	69	26	150	55%	8	3%	11	4%	32	12%
17d	Everybody is to be blamed for the road failure.	81	30%	72	27%	14	5%	41	15%	62	23%

Source: Generated from Authors Fieldwork Data.

Table 11 represents the percentage response from the respondents on the questions contained in the section C of the questionnaire. SD stands for Strongly Disagreed, D for Disagreed, N for No Idea, SA for Strongly Agreed and A for Agreed. It should be noted that the percentage recorded for N (No Idea) is the sum of the respondents that did not indicate any answer for the question and those that selected N and the fractional percentages were rounded up to the nearest whole number. The different issues raised in the questionnaire were tested individually with befitting statistical tools using the questions that pertains them to generate data. The issues of interest includes; Economic Effects, Environmental Effects, Health Effects and Causes of the road failure.

Statistical Analyses

Test of Causes of Road Failure

Table 12: Grouping of Responses of Respondents on Causes of the Road Failure

Cause	Number of respondents agree and the %	Number of respondents disagree and the %	Decision
Bad nature of the soil	149 (70%)	63 (30%)	Agree
Poor material used	108 (52%)	100 (48)	Agree
Stress of heavy vehicles	127 (62%)	79 (38%)	Agree
Old age of the road pavement	191 (75%)	64 (25%)	Agree
Incompetence of the contractor	175 (70%)	75 (30%)	Agree
Mismanagement by the government	165 (65%)	87 (35%)	Agree
Inadequate maintenance	193 (73%)	71 (27%)	Agree

The decisions in Table 12 were based on the number of respondents that agreed to the problem as one of the causes of road failure. The values in brackets are percentages computed for each question without the number of respondents who were neutral to the questions. Higher percentage implies higher number of respondents in support of the question. To determine the significant causes of road failure among causes listed, One-way Analysis of Variance was used. The result is as shown below;

Hypothesis:

H_0: there is no significant difference in the classification/grading of causes of road failure by respondents.

H_1: there is significant difference in the classification/grading of causes of road failure by respondents.

Table 13: Descriptive Observation of Responses of Respondents on Causes of the Road Failure

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	2	106.0000	60.81118	43.00000	-440.3668	652.3668	63.00	149.00
2.00	2	104.0000	5.65685	4.00000	53.1752	154.8248	100.00	108.00
3.00	2	103.0000	33.94113	24.00000	-201.9489	407.9489	79.00	127.00
4.00	2	127.5000	89.80256	63.50000	-679.3440	934.3440	64.00	191.00
5.00	2	125.0000	70.71068	50.00000	-510.3102	760.3102	75.00	175.00
6.00	2	126.0000	55.15433	39.00000	-369.5420	621.5420	87.00	165.00
7.00	2	132.0000	86.26703	61.00000	-643.0785	907.0785	71.00	193.00
Total	14	117.6429	48.32360	12.91503	89.7416	145.5441	63.00	193.00

Table 14: Observation From Analysis Of Variance

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1926.714	6	321.119	.079	.997
Within Groups	28430.500	7	4061.500		
Total	30357.214	13			

The ANOVA shows the variation among the causes is not significantly different but the classification is as follows;

Multiple Comparisons

Table 15: Observation LSD for Causes of the Road Failure

(I) factor	(J) factor	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	2.00000	63.72990	.976	-148.6973	152.6973
	3.00	3.00000	63.72990	.964	-147.6973	153.6973
	4.00	-21.50000	63.72990	.746	-172.1973	129.1973
	5.00	-19.00000	63.72990	.774	-169.6973	131.6973
	6.00	-20.00000	63.72990	.763	-170.6973	130.6973
	7.00	-26.00000	63.72990	.695	-176.6973	124.6973
2.00	1.00	-2.00000	63.72990	.976	-152.6973	148.6973
	3.00	1.00000	63.72990	.988	-149.6973	151.6973
	4.00	-23.50000	63.72990	.723	-174.1973	127.1973
	5.00	-21.00000	63.72990	.751	-171.6973	129.6973
	6.00	-22.00000	63.72990	.740	-172.6973	128.6973
	7.00	-28.00000	63.72990	.674	-178.6973	122.6973
3.00	1.00	-3.00000	63.72990	.964	-153.6973	147.6973
	2.00	-1.00000	63.72990	.988	-151.6973	149.6973
	4.00	-24.50000	63.72990	.712	-175.1973	126.1973
	5.00	-22.00000	63.72990	.740	-172.6973	128.6973
	6.00	-23.00000	63.72990	.729	-173.6973	127.6973
	7.00	-29.00000	63.72990	.663	-179.6973	121.6973
4.00	1.00	21.50000	63.72990	.746	-129.1973	172.1973
	2.00	23.50000	63.72990	.723	-127.1973	174.1973
	3.00	24.50000	63.72990	.712	-126.1973	175.1973
	5.00	2.50000	63.72990	.970	-148.1973	153.1973
	6.00	1.50000	63.72990	.982	-149.1973	152.1973
	7.00	-4.50000	63.72990	.946	-155.1973	146.1973
5.00	1.00	19.00000	63.72990	.774	-131.6973	169.6973
	2.00	21.00000	63.72990	.751	-129.6973	171.6973
	3.00	22.00000	63.72990	.740	-128.6973	172.6973
	4.00	-2.50000	63.72990	.970	-153.1973	148.1973
	6.00	-1.00000	63.72990	.988	-151.6973	149.6973
	7.00	-7.00000	63.72990	.916	-157.6973	143.6973
6.00	1.00	20.00000	63.72990	.763	-130.6973	170.6973
	2.00	22.00000	63.72990	.740	-128.6973	172.6973
	3.00	23.00000	63.72990	.729	-127.6973	173.6973
	4.00	-1.50000	63.72990	.982	-152.1973	149.1973
	5.00	1.00000	63.72990	.988	-149.6973	151.6973
	7.00	-6.00000	63.72990	.928	-156.6973	144.6973
7.00	1.00	26.00000	63.72990	.695	-124.6973	176.6973
	2.00	28.00000	63.72990	.674	-122.6973	178.6973
	3.00	29.00000	63.72990	.663	-121.6973	179.6973
	4.00	4.50000	63.72990	.946	-146.1973	155.1973
	5.00	7.00000	63.72990	.916	-143.6973	157.6973
	6.00	6.00000	63.72990	.928	-144.6973	156.6973

Source: Generated from Statistical Analysis of Authors Fieldwork Data.

Using the Post HOC test which is used in statistical hypothesis for classification, two treatments/items are said to have almost the same characteristic if the significance value is greater than 0.05 and the higher the value the

closer the items in classification. Based on this fact, problems listed in the research tool can be grouped as 1, 2, and 3 having almost the same number of respondents and 4, 5, 6, and 7 having almost the same number of respondents. The mean values can be used in ranking the problems as;

- Inadequate maintenance
- Mismanagement by the government
- Old age of the road pavement
- Incompetence of the contractor
- Bad nature of the soil
- Poor material used
- Stress of heavy vehicles

The problems were arranged in ascending order which implies the least of the problems is stress of heavy vehicles.

CONCLUSION AND RECOMMENDATIONS

The work thus concluded that all the factors listed contribute to the failure of the road with Inadequate maintenance, Mismanagement by the government and Old age of the road pavement being the major factors. The work therefore recommends that there should be Quality Determination for materials during construction, Effective Maintenance Programme (routine or preventive maintenance, periodic maintenance, and disaster maintenance or major repairs of our roads) and Establishment of an Active Maintenance Crew.

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