Assessment of Selected Highway Road Maintenance Project Performance in Akwa Ibom State, Nigeria [1]

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ABSTRACT

This study is an explorative study on the maintenance of road construction in Akwa Ibom State Nigeria. The objectives are to: identify the causes of deterioration of major highways to serve as a guide for project performance; assess the performance indicators of highway maintenance for effective project performance; analyze the determinants of road maintenance project performance in Akwa Ibom State vis-à-vis; funding, physical resources, monitoring and control and; proffer solutions for achieving the goal of road maintenance project performance in Akwa Ibom State. Questionnaire was used to collect data. Relative severity index (RSI) and multiple regression was used to analyze the data collected. The result of the RSI show that lack of drainage system & underground water is the major causative factor that lead to highway deterioration in Akwa Ibom State. This is followed by poor design construction. Whereas weak local professional bodies are the least causative factor. Multiple Regression result show that five out of the six identified challenges of road maintenance projects are significant while training and development is not a significant challenge. Funding is the most critical challenge faced by road maintenance projects in Akwa Ibom State. The study recommend that preventive and predictive maintenance policies should be adopted, Realistic budgets with seamless release of fund and; that drainage system should be included in road maintenance design and back-up with prompt and adequate funding for implementation.

Keywords: Project performance, Drainage system, funding level, highway deterioration and maintenance, physical resources, poor quality of design and materials, technical capability.

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1. Introduction

There has been increasing public concern due to the terrible and decaying state of the major highways in South-South Nigeria and Akwa Ibom State in particular. The reason they have been in this condition for so long is that the agencies in charge of maintaining the roads have not given them enough care and attention. These prominent highways suffer from inadequate maintenance or upkeep due to their shoddiness and unreliability. The roads are not suitable for use in all seasons due to the lack of maintenance, and they are unable to tolerate severe weather or heavy traffic (National Technical Working Committee on Transport, 2009).

According to a casual assessment, the majority of the roads in the Akwa Ibom State are in extremely poor shape and need either proper maintenance or complete rehabilitation. But the majority of the roads are in extremely bad shape, with gullies, potholes, erosion, flooding, and other signs of deterioration. This is mostly caused by poor or nonexistent road maintenance, with inadequate plans for timely and economically sound completion. Trunk A and trunk B road quality and dependability have grown increasingly elusive. A case in point in Akwa Ibom State includes; Ibeno road in Oron, Calabar Itu road, and Ikot Ekpene road. In order to support an effective transport system in Akwa Ibom State, the State Government and the Federal Road Maintenance Agency (FERMA) are either now rehabilitating or have completed rehabilitating the crumbling portions of these highways. The Executive Bill that was approved by the National Assembly and signed into law by the President is known as FERMA.

Ensuring the efficient and effective maintenance of all currently-existing State and Federal roads is one of FERMA's mandates. Nonetheless, the National Technical Working Committee on Transport (2009) notes that the provision of a functional and efficient transport system is a social responsibility of government at all levels. However, insufficient financing prevents this social obligation from being fulfilled; this is likely due to flaws in the way road projects are funded and carried out, which are a result of budgetary provisions and the conventional direct contract award procedure (Oni & Okanlawon, 2021). It is clear that projects in other economic sectors and subsectors compete with road infrastructure for funding, (Merna & Njiru, 2020), and it is the responsibility of the government to balance and distribute investments among limited resources. Because of this, public-private partnerships are now a practical way to close the funding gap in the transport industry (Merna & Njiru, 2020). Debates about the amount of investment recommended for the transport sector may arise from the possibility of conducting some transactions through a wide range of ICT platforms without requiring any kind of physical interaction. Nonetheless, transportation serves as a tool to reduce the physical distance between production and consumption, and long-term productivity can be increased through effective management and prompt application of a suitable flow of inputs for upgrades and repairs (Mundhe, 2018).

The importance of improved road infrastructure in determining the level of socioeconomic development cannot be overstated. This is just so that the citizens can grow by connecting. The necessary road infrastructure needs to be installed in order to support the economy's present rate of growth and development. As posited by FERMA (2020) and Reforming Road Transport in Nigeria (2009), in terms of road network, Nigeria leads other Sub-Saharan African nations. With an estimated 200,000 km of roads linking villages to cities, the far from the near, and the inter-land with the urban market, the nation boasts the greatest road network in West Africa and the second largest south of the Sahara. It appears that Nigeria is witnessing an increase in the types of cars on the road, which makes road maintenance and reformation imperative.

To support the growing population, all of these indices point to the necessity of improving road infrastructure delivery and maintenance initiatives. But the effort is massive, and it will cost a lot of money. It is evident from the evaluation of the existing state of road infrastructure that, for a nation of its size, the nation has not met its standards for the availability and provision of a good road network. In light of this, the Nigerian Federal Government has acknowledged the potential and difficulties present in the country's road infrastructure industry (Ndubueze & Echeme, 2025). Furthermore, the Nigerian government has discovered a practical way to use FERMA to address the issues the industry is facing while capitalizing on the increased revenue from improved road infrastructure.

The Federal Government has initiated road sector reforms as a proactive measure. These reforms aim to collaborate with the private sector in funding and managing the road sector, thereby improving service delivery, enhancing management capacity, and creating a favourable institutional, legal, and regulatory framework (Ndubueze & Echeme, 2025). Unfortunately, there had been no appreciable progress achieved in keeping roads well maintained to facilitate both automotive and human traffic flow. To address the issue of road maintenance, the Federal Road Maintenance Agency (FERMA) was established in 2002 in accordance with the initiative. Based on statistical data, it appears that FERMA has not made significant progress in managing road maintenance, which has led to a high frequency of accidents on the highways, most of which have resulted in damage and loss of property and life. Researchers have not done much in highlighting FERMA's road maintenance efforts in order to identify any gaps and come up with a solution to reduce the threat. It therefore becomes imperative that a research be carried out on road maintenance management in Akwa Ibom State, Nigeria, with a view to identifying the shortcomings in road maintenance and provides avenue for possible solutions to the menace.

It must be stated that the extensive road network of Akwa Ibom State serves road users from Cross River, Abia, Rivers, and Ebonyi states. Road users find Akwa Ibom State's roads challenging due to their terrible condition, quick deterioration, and other issues. The condition of the roads has a negative impact on the financial situation of the inhabitants when it comes to logistics and the movement of commodities. In Akwa Ibom State, these roads have typically witnessed little or no maintenance. Ibeno Road, Calabar-Itu Road, and Ikot Ekpene Road maintenance projects were

started very late and had poor design quality. Little consideration was given to the roads' ages, the climate, which changes frequently with severe rainfall, the poor drainage system, the high traffic density, the geological topography, etc. (Udo, 2026). Numerous routes have seen the abandonment of maintenance efforts, which have either been postponed or completed at excessive costs and with shoddy finishes. A quick look reveals that the issue stems from a number of issues that cannot be conclusively linked to the methods used in the maintenance of these highways. Each of these elements works both individually and collectively to determine if the maintained roads are safe to drive on.

Despite the inadequate road network infrastructure in the Akwa Ibom State, there has been a regression in the movement of vehicles, people, and other resources necessary for the socioeconomic growth of the State. There has not been much success in the movement of goods and services. As a result, the anticipated socioeconomic development has remained a pipe dream. Unfortunately, where roads do exist, they are either badly maintained and have been abandoned. As a result, they are turning into popular locations for murders, robberies, kidnappings, and other anti-socioeconomic crimes. Ignoring this state of affairs will not only allow the vices to flourish but also impede the achievement of socio-economic development goals that could have been achieved if the roads had been maintained in a decent manner.

Furthermore, the federal government's renewed focus on agriculture as a vital component of economic growth will be for naught if the nation's roads are not improved to facilitate the movement of produce from various regions to their intended destinations. Hence, it has become critical to conduct a study on road maintenance management with a view to setting guidelines and decision support system for effective maintenance of roads in Nigeria; with particular emphasis to Akwa Ibom State Nigeria.

However, the objectives include: identify the causes of deterioration and failures of federal highway to serve as a guide for project performance; assess the performance indicators of highway maintenance for effective project performance and; analyze the determinants and drivers of highway maintenance project performance in Akwa Ibom State vis-à-vis; funding, physical resources, monitoring and control.

However, the following hypotheses were formulated to aid in achieving the objectives;

- Ho_1: The identified overall drivers and decision variables could not lead to efficient highway maintenance project performance.
- Ho_2: Method of funding employed by the government will not have significant performance impact on evolving highway maintenance projects.
- Ho_3: Capacity of construction technology will not lead to improve management of highway maintenance projects performance.

Ho_4: The adoption of contracting maintenance procedures and regulations will not significantly lead to improve performance of highway maintenance projects.
Ho_5: The level of application of project management for planning, monitoring and control will not decisively result to improve performance of highway maintenance projects.
Ho_6: Training and manpower skill development are not significant decisive drives for effective management of highway maintenance project delivery.
Ho_7: The level of available physical resources will not lead to effective management of highway maintenance project.

By facilitating the transportation of goods and services, particularly agricultural produce to areas in need, well-maintained and managed highways will offer a multitude of opportunities for the State's socioeconomic growth as well as that of other States in the South-South region of Nigeria. These benefits will also contribute to an improvement in the standard of living and general well-being of the populace. In order to assist society, become rid of the sights of abandoned highway road projects, the study will help participants in the project to coordinate their work and raise the chance of completing the highway maintenance projects successfully.

2. Conceptual Review

The term "road maintenance" refers to the preservation and upkeep of the road's structural components. In order to arrange extensive database containing information on inventory and road condition, as well as to ensure that policies, processes, and procedures are followed so as to complete the activities necessary to meet goals, an efficient road maintenance management system (RMMS) is required (Mogamed 2020). However, the operation of road facilities and services to provide adequate and safe traffic, as well as the preservation of each type of roadway, roadside, and structures close to their original state as constructed, constitute maintenance of highways (Jamal (2017).

Figure 1: Components of Road Maintenance

Source: Jamal H. (2017), Road Maintenance, Highway Maintenance Transportation engineering. http://www.aboutcivil.orgmtcofhwsrd.html.

Requirement for Effective Highway Maintenance

Road development consumes a large portion of the nation's resources. Ball (2019) asserts that, among other things, the government depends on qualified experts to provide expert engineering and planning guidance in order to guarantee the success of highway road projects.
However, the success of a highway road project depends on a number of variables outside engineering and planning services. Ball (2019) contends that technical assistance for maintaining the constructed roads is necessary to ensure that the economic benefits of roads are realized. The following are necessary for efficient road maintenance;

i) **Institutional:** Establishing competitive environment according to (Ralph, 2021), increases specificity, improving organizational effectiveness and efficiency but also introduces a competitive element for the interested parties. The aim of the competition should be to gain work of sufficient quality at the most economic price. Competition can be based on price, quality, performance or the mixture of the three. However, the introduction of competition and business-oriented objectives into a public organization requires a change in culture and the implications can be threatening to existing civil or public workers.

ii) **Technical**: Range of techniques used are dependent on the nature of the deterioration which comprises anything from minor potholes or surface patches through to universal pavement construction and drainage upgrades depending on the source of the damage (Ralph, 2021).

iii) **Financial:** In order to achieve the objectives of the road maintenance agency, activities require large funds. As a consequence, most agencies are now trying to improve the efficiency of their maintenance plans by adopting several new strategies (Rijn, 2016). The main target of these newer strategies is accomplishing a possible maintenance at the least possible cost. Some of these strategies include; maintenance contracting methods, improving the management of the available resources, standardizing and improving production processes, prioritizing of the work activities and implementation of new technologies (Ball, 2019). Despite the importance of roads in terms of both their intrinsic value and the role they fulfill, most are poorly managed and badly maintained in the developing world.

Review of Past Related Studies

Given its impact on the social, economic, and political conditions of every nation on the planet, the significance of transportation infrastructure cannot be overstated. As posited by Olatunji & Diugwu, (2022), there is a strong correlation between the growth of the transport sector and the overall economic growth of the nation. This is because of the success and prosperity of this sector that attracted other sectors to be involved. The empirical study is summarized in the Table 1.

Table 1. Summarized Empirical Review

Author/ Year	Paper Title	Methodology	Factors Identified	Limitations
Mandl, Dierx and Llzkovitz (2021)	Effectiveness and efficiency of public spending on road maintenance projects in Developing Countries	Questionnaire and Relative Importance Index, t-test	Expenditure, level of urbanization, the number of automobiles and drivers; and spatial factors	There was no quantitative approach to data analysis. Hence, the variables were not ranked to determine their level of severity on highway road projects
Okigbo (2012)	Immediate and Remote Causes of failure in Nigerian highways	Questionnaire, Correlation and simple regression	Poor design and construction, Poor maintenance of already built highways, Use of low-quality materials, Poor workmanship and supervision of construction work and, applying of heavy traffic that were not meant for the road.	There was no quantitative approach to data analysis. Hence, the variables were not ranked to determine their level of severity on highway road projects.
Franc-Mensa, Brien, Khwaja and Bussal (2021)	Geographical Integrated Highway Maintenance and Construction Planning. A Case Study of Fort Worth, Texas	Questionnaire, Analysis of Variance, t-test	Traffic intensity, Thickness of pavement, Number of lanes, poor highway facilities, no knowledge base, inadequate sanction for highway failure, no local standard of practice, poor laboratory and in-situ tests on soil and weak local professional bodies, construction and management.	There was no quantitative approach to data analysis. Hence, the variables were not ranked to determine their level of severity on highway road projects.
Tafawara and Sarah, (2023)	Causes of Cracks and Deterioration of Pavement on Highways in Jordan from Contractors' Perspective	Questionnaire and Multiple Regression Analysis	Effect of cracks and structural failure, standards specifications and policy, traffic load and volume, properties and construction conditions, drainage system and ground water, aggregate properties, alignment and geometry of road, flexible pavement layers thickness and, pavement with highway maintenance.	There was no quantitative approach to data analysis. Hence, the variables were not ranked to determine their level of severity on highway road projects.

In Akwa Ibom State, built roads frequently deteriorate and fail despite receiving little to no maintenance care. It has not been addressed how to maintain roads in a way that will withstand the test of time. None of the studies have been able to quantitatively determine the overall criteria that will be managed and controlled to complete road maintenance projects on time, within budget, and with the required quality, dependability, and service durations.

3. Methodology

This study adopted descriptive survey technique designed to be observational and inferential. This because the study involves observation of the real situation and developing questionnaire to obtain information from highway maintenance managers, quality assurance and control professionals and other experts. To this end, Relative Severity Index (RSI) and Multiple linear regression analysis were used to analyze the data collected and deductions were made base on the findings.

Data were collected from both the primary (questionnaire designed using Likert five-point scale. The scoring model is as follows: Very effective = 5 points, effective = 4 points, neutral = 3 points, ineffective = 2 points, and very ineffective = 1point.) and secondary (highway maintenance records of FERMA on the 3 sampled maintenance projects along the Ibeno road in Oron, Calabar Itu road, and Ikot Ekpene road, library sources, internet search engines/websites) sources.

The population of this study was chosen from the highway maintenance units of FERMA and related consulting firms in Nigerian. The study was limited to the 3 major highway maintenance sections along Ibeno road in Oron, Calabar Itu road, and Ikot Ekpene road roads as the population. Sample of the projects was used with a view to extending our findings to the entire population. However, the researcher followed a subjective approach, which ensures that the sample is representative of the population and at the same time uses an economically feasible subset of it. From the personnel data base of FERMA and its consulting firm, the technical and managerial staff captured as the target respondents are eighty-nine (89). This therefore formed the population size (N) of the respondents and N for the highways is three (3). Since N is relatively small in both, they were used as sample sizes based on consensus. A total of 89 copies of questionnaires were distributed to experts who are knowledgeable in the selected areas. The targeted respondents are professionals and experts in the area of highway maintenance project and include; civil engineers, project managers, construction technologist and quantity surveyors.

3.1 Sampled Highway Maintenance Projects Used for the Study include:

1. General Maintenance and Pavement Strengthening of Ibeno road, between Km 9 + 000 – Km 30 + 000 (Both Bounds) in Oron, Akwa Ibom State,
2. Repairs of Low-Lying Location along Calabar Itu road, in Akwa Ibom State.,

3. General Maintenance of Umuahia-Ikot Ekpene Road between km 42 + 300 – km 67 + 300 in Akwa Ibom State

Purposive sampling technique was used in the study based on the personnel that have direct knowledge of the research area and choice of the 3 highways was made because of their high severity index and traffic density in addition to their economic importance in the movement of commuters, goods and services to various destinations in and out of Akwa Ibom State Nigeria.

The methods of data analysis are the Relative Severity Index for assessing the severity of factors adversely affecting highways maintenance projects in Aka Ibom State and, the Multiple Regression analysis via SPSS version 26 used to evaluate factors influencing the performance of highway maintenance projects. To study explored the collective and individual relationship of these factors to highway maintenance project success.

3.2 Relative Severity Index (RSI)

This was used to ascertain the degree of adverse effects of each of the causative and factors affecting highway maintenance caused failure to highways and their maintenance projects.

RSI = $\sum_1^n \frac{WiFi}{w} \text{ x } \frac{100}{1}$ ..... (1)

Where Wi = weighted score of individual causative factor

3.3 Multiple Linear Regressions and Correlation Analyses

The aim of multiple regressions is to examine the nature of the relationship between a given dependent variable success of highway maintenance and two or more independent variables in a regression function. In multiple regressions, the model describing the relationship between dependent variables y and a set k independent variable $X_{1,}\, x_{2\,\ldots} x_K$ can be expressed as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3 + X_3 + b_4X_4 + b_5X_5 \ldots\ldots\ldots\ldots \quad (2)$$

where: Funding level & policy (X_1), Construction technology (X_2), Contracting maintenance procedures & regulations (X_3), Project management monitoring & control (X_4), Training & manpower skill development (X_5), Degree of physical resources (X_6), Y= Effective management of highway Maintenance Project.

Decision Rule: The test of hypothesis was conducted at 0.05 (5%) level of significance. When the P-value (sig.) is ≤ 0.05, the null hypothesis is rejected while the alternative hypothesis is accepted, and vice versa.

4. Results and Discussions

The data generated from field survey were distributed and returned as shown on table 2.

Table 2 Questionnaire Distribution and Return

S/N	FERMA Staff and Consultants	Number Distributed	Number Return
1.	Civil Engineers	15	14
2.	Construction technologist	12	10
3.	Project Managers	13	13
4.	Quantity Surveyor	10	9
5.	Consultants	15	12
6.	Quantity Surveyors	14	11
7.	Structural Engineers	10	9
	Total	**89**	**78**

Out of the 89 copies of questionnaire distributed, 78 were retrieved and used representing 88% response rate.

4.1 Analysis of Relative Severity Index (RSI) of factors and causes of failures of highways in Akwa Ibom state Nigeria; using equation 3 as follows:

RSI $= \sum \frac{Wifi}{W}$ ***where Wi*** $=$ Individual weight in which: SD = 1 point D = 2 points.
N = 3 points A =4 points, SA = 5 points
W = sum of maximum weight = 450, Fi =frequency or number of respondents for each weight**.**

The ranking of the severity index in Table 3, indicates that drainage systems and underground water (S5) is the most critical factor that affect highway maintenance projects. This is followed by poor design and construction (S9), low quality materials (S11), etc. the least critical factor is weak local professional bodies (S17).

The implication is that no or blocked drainage systems seen around most highways in most parts of the State contributes greatly to the problem of road dilapidation. Also, most road designs and construction method employed have affected and is still contributing to highway potholes and damaged which has negatively affected lives and properties. However, it not a surprise to find weak local professional bodies have proven capacity to monitor and evaluate highway road projects in the State.

Table 3. Relative Severity Index of Causative Factors of Highway Deterioration

Code	CAUSATIVE FACTORS OF HIGHWAY FAILURE	Frequency					Total score $\sum Wifi$	RSI (%)	Rank
		SD	D	N	A	SA			
S1	Cracks and structural failure	8	10	22	18	20	266	59.11	6th
S2	Standards / specifications policies	8	20	14	18	18	252	56.00	8th
S3	Traffic density / load	8	26	10	14	20	246	54.67	9th
S4	Construction conditions	28	18	15	10	7	184	40.89	16th
S5	Drainage systems and underground water	2	8	8	20	40	322	71.56	1st
S6	Alignment and geometry of roads	22	18	18	10	10	202	44.89	13th
S7	Flexible pavement	31	19	14	6	8	175	38.89	15th
S8	Layers thickness	10	8	8	24	26	276	61.33	4th
S9	Poor design and construction	3	5	10	24	36	319	70.89	2nd
S10	Lack of effective maintenance culture	17	20	18	8	14	213	47.33	12th
S11	Low quality materials	2	6	18	22	30	306	68.00	3rd
S12	Poor workmanship and supervision	10	8	14	26	20	252	56.00	5th
S13	Poor highways facilities	30	18	12	8	10	184	40.89	14th
S14	No knowledge based in maintenance	9	10	20	20	19	264	58.67	7th
S15	Inadequate sanction for highway offenders	44	15	10	3	6	146	32.44	17th
S16	Poor laboratory institute test	16	22	8	18	14	226	50.22	11th
S17	Weak local professional bodies	50	15	7	5	1	126	28.00	18th
S18	Inadequate number of lanes	18	10	10	24	16	244	54.22	10th

4.2 Analysis of Multiple Regression Result

The results from the multiple regression were shown in tables 4 and 5.

Table 4 Analysis of Variance (ANOVA)

Model	Sum of Square	df	Mean square	F-ratio	Sig.
Regression	154.856	6	25.809	34.818	0.000
Residual	2131.362	72	30.019		
Total	2286.362	78			

Table 5 Coefficients of Multiple Regression

Constant	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
Y	2.099	1.305		1.608	0.113
X_1	0.663	0.126	0.353	5.263	0.000
X_2	0.576	0.160	0.263	3.596	0.001
X_3	0.304	0.134	0.141	2.166	0.043
X_4	0.308	0.138	0.158	2.229	0.030
X_5	0.257	0.186	0.102	1.383	0.172
X_6	0.670	0.152	0.309	4.393	0.000

Dependent Variable y

The fitted regression equation:

$Y = 2.099 + 0.663X_1 + 0.576X_2 + 0.304X_3 + 0.308X_4 + 0.257X_5 + 0.670X_6$ ……..eqn. 1.

All the variables are positively related to effective management of highway maintenance projects. The implication is that management highway maintenance projects increases with an increase in the variables and vice versa.

4.3 Hypothesis Testing

Ho_1: The identified overall drivers and decision variables could not lead to improved highway maintenance project performance.
From table 4, the significance of F-ratio value = 0.000 < 0.05. The null hypothesis is rejected in favour of alternative hypothesis. This implies that the result of the test is significant at 5% level of significance

Ho_2: Method of funding employed by the government will not have significant performance impact on evolving highway maintenance projects.
From table 5, the p-value of 0.000 < 0.05. Hence, the test is significant for managerial decision making.

Ho_3: Capacity of construction technology will not lead to improve management of highway maintenance projects performance.
From table 5, the sig. = 0.001 < 0.05. The test is also significant as null hypothesis is rejected in favour of alternative hypothesis.

Ho_4: The adoption of contracting maintenance procedures and regulations will not significantly lead to improve performance of highway maintenance projects.
From table 5, the p-value for x_3 = 0.043<0.05. The test is also significant to be used for formulating maintenance project policies.

Ho_5: The level of application of project management for planning, monitoring and control will not decisively result to improve performance of highway maintenance projects.
From table 5, the p-value for $x_4 = 0.030 < 0.05$. The null hypothesis is rejected for x_4, while the alternative hypothesis is accepted.

Ho_6: Training and manpower skill development are not significant decisive driver for effective management of highway maintenance project delivery in Imo State.
From table 5, the p-value for $x_5 = 0.172 > 0.05$. The test result indicates that the null hypothesis is accepted while the alternative hypothesis is rejected. Hence, x_5 could not be used for decision making.

Ho_7: The level of available physical resources will not lead to effective management of highway maintenance project.
From table 5, the p-value for $x_6 = 0.000 < 0.05$. The test result is significant for decision making while the null hypothesis is rejected.

Table 6: Ranking of Success Factors for Highway Maintenance Project Performance by FERMA in Akwa Ibom State Nigeria

Code	Drivers and determinants	t -value	Rank
X_1	Funding Level	5.263	1^{ST}
X_6	Degree of Physical Resource	4.393	2^{ND}
X2	Capacity of Construction Technology	3.596	3^{RD}
X4	Project Planning, monitoring and control	2.229	4^{TH}
X3	Contracting Maintenance Procedures and regulation	2.166	5^{TH}
X5	Training and Manpower Development	1.383	6^{TH}

4.4 Findings from Secondary Data

Some secondary data were obtained from FERMA Uyo in Akwa Ibom State on the sampled highway maintenance projects. Such data were not found suitable for relevant data analysis rather, for elucidation of research information. The data indicates that the failures on the carriageway of the roads under consideration were consistent with the following causative factors: poor drainage system, stagnation of run-off on the carriageway, silting of concrete lined drains, increased volume of axle load on the road. Summary of the findings are detailed below:

1. **General Maintenance and Pavement Strengthening of Ibeno road, between Km 9 + 000 – Km 30 + 000 (Both Bounds) in Oron, Akwa Ibom State,**

The Km 9 + 000 – Km 30 + 000 of the Ibeno Carriageway lies in Uyo - Oron section of the road.

The road consists of 6.8m width of asphaltic concrete carriageway, with 2.75m and 1.5m width of asphaltic concrete outer and inner shoulders, respectively. The road is a major arterial route linking major towns in Cross Rivers, Imo, Abia States, respectively and beyond. The information obtained on the project indicates that the causative factors of the failure on the carriageway between km 9 + 000 – km 30 + 000 along the road include:

i. Blockage of box culvert at various locations
ii. Unlinked concrete lined drains
iii. Surface run-off stagnating on the carriageway and shoulder thereby weakening the asphalt surface and
iv Increased volume of high axle vehicle along the road

2. Repairs of Low-Lying Location along Calabar-Itu road, in Akwa Ibom State.

The Calabar-Itu road is a section of the Calabar– Itu road. The road consists of varying width of between 7.3m – 11m of asphaltic concrete carriageway with 2.75m width of eroded surface dressed shoulder on either side of the carriageway. The low-lying location falls within km 32 + 000 of the road. The causes of the failure of the carriageway and shoulders were identified from the obtained information on the road to include:

i. Low-lying nature of the road at km 32 + 000
ii. Stagnation of water by the road verges persistently seeping into the sub grade.
iii. Nature and blockage of the concrete lined drains

3. General Maintenance of Ikot Ekpene Road between km 42 + 300 – km 67 + 300 in Akwa Ibom State

The km 42 + 300 – km 67 + 300 of the Umuahia – Ikot Ekpene road lies within Ikot Ekpene-Umuahia section of the road. The Umuahia – Ikot Ekpene Federal Highway is about 86km long and is adjoining to Abia State–Akwa Ibom Expressway. The cross section of the road consists of 7.3m width of asphaltic concrete carriageway with 2.75m graded and eroded surface dressed shoulders at some sections. The road is a major arterial route linking major towns and communities in Imo, Abia and Enugu States, respectively and beyond. The causative factors of the failure on the carriageway between km 43 + 200 – km 55 + 300 along the road include the following:

i. Stagnation of surface run-off on the carriageway and shoulder which weakened the asphaltic surface causing water to permeate to the underlying soil
ii. Inadequate provision of concrete lined drains
iii. Increased volume of high axle vehicles on the road
iv. Silted concrete lined drain at various locations

4.5 Discussion of Results

Funding level is the most significant success factor that could lead to effective maintenance management of highways in Akwa Ibom State (see Table 6). It could be adduced that late or non-release of funds is one of the major constraints to highways maintenance projects performance leading to failure. This corroborates with the findings of (Mandl, et al. 2021). Adequate funding pattern makes the wheel of project implementation to go round and is very importance for projects success and avoid abandonment (Echeme & Moneke, 2023). However, funding level should align with budget and cost breakdown structure meant for the highways maintenance project to ensure that enough fund is available for the completion of each stage of the project.

Table 3; Indicates that poor or lack of drainage system, poor quality of maintenance design and construction, poor quality materials and then pavement layer thickness are the major causative factors of highways failures and deterioration. Tafawnra and Sarah (2023); Franc- Mensah, et al, (2021) and Mandl, et al (2021) agree with this finding. Significant funding level and budgets are therefore needed to integrate, consider and include these factors in the design and implementation of highway maintenance projects.

Table 5 also attests that availability and timely supply of physical resources are significant factors that could lead to effective highway maintenance project success. The availability and on the site timely supply of quality physical resources are inferred to be significant to the successful highway maintenance projects performance by FERMA in Akwa Ibom State. However, resources availability, timely and scheduled supplies to the dilapidated sections of the sampled highways are very crucial and proactive to the maintenance projects. Resource scheduling is a process of converting a project plan into a working schedule that takes account of resources which can be made available as and at when due. Bulk material resources such as chippings, bitumen, reinforced/structural steels, laterites, water etc., are very crucial for highway maintenance project delivery. The availability and use of well-maintained and functional construction equipment in the category of; earth-moving plants, concreting equipment, materials handling equipment, transportation, fleet and utility services equipment will lead to effective highways maintenance project delivery in Akwa Ibom State. However, the projects managers should formulate action plans on the best way of using available resources so as to give rise to efficiency during highway maintenance projects.

Construction technology ranks third as a significant factor that will lead to successful management of highways maintenance projects performance (see Table 6). According to Akanni, Oke and Apkomiemie (2014) the appropriate construction technology can be measured by the availability of locally made plant and equipment, skilled manpower resources, extent of local materials resources and degree of utilization of such local construction materials. However, Nigeria usually depends on imported and foreign construction technology in some key areas. There is need to

encourage and develop local technology to improve and sustain the success of highway maintenance projects.

The lack of technological know-how and shortage of managerial manpower were considered to be one of the major constraints and problems facing the nation. Akanni, et al. (2014) maintained that as at 1980, the situation was described thus; lack of basic knowledge of production methods and design techniques for machinery constitute a serious constraint to rapid industrialization of the country. As at today, the country still remains a net importer of technical manpower, virtual most spare-parts are imported and most investment in research and development are made abroad, except those sponsored by the government in public owned institutions. Highways maintenance projects performance success could be recorded if construction materials are locally sourced, exploited and processed, equipment, machineries and spare parts are locally designed, fabricated, maintained and sustained with locally manpower and skill development in the area of highway maintenance projects so as to be in tandem with local environment sustainability.

The adaptation of project management techniques in planning, monitoring and control of highways maintenance projects is a critical factor to effective maintenance project delivery (see Table 5). To be proactive to successful management of highway projects, project managers in addition to their traditional functions, must develop a skill to scan the environment, to identify potential problems and try to establish strong relationships that can help in the management of key actors and factors on which successful implementation of highways maintenance projects depend. With the emerging global opportunities, Chitkara (2016) avers that; projects cross geographical boundaries, corporate channels, traditional systems and cultural diversities. He maintained that the knowledge areas needed to manage such projects comprise project management techniques, general management practices and technological related subjects. He concluded that these techniques can be applied to all types of projects. Some of these project scheduling management techniques include; Critical Path Method (CPM) Program Evaluation and Review Technique (PERT), Gantt chart etc. Telsang (2010) concurred that network scheduling technique is a technique used for planning and scheduling large projects in the fields of construction, maintenance, fabrication and other areas.

Contracting maintenance proceedings is also a significant success factor of highway maintenance project management that must be complied with (see Table 5). Project management requires teamwork among the three principal contracting parties. Members of the owners' team must provide the project needs, the level of quality expectation, a permissible budget and the required schedule. The designer's team must develop a set of highways maintenance contract documents that meet the budget of client's objectives, required level of quality and schedule. The contractors' team must efficiently manage the physical work required to build the projects in accordance with the contract documents (Stevensons, 2020).

Training and manpower development did not indicate significant evidence and contributions to effective management of highways maintenance projects in Akwa Ibom State by FERMA (See

Table 5). This is a surprise. Either there are no training programmes available or the available ones lack the capacity as most of the skills are usually imported into the country alongside with construction technology. Also, many of the highway maintenance projects are characterized by short durations and transition from one site to another because of small scope in each site.

5.0 Conclusion

Based on the finding made in this study, the following conclusion are made.

Highway failures and dilapidation are serious threat to economy of Akwa Ibom State with resultant impediments to movement of commuters, goods and services; hence retrogressive to the economic development of the State. Many causative factors are found to be responsible for highway failure and dilapidation and the major ones are; poor drainage systems and effects of underground water, poor design and construction of the highway maintenance projects, low quality input materials and thin base thickness of the pavement, surface run-off stagnating on the carriageway and shoulder thereby weakening the asphalt surface, unlinked concrete lined drains, increased volume of traffic, silted concrete lined drain at various locations. Highway maintenance projects could be effectively managed by enhanced funding level, availability and efficient utilization of physical resources, capacity of construction technology etc.

Since many of these roads are not maintained until such catastrophic stage, preventive and predictive maintenance policies are recommended because delays cause more devastations.

Realistic budgets with seamless release of adequate and appropriate fund as and when due is recommended since insufficient funding level lead to highway maintenance project abandonment and failure.

Drainage system should be included in highway maintenance design and back-up with adequate funding for implementation and inclusion. The FERMA should set up a highway monitoring and inspection team to identify point of defects along the highways and prevent them from propagation and further deterioration, dilapidation along the highways.

The quality of physical inputs such as materials and machines should be inspected and evaluated prior to utilization so as to contain shoddy output or repeat work.

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