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## Evaluation of factors responsible for road failures in Nigeria and the Way Forward

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### ABSTRACT

Most Nigerian roads are failing because adequate plan is not made before construction. This paper analysed the causes of road failure in Nigeria roads, with the aim to suggest possible solutions to reduce the problem. Road is a very important infrastructure in any community, and greatly affects the economy of any nation. As such, roads must be properly designed and constructed. After construction, they need to be maintained to ensure that the objective of safety, strength and durability are met. Failures on both major and minor Nigerian roads have become a normal occurrence to the Nigerian populace. High accident rate, increased travel time, increased cost of vehicle maintenance and high crime rate are some of the consequences of road failure. This paper further identified poor design of roads, bad supervision and workmanship, lack of routine and periodic maintenance, bad drainage, improper use and overloading and inadequate sanction for highway failure as the major causes of failure on Nigerian roads. The study proposed the provision of adequate and appropriate designs, supervision and quality control, decongestion of the Nigerian roads, among others, as possible way forward to this menace.

Keywords: Road, Poor design, Infrastructure, Road failure, Construction.

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### INTRODUCTION

Road is an important infrastructure in a nation or community of people. It greatly affects the economy of any nation [1]. Roads must be properly designed and constructed. After construction, they need to be maintained to ensure that the objective of safety, strength and durability are met [2]. Failures on both major and minor Nigerian roads have become a normal occurrence to the Nigerian populace. Road failure leads to accidents on roads [2]. Many newly constructed and rehabilitated roads in the country do not last long enough before failure. Roads are built to provide safe passage of vehicles and must be properly designed and constructed. After construction, there arises need for appropriate maintenance for the road to attain its design life and to ensure that the objectives of safety, strength and durability are met. The rate at which roads deteriorates in service ranges from the quality of materials used, workmanship standard, to the quality of design and supervision during the road construction. This paper intends to ascertain the causes of road failure in Nigerian roads and to suggest possible solutions to the problem. According to Ndefo [3] "Nigeria has about 200,000 km of roads spread all over the country; these roads are made up of over 32,000 km of federal roads spread over the thirty-six states and the federal capital, over 30,000 km of state roads and over 130,000 km of local government roads". Within the states, the local government roads are further classified into urban and rural roads. According to ownership, Nigerian roads are classified into federal, state, and local government roads. Federal roads are divided into federal trunk 'A' roads and the federal trunk 'F' roads. The federal trunk 'A' roads are those under the federal government ownership and they are developed and maintained by the federal government while the federal trunk 'F' roads are those that were formerly under the state ownership but were taken over by the federal government with a view to upgrading them to federal highway standards. State roads are classified as the state trunk 'B' roads and are under the ownership and management of the

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**Publications**

various state governments. Local government roads are classified as the local government trunk 'C' roads and are the roads under the ownership and management of the local governments in the country. These roads are divided into the urban, rural and village access roads [3].

Nigeria's pavement today are characterized by distress of various kinds like potholes, cracks, depression, ruts etc. whose cause are due to various reasons from use of substandard construction materials to inappropriate designs [4]. Komolafe [5] stated that "the state of Nigeria roads stands out like a sore thumb and their national picture is simply scandalous". This makes them difficult needs, because people are confronted with delays due to traffic congestion and accidents that have claimed lives of bread winners of many homes. As identified by Ndefo [3] Failures includes: Potholes and Cracks, Depression on road surface, Development of Gully due to erosion, failed road shoulders, Faulty Drainage, Faulty Traffic signals and Street lights and Wiping off of Lane markings.

**Challenges of Failure along Nigerian Roads**

Failure along Nigerian roads affects both the road users and the vehicles. Some of the effects identified are increased accident rate, increase in faulty vehicles, high vehicle maintenance cost and increase in travel time either due to traffic congestion or due to bad nature of road section. Other effects of road failure include insecurity posed by criminals at failed sections of roads, risk of flooding and erosion and adverse effect on economic development [3].

**Features of Standard and Functional Road**

Ndefo [3] opined that most Nigerian roads are non- functioning according to the standard of a safe road. A functional road should possess the following characteristics:

1. The road should be able to give an all- weather support to vehicles. That is, it should bear and distribute wheel loads to within the bearing capacity of the sub grade soil.
2. It should boast of adequate drainage facilities. This means that there should be free flow of water and flood along its drainage systeslopes, and sight distance that make for easy movement and passing with safety at established level of service. Steps involved in achieving good and functioning roads are as identified by researchers:
  - i. Thorough Preliminary Geological Investigation: Preliminary investigation involves evaluation of the geotechnical properties of the subgrade and determination of the expected traffic load. Also hydrological properties of the area should be evaluated in order to propose a functioning drainage system
  - ii. Proper Design of the road: The major objective of preliminary investigation is to acquire real and reasonable information, which will help during the design of the road. Good design takes into consideration the expected traffic growth, the wheel load, the climatic condition, the water level of the area, availability of pavement materials and availability of water for construction.
  - iii. Quality control and supervision: Supervision ensures that the construction work is executed according to the design. Quality control is very important in road construction. It ensures that the quality and properties of different materials of the pavement layer is not lower than the ideal designed properties.
  - iv. Timely maintenance: Roads are designed to last for a particular time after which there will be need for major rehabilitation or reconstruction depending on the extent of failure. However, some portions of the road may experience maintenance so that water will not flow back on to the pavement to cause one problem or the other.
  - v. It should provide adequate skid resistance: This implies that it should provide enough frictional adhesion to vehicle tyres especially during acceleration, deceleration and cornering.
  - vi. There should be adequate highway geometrical facilities like good geometric design of road widths, intersections, side defect due to improper usage by road users, accidents and so on. Any defect of such needs timely maintenance; failure to do this may reduce the lifespan and serviceability of the road. Timely maintenance is very important as it prevents defect in a road portion from spreading to other portions of the road.

**Factors Responsible for Failure along Nigerian Roads**

Osadebe et al [6] identified the major causes of failure on Nigerian roads as follows:

- i. Inadequate Preliminary Geological Investigation: This is mostly common in local government roads and some state roads. The in-situ tests required to be carried out on the subgrade are not always done. The effect of this is either poor design as a result of the use of assumed geotechnical data or road construction without design. There is the need for the adequate testing of the subgrade soil which is the foundation used for road construction. Unfortunately this is not always done. This is due to lack adequate laboratory facilities and trained laboratory manpower for the jobs.

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- ii. Poor design of roads: A good road design should not only cater for the present traffic and drainage need but should project and forecast for the possible increase in Traffic. Due to inadequate projection, most roads today are overloaded and are failing because they were not designed to carry the traffic loads they are subjected to.
- iii. Bad Supervision and Workmanship: A good pavement design with good detailing without a good supervision by the designer (consultant) is equally useless as this could lead to road failure [6]. Supervision ensures that the road construction is rightly executed and that good equipments and materials are used. Bad workmanship is therefore the consequence of inadequate supervision. Quality control which includes laboratory and in-situ tests on the filling, sub-base and base materials, determination of the thickness of pavement layers and so on are not done on many Nigerian roads. While investigating the causes of road pavement failure on Port Harcourt – Enugu express way, Osadebe et al [6] found out that in a section, there is a wide variation in the surface course thickness along the carriage way and the specification requirement for aggregate grading and void ratio was not met in more than 60% of the sample test. Adams and Adetoro (2014) also discovered that in Ado-Ekiti - Akure road, nearly all the soil materials used for the base course are not suitable thus, failure of the road.
- iv. Lack of routine and periodic maintenance: One of the main problems of highway development in Nigeria is maintenance. The roads are rarely maintained and whenever maintenance is attempted, it is done haphazardly. Road maintenance in Nigeria has become politicized as maintenance is now mostly carried out during campaigns or presidential tours. The effect of delayed maintenance is the spread of road defect to areas bounding the failed section. This is mostly due to the ingress of moisture from the failed section to the underlying layers of the road.
- v. Bad drainage: Drainage is an important feature in determining the ability of any given road pavement to withstand the effects of traffic and environment. Poor drainage conditions on road pavement are of adverse effects and causes failures in different ways. Proper and well maintained drainage systems provided to road pavements will increase their life span but improper and not well maintained drainage systems causes' failure of road pavements at its early age thereby drastically reducing their service lifespan [7]. Inadequate and blocked drainage system on Nigerian roads has made pavement to be in saturated condition. That is why the water which may have percolated into the lower layers is not able to drain out through the sides. This results in potholes and cracks.
- vi. Improper use and overloading of roads: Improper use of roads is also a major cause of failure. Exerting too much load on the road by overloading vehicles, uncontrolled parking, spilling of petroleum products on asphaltic surfaces are few examples. Also, major and minor roads now receive traffic loads they were not designed against. After carrying out Traffic survey on the Enugu – Port Harcourt road, Osadebe et al [2] realized a high degree of overloading on the road which is one of the major causes of pavement deterioration. This is also the case with many other major and minor roads in the country.

#### **WAY-FORWARD TO ROAD FAILURE ALONG NIGERIAN ROADS**

Having understood the causes of failures along the country's roads, the following suggested solutions are discussed below:

- i. Provision of adequate and appropriate designs: The design process should always be the first phase of any project. A good and functioning road is a product of a good design and vice versa. The construction of a road starts from conception, planning and design. According to Ndefo [3], without a good design of the road, the functionality of the road may not be achieved. Even when the construction and supervision is adequate without the design process well done, the end product in the form of a road project will not be functional.
- ii. Supervision and Quality Control: Supervision is very important for the success of the road construction. A well designed road, without adequate supervision, does not guarantee a well-constructed road. Necessary Laboratory and In-situ tests should also be carried out to ensure that construction of roads are done to specifications. Quality in road construction and maintenance can only be achieved by controlling all features and characteristics that will impact desired quality on the road and that good quality tested material cannot be overemphasized during construction.
- iii. Decongestion of Nigerian roads: It is not debatable that Nigerian roads are congested with vehicles. Therefore, the government should divert road traffic to other forms of transport like rail or waterways. This will reduce overloading presently experienced on many Nigerian roads. Ndefo [3] reported that 95% of movements in Nigeria were done on roads while the remaining 5% are done by rail, air and sea.

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- According to him, decongestion of Nigerian roads will minimize road misuse and abuse thereby saving them from undue deterioration.
- iv. Timely maintenance of roads: The government agencies vested with the role of road maintenance must be proactive. Timely maintenance will not only ensure that roads are always in good condition but also protect other road sections from failure.
  - v. Provision of highway facilities: Highway facilities like good drainage, parking lot, shoulders and highway signs and markings are very important and ensure good functioning roads. Adequate provision should therefore be made for these facilities on Nigerian roads.
  - vi. Use of well trained personnel: If Nigerian roads are designed, constructed, supervised and maintained by qualified and well trained personnel; failure on Nigerian roads will be reduced. The government, through the Council for the Regulation of Engineering in Nigeria (COREN), should therefore ensure that well trained and qualified professionals are involved in the different stages of road construction and maintenance.
  - vii. Government policies: Government at all levels should enact and enforce laws that will curtail the greed of individual government officials and contractors and will ensure good standard road construction work. Also penalty should be spelt out for abuse, misuse and damage of road by individual road users.

#### CONCLUSION/RECOMMENDATION

Most Nigerian roads are failing because adequate plan is not made before construction. Hence, government and relevant stakeholders should ensure that proper supervision of road projects is ensured. Also, the maintenance culture of government agencies needs to be improved; while enforcing the laws against road abuse so as to deter further abuse of Nigerian roads.

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