Nigerian Institution of Highway & Transportation Engineers (NIHTE)

(A Division of the Nigerian Society of Engineers)

A Four-Monthly Journal of NIHTE

January - April, 2024 | Vol. 6 | 7th Edition | *Think, Transform & Transcend*

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The No.1 Highway & Transportation Engineering Development Journal

NEW YEAR MESSAGE BY THE CHAIRMAN, ENGR. HASSAN SAIDU, FNSE, FNIHTE

Let us constantly live our lives in appreciating He Who, has given us the privilege of a new year once more. This would be quite

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THE NIHTE CHAIRMAN, PRESENTING A BIRTHDAY GIFT AND CARD TO MADAM PRESIDENT

HOW DOES OGUNTALA'S FIRST 100 DAYS REFLECT HER VISION FOR NSE

President Oguntala marked her first 100 Days in Office with a "Conversation with colleagues", that reflected how Oguntala views her presidency and the role of Nigerian Society of Engineers (NSE) government in improving members lives.

She looked at collaborations with Federal Ministry of Women Affairs, strategic partnership with NCDMB, Total Energies, Ministry of Water Resources, Nigerian Nat. Resources for Irrigation, etc., and she thanked everybody on her successful investiture. Over two hundred members attended the meeting.

ENGR. MARGARET AINA OGUNTALA, FNSE

PRESIDENTIAL INAUGURAL SPEECH OF ENGR. MARGARET AINA OGUNTALA, FNSE, 34TH PRESIDENT OF THE NIGERIAN SOCIETY OF ENGINEERS (NSE)

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ISSN 2360-6826

OUR VISION

- To transform the nation's highway & transport sector that is centered on road safety, compliance, intervention, monitoring, assets management, reform, financing and capacity building for the nation's highway and transportation professionals.

OUR MISSION

- To think, transform and transcend the nation's highway & transport practice to that of global best practices.
  To provide forum for members and partners of the highway & transport industry that foster education, innovation, research, fellowship, promoting a safe, sustainable and efficient highway & transport system.
  To bring radical changes into the highway & transport practice in design, construction, maintenance, sustainability and management of highway & transport infrastructures.
  To engage highway and transportation stakeholders.
  To hold research, conference, seminar, technical publication, workshops, lectures in line with global best practices.
  To provide professional leadership while developing and sharing knowledge, capacity building and technology acquisition.
  To develop the nation's highway design and construction standards.
  To net-work and engage with highway industry leaders from different countries of the world.
  To have unparalleled professional and business development opportunities around the globe.

Core Values	Goals
Education and Innovation.	Increase visibility.
Diversity, Inclusiveness and Ethics.	Maintain membership and extend market diversity.
Quality life	Promote education.
Fellowship.	Educating highway & transport decision makers.

Aims & Scope

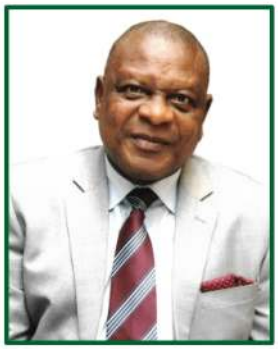
As an academic journal, the ***Journal of the Nigerian Institution of Highway and Transportation Engineers (NIHTE),*** provides a platform for the exchange and discussion of novel and creative ideas, on theoretical and experimental research in the field of Highway and Transportation. This journal publishes high-quality peer-reviewed papers on engineering, planning, management, and information technology for highway transportation. The journal is committed to rapid peer review and publication.

The scope of the ***Journal of the Nigerian Institution of Highway and Transportation Engineers,*** includes: -

- Road engineering, railway engineering, environmental engineering, ITS and traffic engineering and bridge and tunnel engineering
- Automotive engineering, design, manufacture, and operation of vehicles
- Air transportation, maritime transportation, road transportation, and railway transportation
- Analysis, operation, optimization, and planning of highway and transportation systems and networks
- Travel behaviour, information technology, traffic control, and traffic flow theory
- Economics, health, safety, security, environmental and management of highway and transportation
- Multi-modal highway, transportation and logistics research
- Intelligent highway and transport systems
- Materials science,

EXECUTIVE MEMBERS, NATIONAL

Engr. Saidu Hassan, FNSE, FNIHTE
CHAIRMAN



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EDITORIAL

Manuscripts, Letters, Reports, Adverts, Books, Reviews, etc, should be sent to the Editor, NIHTE:
nihe2013@yahoo.com or Nihte National Secretariat,
c/o National Engineering Centre, CBD, Abuja.
Gsm No.: 08032630023, 08033705986,08065668058, 08033290596

A NOTE FROM THE LEAD EDITOR'S PEN

Dear Readers,

Reference is made to the Chairman's New Year message, and NSE President's 100 Days in Office.

I wish to extend my deepest gratitude to each and every one of us that have been source of motivation with our optimistic attitude and creative spirit. The future is filled with opportunities and I am confident that together, we will continue to excel and shape a future that is not only successful, but also sustainable.

I intend to set more ambitious tasks, targets and goals that will deliver strategic advantages for NIHTE and to also achieve progressive milestones.
I thank all of us for always exceeding expectations. We elevated the meaning of teamwork to a new level. I'm truly grateful for our professionalism and focus on excellence.

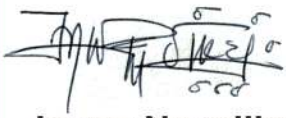
Kindly find time and peruse the Journal with so many exciting news, articles, etc.
Wishing all of us a Joyful Christmas and a Happy New Year!

We wish to stay connected during this time, so please, find time to email us at: - nihe.nse2013@gmail.com or japavisca@yahoo.com

Or call 08032630023, 08023549515, 07038064059, 08065668058, 08066898981, for any submission.

Welcome again to NIHTE quarterly Journal.

Sincerely,



Jones Nwadike
Lead Editor

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About NIHTE

NIHTE – *the Nigerian Institution of Highway and Transportation Engineers* – is a non-profit, non-partisan institution representing highway and transportation in the Nigerian Society of Engineers (NSE), in Nigeria. It represents all highway and transportation modes, including air, highways, public transportation, active transportation, rail, and water. Its primary goal is to foster the development, operation, and maintenance of an integrated national highway and transportation systems.

NIHTE works to educate the public and key decision-makers about the critical role that highway and transportation play in securing a good quality of life and sound economy for our nation. NIHTE supposed to serves as a liaison between national, state and local government departments of highway and transportation and the Federal government and is supposed to be an international leader in setting technical standards for all phases of highway and transportation systems development. Standards are supposed to be issued for design, construction of highways and bridges, materials, and many other technical areas.

Construction workers are often at risk of exposure to many infectious diseases, such as coccidioidomycosis, histoplasmosis, hypersensitivity pneumonitis, disseminated histoplasmosis, dengue, asbestos-related illnesses, silicosis, legionellosis, tuberculosis, blood-borne pathogens, and COVID-19. Due to severe working conditions and possible accidents, construction fields are high-risk zones by nature. It is very important to recognize and control the preventable health and safety hazards within these environments. The need for identification and prevention of these diseases is urgent, according to NIHTE. We can be nimble and quick in illustrating to those who are exposed to theses hazards, how to spot them and, hopefully, eradicate them, with help from health workers.

Cont'd. from page 1

discernible if we can pause and come to terms that a whole year comprises of 31536000 seconds or 525600 minutes or 6760 hours, 365days, 52weeks, or 12 months. It is the culmination of all these that we refer to as a whole year. During the period of one year, an average human being would take in a whopping 8.409.600 breathes free of charge.

We deserve to pat each other on the back for being among those fortunate to be part of a new year. Not everyone is as lucky for the renewal of the loan of Life, which we erroneously deem as a Gift. It is indeed a treasured loan, where it is a gift, we would have it ad-infinitum, but no one has been able to achieve such, because NOTHING survives the ravages of time, beside the Word of God. There is no argument about it, a new year portends new hope, renewed aspirations, time to take stock and position ourselves to maximizing the opportunity that comes with a new year. All these are in order after all to the generality, good living is about getting a good degree, good employment, caring spouse, lovely children, posh car/s decent accommodation and all that.

I take great pride in being part of a highly motivated professional team, which has continued to support new initiatives and serve our members. Without you, we wouldn't be in such a strong position.

We are delighted to have continued to sign Professional Development Partnership agreements, both with academia and other major partners. Continuing to forge these bonds allows us to facilitate the further development of aspiring engineers, helping enable them to reach their full potential.

The success of the hybrid training events has continued again this year. We have also seen the formation of new Chapters and discussions are ongoing about other potential Chapters. We thank God for the continued growth in membership.

In conclusion, I wish to stimulate thoughts as follows: -

We must try to give few minutes every day to introspection and close examination. We should carefully scrutinize our day's work and thank God for the good deeds done, while repenting for the bad habits, with a resolve not to repeat them again.

Those who had been unlucky to have paid through their noses to receive oxygen in any hospital ICU would better imagine the greatness of the Supreme Lord and that we just can't thank Him enough.

Ergo: As we pass through life in the year 2023 and thenceforth, we should let our thanks be greater than our demands. If we must demand anything, the Lord's grace is more than enough. We shouldn't just rise in the morning as the animals do and hit the road, without devotion to He Who has woken us to life again, just as we remind ourselves that we die daily when we hit the bed, and we are woken up by the Giver of Life to continue with earthly life, anytime we rise in the morning.*

May the Good Lord grant us the grace of clear thinking to enable us discern and ceaselessly sift between the way of the Lord and the satanic way all through the New Year and ever more.

I thank you for the patience of reading through.

Happy New Year

1ST EDITION OF NIHTE ANNUAL LECTURE, 2024

ENGR. MARGARET AINA OGUNTALA, FNSE, 34TH PRESIDENT OF THE NIGERIAN SOCIETY OF ENGINEERS (NSE) INVESTITURE PICTURES

PRESIDENTIAL INAUGURAL SPEECH OF ENGR. MARGARET AINA OGUNTALA, FNSE, 34TH PRESIDENT OF THE NIGERIAN SOCIETY OF ENGINEERS (NSE)

(ABRIDGED VERSION)

Distinguished guests and esteemed colleagues,

I stands as a remarkable thread, weaving its way through the annals of time. It is a day the Lord has gifted us, a day of profound significance that resonates not only in my life but in the lives of all Nigerian Engineers.

Today, as I stand before you, I carry with me the profound weight of the countless individuals who have played a role in shaping my life's trajectory Engineers and non-engineers alike, your influence has been immeasurable. It is to you, the architects of my journey, that I extend my heartfelt gratitude. For, without your support, your guidance, and your unwavering faith, the woman who now stands before you would not be. This saddle of leadership is a mantle that I accept with humility and purpose. As we take this transformative journey together, my mind is captivated by a single word: "rebirthing." "Rebirthing" is not just a word; it is a beacon guiding us toward new horizons. It resonates with me as a woman and a mother, embodying the spirit of renewal and nurturing. Just as we women embrace the responsibility of nurturing and nourishing life, I solemnly pledge to nurture engineering to new heights during my tenure.

Hence, I am honored to unveil our theme for the next two years: "Rebirthing the NSE for the Growth, Empowerment, and Advancement of Engineering in Nigeria." This theme encapsulates our collective mission, reflecting a commitment to not only continue from the lofty heights to which the Past Presidents of this noble body have taken our society but to propel engineering in Nigeria to soaring new heights. In the sections that follow, I will unveil our strategic blueprint to achieve this vision and I will issue a compelling "Call to Action" that beckons all members of NSE to unite, empower, and advance engineering excellence.

NSE'S JOURNEY OF RESILIENCE, PROGRESS, AND TRIUMPH

Distinguished members of the Nigerian Society of Engineers, Ladies and gentlemen, As we gather here today to embark on this transformative journey, we cannot move forward without recognizing the path that has brought us to this moment. Our history, filled with resilience, progress, and unwavering commitment to engineering excellence, stands as a testament to the remarkable journey that has led us to where we are today.

OUR LOGO: A SYMBOL OF UNITY AND PRIDE

Ladies and gentlemen, esteemed members of the Nigerian Society of Engineers, I am deeply moved by the symbolism within our beloved NSE logo—a circular emblem that is not just a mere graphical illustration or drawing but a reflection of our identity, our values, and our aspirations. It is a symbol that unites us, drives our innovation, and represents the very core of engineering excellence.

CHARTING THE PATH TO ENGINEERING PROGRESS: MARGARET OGUNTALA PRESIDENTIAL STRATEGIC AGENDA (MOPSA) UNVEILED

Esteemed guests and cherished members of the Nigerian

Society of Engineers (NSE). I acknowledge that setting clear focus areas is paramount to guiding our collective efforts. In response to the question of what will define the key focus areas for my tenure, I am delighted to introduce you to a strategic agenda that will underpin our mission—a roadmap that we have aptly named the "Margaret Oguntala Presidential Agenda," or MOPSA for short.

ENGINEERING EXCELLENCE IN ACTION: OUR STRATEGIC PRIORITIES

We have embarked on a journey of transformation, and our mission is clear—to lead the rebirth of the NSE and elevate engineering in Nigeria to new heights. Today, I present to you the roadmap that will guide us in turning our vision into a reality; a set of strategic priorities that will propel our noble society forward: -

1. **Enhancing Mandatory Professional Development**
2. **Embracing Technological Innovation:**
3. **Advancing Innovation with Engineering Hubs**
4. **Empowering VSTEM**
5. **Advocacy and Collaboration**

CONCLUSION

In closing, let me leave you with a simple yet profound thought by Henry Ford: "Coming together is a beginning. Keeping together is progress. Working together is a success." By coming together, we begin the path to progress. By keeping together, we make steady progress, and by working together with unwavering dedication, we will undoubtedly achieve success. Our journey is only just beginning, and I am excited to walk this path with you all.

May our shared journey be filled with accomplishments, discoveries, and the boundless spirit of engineering excellence!

God bless The Federal Republic of Nigeria. Thank you!
God bless The Nigerian Society of Engineers (NSE).
God bless The Federal Republic of Nigeria.

ENGR. MARGARET AINA OGUNTALA, FNSE
President/Chairman-in- Council
The Nigerian Society of Engineers

HEAVY VEHICLES AS A MAJOR CAUSE OF ROAD DISTRESS ON OTA-IDIROKO ROAD

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ABSTRACT
The prevalence of flexible pavement deterioration in the country has been adduced largely by highway researchers to trucks or heavy vehicles carrying much in excess of permitted legal limits. This study investigated levels of deterioration of Ota - Idiroko road as caused by heavy vehicles through a 7 day traffic counts conducted at 3 strategic points [Honda Bus-stop (Ota), Bells University Main Gate (Ota) and A.U.D Primary School (Atan Ota)] along the road. Traffic data generated were analyzed with AASHTO Design Guidelines (1993) to evaluate Equivalent Single Axle Loads (ESALs) and Vehicle Damage effects on the road. The Traffic Volume, Average Daily Traffic (ADT), and Average Heavy Vehicle per day (AHV/day) were estimated to be 729, 800; 104, 257; and 3, 444 respectively. Motorcycles, Tricycles, Passenger cars and Heavy vehicles constitute 30.21%, 13.60%, 59.2% and 3.30% of the total traffic volume respectively. ESALs were estimated according to AASHTO Design Guidelines to be 76, 797. An average Load Equivalency Factor (LEF) of 3.913 was estimated for each heavy vehicle plying the road which could explain some failures (alligator cracks, potholes, depression, linear or longitudinal cracks along the centre line amongst others) noticed on the road.

Keywords: Flexible pavement deterioration, traffic counts, Equivalent Single Axle Load (ESAL), Load Equivalency Factor (LEF).

1.0 INTRODUCTION

Pavement is an engineering structure placed on natural soils and designed to withstand the traffic loading and the action of the climate with minimal deterioration, and in the most economical way (Hudson *et al*., 2003; Osadebe etal, 2019; and 2021). Every vehicle which passes over a road causes a momentary, very small, but significant deformation of the road pavement structure. The passage of many vehicles had a cumulative effect which gradually leads to permanent deformation. Magnitude and configuration of vehicular loads together with the environment have a significant effect on induced tensile stresses within flexible pavements (Yu *et al*., 1998). Heavy vehicle load on the pavements subjects them to high stresses causing damage. However, not all trucks have the same damaging effects; the damage on the road pavement depends on speed, wheel loads, number and location of axles, load distributions, type of suspension, number of wheels, tire types, inflation pressure and other factors (Gillespie *et al*., 1993; Osadebe etal, 2019; and 2021).

A flexible pavement combines layers of generally different materials in a structural system designed to withstand the cumulative effects of traffic and climate to the extent that, for a predetermined period, the foundation or Subgrade is adequately protected and the vehicle operating costs, safety and comfort of the road user are kept within tolerable limits (Mc Elvaney etal, 2005; Osadebe etal, 2019; and 2021). Pavements are designed to last for a specific number of years. However, the life of a pavement can be extended by carrying out appropriate maintenance. It is assumed that the pavement deteriorates due to repetition of the stresses, strains and deflections generated by traffic loads, ultimately reaching a terminal condition that necessitates strengthening. A number of factors can contribute to the failure or deterioration of a pavement. The aim of this paper however is to evaluate the damaging effects of heavy axles on flexible pavement.

Traffic loading in terms of numbers and axle repetitions had shown to be one of the major causes of pavement failure. The failure of a flexible pavement is represented by localized depressions and heaving up in its vicinity. The sequence of depressions and heaving-up develops a wavy surface of the pavement. Settlement of any of the component layers of the pavement develops waves and corrugations or longitudinal ruts and shoving on the pavement surface (Kadyali & Lal, 2008; Osadebe etal, 2019; and 2021).

Sub-grade failure has been attributed mostly to excessive stress application from more load than designed, and inadequate thickness (Ndoke, 2013; Osadebe etal, 2019; and 2021). The sub-base and base

failures have been attributed mostly to the loss of cohesion or binding action under repeated application of loads. Finally, even the failure of the surface is attributed partly to traffic loading (Ndoke, 2013; Osadebe etal, 2019; and 2021). Since traffic loading is a recurrent factor in the failure of all the layers, there is therefore the need to look at the impacts of axle load on pavement failure (Ndoke, 2013; Osadebe etal, 2019; and 2021).

Several previous studies on road damage that have been done by researchers identified overloaded heavy vehicles as the primary cause of road pavement structure distresses, with service lifetime decreasing during design life time (Rahim, 2000; Koesdarwanto, 2004; Sulisty etal, 2002 and Osadebe *et al*., 2013). The presence of overloading is indicated by the width area of rutting which is more than 60% of total road structural distress per Km and by maximum axle load (MAL) of the heavy vehicle which is larger than the standard MAL. Evaluation of the effect of heavy vehicle overloading to the pavement damage/service life on the road by Sulisty etal, 2002, concluded that because of overloading on the road, there was a decrease of 1.4 year design life or 28% of the original design life 5years. The studies on Road Pavement Failures by Osadebe *et al*. (2013) and Osadebe etal, 2019, concluded that owing to high volume of heavy vehicles with high axle loading, the maximum allowable axle load limits in service along Port Harcourt-Enugu road and Abuja-Kaduna-Kano road exceeded the design provisions by as much as three folds which accounted for the levels of deterioration of the roads. Osadebe etal, 2021, on comparative analysis of effects of heavy vehicles on roads in Southern and Northern Nigeria estimated an average load equivalency factors of 3.43 and 3.02 respectively for each heavy vehicle plying the roads and this could explain some failures; alligator cracks, potholes, depression, longitudinal cracks along the centre-line inherent on the roads. The failures were caused by overloading of heavy vehicles, unstable subgrade, subbase, base and asphaltic materials, lack of proper maintenance culture, lack of proper compaction to mention, but few. They added that trucks or heavy vehicles carrying much in excess of legal limits were largely responsible for deplorable state of the road and recommended that, weigh bridges be introduced on all highways in Nigeria in order to ensure that maximum allowable load limits in service do not exceed the design provisions.

The presence of heavy vehicles on Ota-Idiroko road is enormous because of various industries in Ota and Agbara towns in Ado-Odo/Ota Local Government Area. This road is constantly in distress as a result of activities of heavy vehicles plying it; hence this study investigated the effect of heavy vehicles on pavement deterioration of Ota-Idiroko road by determining average load equivalency factor of each heavy vehicle and its effect on the road using AASHTO Design Guideline (1993).

2.0 METHODOLOGY

2.1 Preliminary Field Investigation

Field investigation of the carriageway, shoulders, drains, cuts, embankments, etc., was conducted in order to assess the structural conditions, the extent of defects, deterioration or failure and identify major surface features which provide sufficient information for the detailed fieldwork. Most importantly, this exercise was embarked on in order to identify appropriate spots or locations where traffic counts could be administered along Ota - Idiroko road. Consequently, 3 locations spanning Sango Ota through to Atan Ota were chosen; Honda Bus stop, Bells University Main Gate, and A.U.D Primary School, Atan.

2.1.1 Field Investigation

A 7 day traffic counts were manually carried out simultaneously at 3 different locations (Honda Bus Stop, Bells University Main Gate and N.U.D Primary School, Atan) along Ota – Idiroko road at coordinates of (Latitude 6° 40' 53.544" N Longitude 3° 11' 51.276" E, Latitude 6° 40' 58.800" N Longitude 3° 10' 27.942" E and Latitude 6° 39' 40.604" N Longitude 3° 5' 30.816" E) respectively as shown is Figure 1. This was done to evaluate the traffic characteristics (most especially number of heavy vehicles), equivalent single axle load (ESAL), heavy vehicle damage effect factor et cetera.

However, to quantify traffic loads on the test pavements, the heavy vehicles considered to cause structural damage to the pavement were given special attention. The three classes of vehicles categorized as truck-type (heavy vehicle) were considered in this study, in accordance with 1993 AASHTO Design Guide requirement. They are vehicle-class of 6B for 2-axle trailer, 7A for 3-axle trailer and 7C for more than 3-axle trailer. Vehicle-class 7C consists of three sub-classes; they are 7C1 for 4-axle trailer, 7C2 for 5-axle trailer and 7C3 for 6-axle trailer. Adopting the AASHTO Road test data for the load distribution of axle load using Equation 1 below to obtain the respective load equivalent factors for the damaging effect of the vehicle on the pavement. This process was repeated for all the categories of the vehicles that have damaging effect as analyzed in the traffic count (Rolt, 1981; Parsley and Ellis, 2003).

The traffic volume on the road was estimated in terms of Equivalent Single Axle Load-ESAL. An

Equivalent Standard Axle is defined as "a Single Axle carrying a load of 80KN or 8.16 tonnes spread over two sets of dual tyres, each dual set separated by 300mm (Parsley and Ellis, 2003). Light vehicles and passenger cars are not considered in estimating the damaging effect of the traffic loading on the road. Axle loads were converted to ESALs using the "Fourth Power Rule". Vehicle Damaging Factor or axle load equivalency factor (LEF or E) of each heavy vehicle was determined using 1993 AASHTO Design Guide procedure, as follows.

$$EF = \left(\frac{Axle\ Load}{80kN}\right)^4 \qquad (1)$$

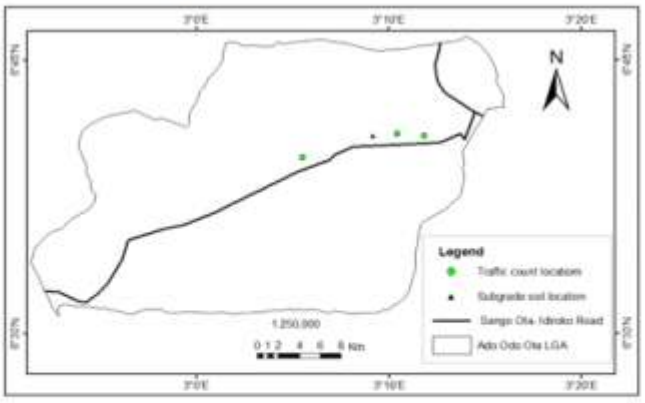

Figure 1: Map Showing the Study Area (Ota - Idiroko Road)

3.0 RESULTS AND DISCUSSION

3.1 Traffic Characteristics of Ota-Idiroko Road

Table 1 shows the traffic characteristics of Ota - Idiroko road from where it could be seen that a total of 729, 800 vehicles were counted, indicating a total traffic volume on both directions. Motorcycles, Tricycles, Passenger cars, and heavy vehicles constitute 30.21% (220, 446), 13.60% (99, 230), 59.2% (386, 014) and 3.30% (24, 110) of the total traffic volume respectively. The average daily traffic (ADT) and average heavy vehicles per day (AHV/day) were estimated to be 104, 257 and 3, 444 respectively.

Table 1: Summary of Traffic Data at Each Counting Station

Type of vehicle	Honda Bus Stop, Ota		Bells Univ. gate, Ota		N.U.D Primary Sch. Atan-Ota		Total	Total
	Idiroko bound	Ota bound	Idiroko bound	Ota bound	Idiroko bound	Ota bound	Idiroko bound	Ota bound
Heavy vehicles	5, 001	4, 452	4, 609	4, 143	2, 967	2, 938	12, 577	11, 533
Passenger cars	66, 802	73, 070	64, 400	68, 730	51, 564	61, 448	182, 766	203, 248
Tricycles	21, 139	21, 805	23, 074	21, 013	66, 093	6, 106	50, 306	48, 924
Motorcycles	42, 352	52, 045	42, 967	46, 979	18, 305	17, 798	103, 624	116, 822
Total							349, 273	380, 527

Total Traffic Volume on both directions = 729, 800
Average Daily Traffic (ADT) = 104, 257
Number of Heavy vehicles = 24, 110
Percentage of Heavy vehicles on each lane = 3.6% (Idiroko bound), 3.03% (Ota bound)
Overall percentage of Heavy vehicles = 3.30%

3.2 Effect of Heavy Axles on Ota – Idiroko Road

The overall equivalent single axle load on Ota - Idiroko road was estimated to be 76, 797 in 7 days according to AASHTO Design Guideline (1993). However, from the analysis from Table 2, an average heavy vehicle on the expressway possesses an average equivalent factor of 3.913 which is approximately four times the standard axle weight for road pavement. This indicates that an average truck on the road studied caused the same pavement damage as almost four standard axles of 80KN would cause. It shows there is high degree of overloading on the road which is one of the major causes of pavement deterioration. However, the percentage of heavy vehicles causing this structural damage to pavement is 3.3%.

A total of 24, 110 heavy vehicles (trucks) of various categories were counted, each possessing an average equivalent factor of 3.913 for the seven days of survey. This implies that on the average, each heavy vehicle on Ota-Idiroko road causes three times the damage of the standard weight legally permitted on the pavement of Nigerian roads. The computed value is high and excessive and probably constitutes one of the major reasons for deterioration of road pavements along Ota-Idiroko.

Table 2: Distribution of Equivalent Number of Vehicle Axle Load Based on 1993 AASHTO Design Guideline considering Heavy vehicles

Category of vehicle/No. of Axle	Code	Total load axle distribution (ton)	Total no. of vehicles		Load Equivalency Factor (LEF per vehicle)							Total load equivalency factor (LEF)	LEF * No. of vehicle		Av. LEF (All vehicle)
			Idiroko bound lane	Ota bound lane	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6	Axle 7		Idiroko bound lane	Ota bound lane	
Truck 2 Axle		18	1845	7193	0.2923	2.2553						2.5476	20692	18326	3.913
Truck 3 Axle	1-1-2	27	78	56	0.2923	2.8362	2.8362					4.3647	306	244	
Truck 4 Axle	1-2-1.1	39	1222	1252	0.2923	2.8362	2.8362*					4.3647	5334	5465	
Truck 4 Axle	1-1-2.2	39	448	447	0.2923	2.8362	2.8362					4.3647	1955	1951	
Truck 4 Axle	1-2-2.2	39	1762	1598	0.2923	2.8362	2.8362*					4.3247	7619	6973	
Truck 5 Axle	1-1.2-2.2	40	42	41	0.2923	2.8362*		2.8362*				4.3247	183	179	
Truck 5 Axle	1-2.2-2.2	40	466	417	0.292	2.8362*		2.8362*				4.3247	2034	1820	
Truck 6 Axle	1-1.2-2.2.2	51	11	9	0.2923	2.8362*		1.3580**				3.6883	41	33	
Truck 6 Axle	1-2.2-2.2.2	51	484	481	0.2923	2.8362*		1.3580**				3.6883	1785	1774	
Truck 7 Axle	1-2.2.2-2.2.2	51	29	39	0.2923	1.3580**			1.3580**			3.0019	87	118	
													39,912	36,885	

Note: * Tandem group axle ** Tridem group axle.
1 – Single wheel single axle
2 – Double wheel single axle
1.1 – Single wheel double axle
2.2 – Double wheel double axle
1.1.1 – Single wheel triple axle
2.2.2 – Double wheel triple axle
The Equivalent Single Axle Load (ESAL) on Idiroko bound = 39, 912
The Equivalent Single Axle Load (ESAL) on Ota bound = 36, 885
The overall ESAL on Ota - Idiroko road = 76, 797

4.0 CONCLUSION

The Traffic Volume, Average Daily Traffic (ADT), and Average Heavy Vehicle per day (AHV/day) were estimated to be 729, 800; 104, 257; and 3, 444 respectively. Motorcycles, Tricycles, Passenger cars, and Heavy vehicles constitute 30.21%, 13.60%, 59.2% and 3.30% of the total traffic volume respectively. An average load equivalency factor of 3.913 was estimated for all heavy vehicles using AASHTO Design Guidelines. That is, each heavy vehicle that plies the road has same damaging effect as approximately four standard axle load of 80KN. Obviously the road is overstretched as it's being subjected to loading beyond permitted legal limit of standard axles. The failures noticed on the road such as alligator cracks, potholes, depression, rutting, and longitudinal cracks could be as a result of/or combination of factors and not limited to overloading from heavy trucks. The factors could include poor or unstable subgrade, subbase, base and asphaltic materials, lack of proper supervision or poor quality control measures, lack of proper maintenance culture, lack of proper compaction to mention but few.

5.0 RECOMMENDATION

It is recommended that weigh bridges should be introduced on Ota-Idiroko road and all highways in Nigeria in order to ensure that maximum allowable load limits in service do not exceed the design provisions.

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HISTORY AS NIGERIAN SOCIETY OF ENGINEERS GETS FIRST FEMALE PRESIDENT

Engr. Margaret Aina Oguntala, FNSE
PRESIDENT/CHAIRMAN-IN-COUNCIL

Engr. Ali Alimasuya Rabiu, FNSE, FAENG
DEPUTY PRESIDENT

History was made in Abuja on Saturday 20th January, 2024, as the Nigerian Society of Engineers, NSE, inaugurated its first-ever female president, Engr. Margaret Aina Oguntala, FNSE. Engr. Oguntala with her inauguration became the 34th President of the Nigerian Society of Engineers.

Speaking shortly after her investiture, she urged the Federal Government to implement fully the Presidential Executive Order 5, which promotes the consumption of made-in-Nigeria goods and services.

She called on the government to amongst other things "implement the GL 09 entry point for engineers in some of the states that are yet to effect the enhanced entry point for engineers in civil service.

Formulate a policy to compel employers of labour to pay commensurate welfare packages/hazard allowances for engineers.

"Implement Executive Order 5 with sincerity of purpose.

Promote Nigerian-made goods and services. Have the Presidency invite the NSE to nominate engineers for inclusion in the newly formed "Policy Coordination, Evaluation, Monitoring, and Delivery Unit" as announced by President Bola Ahmed Tinubu in his 2024 New Year broadcast. We praise the President for this initiative.

"Encourage entrepreneurship by providing incentives and support for engineers in small businesses and startups in the extractive industry. Promote STEM education to encourage more students to pursue engineering careers and contribute to nation-building".

Earlier in his Keynote Address, Senator President Godswill Akpabio praised the society for electing its first female president. Represented by Deputy Senate President, Barau Jubrin, Akpabio said: "Oguntala's appointment serves as a powerful testament to the fact that talent, dedication, and expertise know no gender boundaries. It is a clear indication that the Nigerian Society of Engineers recognizes and values the invaluable contributions of women in shaping the future of engineering.

"Thirty-three (33) men have come before her, serving as presidents of this great body. They have worked tirelessly to make the NSE the outstanding professional organization it is today. Let us applaud their efforts. However, the time has come for the NSE to enter the labor room and give birth to a new version of itself".

He charged the NSE new leadership to focus on the education and training of young engineers, adding that "We must strive to equip our engineers with the necessary skills and knowledge to compete on a global scale.

"This can be achieved through partnerships with educational institutions, industry leaders, and professional organizations. By fostering collaboration and knowledge sharing, we can ensure that our engineers are armed with the latest tools and techniques to tackle complex engineering problems".

Cont'd. on Page 16

2024 EXECUTIVE COMMITTEE MEMBERS

Engr. Margaret Aina Oguntala, FNSE
PRESIDENT/CHAIRMAN-IN-COUNCIL

Engr. Ali Alimasuya Rabiu, FNSE, FAENG
DEPUTY PRESIDENT

Engr. Danladi Ushiki Adamu, FNSE
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Engr. Rachel Ugye, FNSE
EXCO MEMBER

Engr. Tasiu Sa'ad Gidari-wudil, FNSE
IMMEDIATE PAST PRESIDENT

Engr. Joshua Egube, FNSE
Executive Secretary

COURTESY VISIT TO THE NIGERIAN BUILDING AND ROAD RESEARCH INSTITUTE (NBRRI). LED BY OUR NATIONAL CHAIRMAN, ENGR. SAIDU HASSAN, FNSE, FNIHTE.






NATIONAL ASSEMBLY'S ONE DAY PUBLIC HEARING ON CONCRETE VS. ASPHALT ROAD, PRESENTED BY NIHTE PROFESSIONALS, LED BY NIHTE NATIONAL CHAIRMAN, ENGR. SAIDU HASSAN, FNSE, FNIHTE, ON 28TH NOV., 2023





ROAD CONSTRUCTION IN THE SAHEL: A CASE STUDY OF DAMASAK – DIFFA ROAD

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ABSTRACT

In the continent of Africa, the Sahel zone can be found around the mid of upper half and spans from the west to the east belt. With this location, a very small segment of it falls into the far north-east of Nigeria (Figure 1). This small Sahel land area in Nigeria houses Damasak and Dutse (Also known as Duji) towns, while Diffa town is located in the Republic of Niger. The design of the two lane single carriage way, Damasak – Dutse (Duji) - Diffa road was based on the nature of the soil and the terrain found in the Sahel region. After due investigation of the terrain, the soil along the alignment was found to be 'Aeolian' type, which has been transported and laid down by the wind over a long period. The soil texture is essentially sandy that are more of 'Loes' than 'Dune'. The engineering properties show the soil to be very porous, free draining and light in weight. After further detail tests, the road pavement was designed to have fills and sub-base materials obtained by excavation of the top layers of the deposited Aeolian soil in the local borrow pits down to the level at which soils with heavier and larger particle sizes suitable for road fills and sub-base course were found. With due consideration of the available alternatives and bearing in mind the cost implications, the base-course on the carriage way and shoulders were respectively designed to be crushed stone and laterite soil, both imported with great haulage distances from outside the project area. To secure the post construction stability of the pavement embankment made with less cohesive materials of sand and crushed stone base, concrete hunches were provided at the two sides of the entire road length as protection.

Key Words: Sahel, Pavement, Aeolian, Loes, Dunes, Hunch.

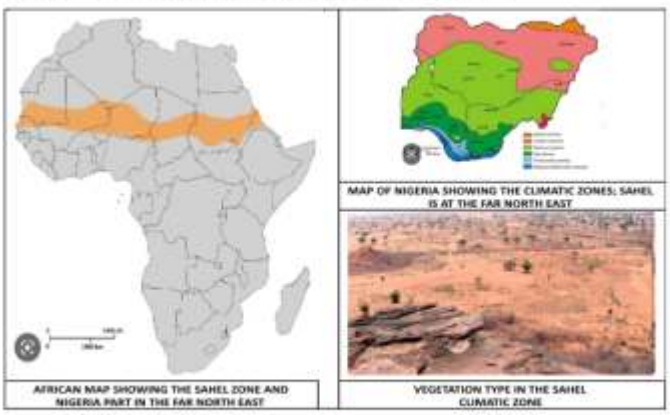
1.0 INTRODUCTION

Africa is the world's most tropical continent. From North to South, it comprises four main Sub-Saharan climatic zones namely; the Desert - popularly known as the Sahara Desert, the Semi-Desert - otherwise known as the Sahel, the Savanna, which is essentially made of grasslands and lastly the tropical forests - known widely as the tropical rain forest. The entire land area of Nigeria falls within the tropical zone of Africa. From south to north, the climatic zones in Nigeria is made up of the mangrove salt water swamp, fresh water swamp and tropical rain forest zones in the south. Moving up is the lager middle areas of the guinea and the Sudan savannah zones that makes up the north, while the very small Sahel zone of essentially a semi-desert, lies in the upper north east of the country, see Figure 1.

Damasak, Dutse (Duji) and Diffa towns are entirely within the Sahel zone, while Damasak and Dutse are located in the extreme upper North of Borno State in Nigeria, Diffa is located in the Diffa Region of Republic of Niger. Damasak – Diffa Road is a segment of the International Trans-Sahara Road.

This paper is an overview of Damasak – Dutse (Nigeria) – Diffa (Niger Republic) Road, the construction was awarded to the duo of Messrs. CGC Nigeria Limited as the main contractor and Ove Arup and Partners Nigeria Limited as the external supervising consultant. The general supervision of the entire site works was by the Federal Ministry of Works, Nigeria with the Engineer's Representative appointed by her as the head. The project traverses entirely inside the Sahel Climate zone which is the beginning of the arid Sahara Desert. The site works starts with physical study and preliminary investigations of the route. This was followed with a study of all the possible construction options for merits and demerits. A comprehensive soil investigation was thereafter done for decision on the materials to be used for the construction works, the workmanship method to be employed, bridge and other hydraulic structure locations and other technicalities for the achievement of the professional best practice. In figure 1 are illustration maps of the zone and the vegetation.

FIGURE 1: THE SAHEL CLIMATIC ZONE



COURTESY: web.ccsu.edu and WIKIPEDIA

1.0 MATERIALS AND METHODS

2.1 THE PRELIMINARIES

Damasak – Dutse (Nigeria) – Diffa (Niger Republic) Road is 35.5km long. It starts from Damasak town in Nigeria and ends in Diffa town in Niger Republic. The segment in Nigeria is 29.1km, and it starts from Damasak and ends in Dutse also referred to as Duji which is located at the bank of River Yobe. The river forms the boundary between Nigeria and Niger Republic in the area. The remaining 6.4km length of the road lies inside Niger Republic and terminates at a junction in the central part of Diffa town.

The road is to be constructed from a virgin land with the existing alignment not having any form of foot, animal and cycle tracks. As a result of this, considerations for alternative routes were made prior to selection of the final route. At the start of construction works, the alignment to work on was already specified in the working drawings. However, the physical route as constructed was based on the comprehensive survey works, results of various tests carried out on site and other findings.

2.2 ROUTE INVESTIGATION:

As expected of the semi-desert Sahel Climatic Vegetation, the project route was an area that has been affected by the expanding desertification through droughts, deforestation, climate change and human activities which have already took place in the area.

After comprehensive soil investigations, the conclusion arrived at is that the road is to be constructed on soils that consists of geologically sandy 'Aeolian' type which has been transported by the wind and get deposited over a long period. The soil's texture is essentially sandy with more of 'Loes' than 'Dune'. This type of soil is generally not good for highway construction due to its light

FIGURE 2: THE PROJECT TERRAIN SHOWING THE SAHEL (SEMI-DESERT) VEGETATION2

A SECTION OF THE PROJECT ROUTE / ALIGNMENT SHOWING SAHEL VEGETATION

SECTION OF THE PROJECT ROUTE SHOWING SAHEL VEGETATION AND SAND DEPOSITS

2.3 DETAIL GROUND INVESTIGATIONS:

The detail investigations were carried out along the road alignment by digging test pits and subsequent study of the soil stratification. With the physical study of the area being made up of essentially sandy materials, concentration was made of the grain size of the materials for classification with respect to the anticipated behaviour under both dead and live loads. Also, the soil classification zone, soil mechanical calculation parameters and if there will be need for soil improvement measures were done at this stage.

Findings from the detail ground investigation indicated that the entire length of the road alignment lies on layers of sands. The stratification study shows that the grain size slightly increases with depth and at a stage remain constant. Except the section around the River Yobe at the Nigeria - Niger Republic border, the other parts of the alignment were found out to be similar in geotechnical properties of being light in weight and very porous with free draining properties (CGC Nig. Ltd.)1. All these findings were characteristics of the soils peculiar to the ones in the Sahel (semi desert) and the Sahara Desert Climatic zones.

2.4 THE SOIL TESTS

After clear identification of the nature of the terrain and soil formation along the road alignment, both physical examination and suitable laboratory tests were carried out for the determination of the soil properties. The physical examination and laboratory tests carried out on the soils at various segments of the road alignment were; -

a. **Visual Tests** – These were done on the existing surface soils and on the materials brought out from the test pits dug at regular intervals along the route. The intervals were reduced at areas identified to be at slightly low level and retaining water during rainy seasons.
b. **Grain size analysis / Particle size distribution** – This test was given special attention since the area is sandy which is peculiar to semi desert area known to be the beginning of the arid Sahara Desert.
c. **Atterberg limits / Hydrometer tests** – This is done on the very fine soils especially those found on the surface of the route.
d. **Permeability / Porosity Test -** This test gives the degree of water passing through the soil voids. Since materials for the fills and sub-base course are to be sourced locally, very special attention was given to this test to determine the suitability for use on the project.
e. **Consolidation test** – Sandy soils are generally with very low compressibility when enclosed, this test was hence also given attention so that possible undulation of completed road can be prevented in future.
f. **Other Tests** – Relevant tests also carried out on the soil along the route include; Shear strength test, bearing capacity determination, likely organic components, mineral components, creeping or long time settlements and other minor but known to be relevant tests.

3.0 RESULTS AND DISCUSSIONS

The findings from the preliminary and detail ground investigations and results of the actual tests carried out made the nature of soils along the route to be concluded as follows (CGC Nig. Ltd.)1; -

a. The type of soil in the entire project route is 'Aeolian', which is essentially deposited sandy soil grains after being transported by the wind forces. The deposits have occurred over a long period and production of layers of same to some depth has taking place.
b. The deposited sandy soil is characterized with large quantity of "Loes' which must have been transported from the Lake Chad banks and get deposited in the adjacent environment including the project area.
c. Low quantity of 'Dunes' sands were identified in the sand deposits. This is normal for sands usually found in the arid and temperate regions like Sahel which is essentially a semi desert climatic zone and beginning of the Sahara Desert.
d. The grain size of the soil deposits increases with depth. The sand deposits have fines (less than 0.075mm) around the surface, fine sand (0.075mm – 0.425mm) as one moves down and thereafter, the texture changes to medium sand (0.425mm – 2.00mm) at deeper depth. At a particular depth, the grain or particle size remains constant. This is expected since the light particle at a particular time must have been carried away by the wind forces leaving the larger particles of same average size in place.
e. The engineering properties of the soils along the route were found to be [1] very porous, [2] free draining, [3] light in weight compare to river sands, [4] have a moderate dry unit weight of about 1440kg/m3 and traces of calcium carbonate found in it.
f. The results made conclusion to be that the existing soils at moderate or shallow depth along the route are generally not good for road construction. This is mainly due to its light weight and low dry unit weight.

4.0 THE DESIGN

4.1 THE ROAD COMPONENTS: Based on the investigations carried out and results of all the tests done at the initial design of the road prior to award for construction, the components of the road incorporated in the working drawings for use of the contractor and the supervising teams comprise of: -

a. A 3.0km bypass that starts with a rotary junction (roundabout) at the outskirt of Damasak town on the Gubio – Damasak Road and also terminate with a rotary junction (roundabout) at KM3.0 on Damasak – Kukuwa/Baga Road.
b. 29.1km Damasak – Dutse Road in Nigeria. The section starts from the rotary junction where the bypass terminates and ends at the beginning of the bridge on River Yobe which is the border between Nigeria and Niger Republic.
c. A 1.4km spur to Dutse Town starting from a point on the Damasak – Dutse Road with end point near the market in the central area of Dutse town.
d. 6.4km that starts at the end of the Yobe River Border Bridge and terminates at a junction along another highway in Diffa town inside Niger Republic.

The line diagram of the project plan showing the main features and a view from Google Earth are as presented in figure 3.

FIGURE 3: THE GOOGLE MAP VIEW AND THE PLAN OF DAMASAK – DIFFA ROAD

4.2 THE DESIGN TECHNICALITIES: The technical design features for the entire road alignment as per the working drawings are; -

a. The route is to be excavated to a depth at which soils that satisfy the specifications are found. The depths here have been predetermined during the initial design stage and were found to be the same with the site findings.
b. The fillings and the sub-base course are to be done with natural granular materials obtained from local borrow pit locations at reasonable haulage distances.
c. The base course on both the carriageway and shoulders are to be crushed stone base from an approved quarry with good / sound igneous rock deposits that will produce requisite aggregates that meets specifications. It needs be noted that the alternative of using sand-bitumen stabilized sand base course which is technically the best option was initially used in the design. However, subsequent consideration of crushed stone base must have been made due to the reality of difficulty in availability in abundance of good natural sand with required specifications in the locality.

d. Provision of concrete hunches at the two sides of the entire road to protect the materials used for the pavement construction. This is necessary to ensure the post construction stability of the pavement since the embankment fill, sub-base and base materials are not with high cohesive force.
e. Carriageway surfacing is designed to be 60mm asphaltic concrete binder course and with 40mm asphaltic concrete wearing course as final surface.
f. The Shoulder surfacing is to be one coat of surface dressing.

4.3 CHANGES IN THE DESIGN: Two major changes were made to the working drawings; one was as a result of response to a request of the Dutse (Duji) community while the other was purely technical. The two changes were necessitated as a result of; -

a. The project as per the working drawing is to have a spur to Dutse town from a point on the Damasak - Niger Republic Border. This design does not go well with the Dutse community as they want the main road to pass through their town. Formal plea was made on this to the Honorable Minister of Works. On consideration and approval of the appeal by the authorities, the investigations conducted reveals that the original design made provision for spur to avoid construction of two bridges at two locations where the route crosses two different branches of River Yobe. To solve this, a study of the existing bridge at Nigeria / Niger Republic Border which is essentially a six cell 6 x 6 box culvert was made. Suitability of a replica of same at the two locations was made by the Ministry's Bridges and Design Department. With go-ahead gotten, the realignment of the road was made to pass through Dutse town with inclusion of the six cell 6 x 6 box culvert at the said two locations.
b. The original design provided crushed stone base for both the carriageway and the shoulders. However, a study of the weather effect on the land surface in the area during the peaks of the long dry season indicates high level of brittleness. Crushed stone base material is known to have high brittle properties with less cohesive force. Apart from the shoulder providing lateral support for the carriageway, it is the part of the highway on which vehicles brake for either permanent or temporary stoppage. Therefore, considering the very low cohesive property of the crushed stone base when covered with single coat surface dressing, it is envisaged that the skidding and corresponding vibration effects shall make the surface dressed covered crushed stone base shoulders highly susceptible to cracking that will lead to failure especially during the long dry season peaks. The initially designed crushed stone base on shoulders was hence concluded to be inappropriate. It was hence proposed to be replaced with a lateritic material with known reliable cohesive properties irrespective of the type of covering and weather conditions. This change was approved by the authorities and the implementation follows on site.

FIGURE 4: SITE OF A PROPOSED BRIDGE AND THE EXISTING SIMILAR ONE[2,3]

ONE OF THE SITES FOR THE TWO BRIDGES / SIX CELL 6x6 BOX CULVERTS TO BE CONSTRUCTED ON TWO BRANCHES OF RIVER YOBE

RIVER YOBE BRIDGE / SIX CELL 6x6 BOX CULVERT AT NIGERIA – NIGER REPUBLIC BORDER NEAR DUTSE TOWN

4.4 THE CONSTRUCTION WORKS: Bearing in mind the fact that the project is a very important one due it's being an International Trans Sahara Road which spans through Nigeria and Niger Republic, the construction works were carefully executed with strict adherence to all the necessary specifications. The necessary reference documents with which the project was to be implemented including Highway Manual Volumes I – VII, Contract documents Volumes I – III, Fundamental Integrated Site Services (FISAS) reference document and others were readily made available on site.

The progress of the project continued to move steadily and attained 31% as at September, 2012 when a security incident occurred. Pictorial presentation of some of the achievements on the project are as illustrated in figure 5, (Fadire, 2012)[3].

FIGURE 5: THE PROJECT'S PICTORIAL PROGRESS / ACHIEVEMENTS[3]

PRIME COAT ON THE CARRIAGEWAY ALREADY COMPLETED WITH CRUSHED STONE BASE COURSE

COMPLETED BINDER COURSE ON CARRIAGEWAY WITH SHOULDERS READY FOR LATERITE BASE

IN PROGRESS: LATERITE BASE COURSE ON THE SOFT SHOULDERS

COMPLETED ROAD SECTION AT A ROTARY JUCTION (ROUNDABOUT) UNDER CONSTRUCTION

4.5 THE SITE CHALLENGES: The challenges faced by the site implementation teams on the project both technical and non-technical are numerous. However, the most important ones shall be as briefly mentioned below: -

a. Construction Materials: The project vicinity does not have any basic construction materials. Filling and sub-base materials were obtained at considerable depths in the local borrow pits. The laterite was obtained from Damboa about 300km away from Damasak, while Aggregates (coarse and quarry dust) was gotten from the contractor's quarry along Maidugiri – Damaturu Road about 250km from site. With great distance, the haulage was really not easy to achieve even with the brand new trucks purchased for the purpose by the contractor.

b. Water for Construction: There exists a very long dry season in the project area. As this season sets in, the two rivers in the project area (Yobe River and Misau / Komadugu Gana River) dries up. Getting water quantity enough for construction is always very difficult during this yearly long dry seasons.

c. Weather – Research has shown that Borno State is one of the warmest states in Nigeria with average temperature of 37°C and peak in the far north of the state, (IMPACT, 2022)[4]. The Sahel Climatic Zone which is located in the far north of the state is classified as Semi-Desert, however, the actual weather witnessed in the project area during the dry season is extremely harsh and exactly like that of a desert. The rainy season is short (3 to 4 months) with January as the coldest while the dry season is very long (8 to 9 months) with peak temperature of 45°C most of the period. Record even has it that a temperature of 49.5°C was recorded in Damasak on 7th September, 1978, the highest ever in Nigeria. Though the short rainy seasons produced pockets of surface waters in the slightly depressed areas of the flat terrains in the environment, the produced floods in the sandy terrain are always short lived making the area to be almost dry all year round. This weather conditions, which are adjudged as the most severe and harsh in Nigeria, are very uncomfortable for the project staffs especially the southerners and non-Nigerians alike. However, it was still endured for the success of the project and development of Nigeria.

d. Security: This is the major challenge faced by the implementation teams (the Ministry, the Contractor and the Consultant). Throughout the period the project was on, members of all the three teams live with security tension existing in the environment. Toward the end of September, 2012, there was an attack which lead to the death of a Chinese staff of the contractor (details omitted). The incidence led to moving out of the site by all staffs of all the teams. The project, which was already at 31% completion was abandoned from the day the incident happened till date (March, 2024). Reports has it that after the site security incident, Damasak town witnessed series of other armed attacks with destruction of many assets and infrastructure especially between 2014 and 2017, (REACH, 2021)[5]. It was also reported that 1,633,829 Internally Displaced Persons (IDP) which is about 25% of Borno State population has substantial part of them from Damasak, Baga and area adjacent to the Lake Chad. Diffa Region of Niger Republic is also not left out of the security crises, (IMPACT, 2022)[4].

5.0 CONCLUSION

Construction of roads in the Sahel Climatic Zone is not easy. Though the zone is geographically classified as Semi-Desert, in reality, it has desert weather in most part of the long dry season. However, the experience, expertise, competency and above all the endurance of all the staffs of the Federal Ministry of Works, Messrs CGC Nigeria Limited (the Contractor) and Messrs Ove Arup & Partners Nigeria Limited (the Consultant) were all combined to achieve considerable progress on the works. With 31% progress achieved as at the time of the sad security incidence and the abandonment, it is still hoped that the project area atmosphere shall soon be conducive enough for the construction works to resume and the project completed 100% thereafter.

6.0 AKNOWLEDGEMENTS

The author thanked the trio of Federal Ministry of Works, Messrs CGC Nigeria Limited (the Contractor) and Messrs Ove Arup and Partners Nigeria Limited (the supervising consultant) for the relevant information on the project that originates from their respective organizations and made used of in the paper. Appreciation with thanks also goes to the authors whose reports / publications as listed in the references were used to buttress the points in the paper.

Having served in several states during my service years in the Federal Ministry of Works with the privilege of either worked in or pass through all the states in Nigeria including Abuja, the Federal Capital Territory, the two postings as head of supervising teams on projects in the Sahel (Semi Desert) Climatic Zone with the most severe, harsh and hot weather in the country and the one to Bodo-Bonny at the edge of the Atlantic Ocean with very difficult, soft and wettest terrain in Nigeria are very rare practical field highway engineering experiences an individual civil engineer can get. It is in the light of this that I will, with respect, thank my then duo bosses and retired Directors in the Ministry; Engr. Abubakar M. Gambo who was the brain behind nearly all my postings while in the service including Damasak – Diffa project (2010 - 2012) and Engr. Oluyemi O. Oguntominiyi who was responsible for my last three postings including Bodo – Bonny Road project (2018 – 2020).

Finally, the author wish to dedicate this paper to the living memories of the trio; [1] Engr. Yakubu Yunusa - Principal Resident Engineer, [2] Bukar Dauda - Senior Technical Assistance (Both were members of the Federal Ministry of Works' supervising team, who died shortly after the incidence that led to the site closure), and [3] the CGC Nigeria Limited's Chinese staff who died during the incidence. May their souls rest in peace!

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NIGERIA, CHINA AND UMAHI'S LIFE JAIL PROPOSAL FOR BAD CONTRACTORS

Obinna Odogwu January 17, 2024

Many people in Nigeria, particularly in the South East geopolitical zone, described the appointment of Chief David Umahi as the Minister of Works by President Bola Tinubu as the best and most fitting. They likened it to inserting a round peg in a round hole. This is, perhaps, because of his sterling performance in office while he served as the governor of Ebonyi State. Available records show that the ex-governor, who is a civil engineer by training, performed very well especially in the area of road and bridge infrastructure development. Of all the governors in Nigeria who held sway from 2015 to 2023, Umahi stood and still stands out because of the quality of his projects. But did you expect less from a well-trained civil engineer who had garnered practical experience building such infrastructure in different parts of the country as a contractor before joining party politics? Before his entry into the country's political arena, he was the Chief Executive Officer of an engineering firm and had reportedly co-chaired one earlier.

As a politician, Umahi was first appointed the Acting Chairman of the Ebonyi State chapter of the Peoples Democratic Party (PDP) in 2007. From 2009 to 2011, he served as the state chairman of the party. He later became the Deputy Governor of the state in 2011. He contested that year's election on a joint ticket with Chief Martin Elechi who was the governor of the state at the time. Against all odds, Umahi won the 2015 governorship election. He was reportedly not the preferred choice of his boss, Elechi, who was said to have wanted the then Minister of Health, Prof. Onyebuchi Chukwu.

To justify that hard-earned mandate of his people and, perhaps, to also prove his detractors wrong, Umahi went to work, building some of the best roads, bridges and other infrastructure in the state. He also paid attention to the aesthetics of the state and particularly gave the state capital, Abakaliki, a new look. Beyond infrastructure, he also executed a number of empowerment programs targeted at lifting his people from poverty and energising the state's youth population into productive ventures. Umahi arguably dwarfed all the governors in the country during his time with high quality cement works; delivering solid projects in record time. That, perhaps, informed the commendations the President received when he appointed Umahi into his current position.

After serving as governor, the civil engineer served briefly as senator. He represented Ebonyi South Senatorial Zone from June 13, 2023 to August of the same year before his appointment as minister. He had won the position at last year's General Elections on the platform of the All Progressives Congress (APC). The leadership of the Nigerian Society of Engineers (NSE) testified to Umahi's stellar performance as governor when they paid him a courtesy call in his office in Abuja recently. They also passed a vote of confidence in him according to a statement issued by the minister's Chief Press Secretary, Barr. Orji Uchenna Orji. President of the group, Engr. Tasiu Sa'ad Gidari Wudil, said that the aim of the courtesy visit was to seek areas of collaboration with one of their own and described Umahi's selection as Works Minister as the best so far.

"Since after your assumption of office, we have been

monitoring your progress, and I must tell you we are not surprised. What you did as Governor in Ebonyi State was amazing," Wudil was quoted as saying. Responding, the minister thanked the engineers for their commendations and expression of confidence in him, promising to continue doing his best for the good of the country. But he didn't stop there. He was, however, quick to suggest in a very subtle way that prison sentences would be good for contractors who execute bad jobs in the country, whether foreigners or locals. "I went to China and I saw their roads.

There was no evidence of any maintenance in nearly 30 years. And I asked them what is the reason, and they said that if you build a road in China and within your lifetime, the road fails, they will come for a test and if there is any evidence of compromise, the person responsible goes to prison for life," Umahi's CPS quoted him as saying. The minister obviously could not understand why contractors would do bad jobs after they've been paid for their services with the taxpayers' money; hence, the story of how such contractors were being handled in China. But will the Nigerian government copy China's example and implement it here? Can the relevant authorities begin to look into matters of our infrastructure development to ensure that contractors take responsibility for their bad actions? Can there ever be punishment for those who, through their actions, show that they don't mean well for this country? And will government officials who award or facilitate the award of contracts to incompetent contractors be made to face the music? It was in this country that a governor, now former, was seen in a video stuffing wads of dollars into his 'babariga' or so. Those who had clearer information about what transpired said that the money was a kickback from a contractor. If that was true, how do you expect a contractor to deliver good jobs when he has given you a part of the money meant for the job as a kickback? Given the state of things in Nigeria today, that China's method as narrated by the Minister of Works would be good for this country. But it shouldn't be for the contractors alone.

It should also include government officials and every other person who contributes in one way or the other to the failure of the country's road and bridge projects. To copy and activate China's example here, the Federal Government would need to effect some policy changes and possibly get the National Assembly to make laws or adjust existing ones, if any, to give such a move some legal backings. Many people believe that Umahi can proffer lasting solutions to the infrastructural problems of this country having shown some examples using his state, Ebonyi. And telling the members of the Federal Executive Council or whoever that should hear about this China's example for possible adoption in Nigeria will not be a bad idea. It's about time we started doing things rightly in this country.

2ND EDITION OF NIHTE ANNUAL LECTURE PICTURES









2ND EDITION OF NIHTE ANNUAL LECTURE PICTURES CONT'D.

COURTESY VISIT TO THE FEDERAL ROADS MAINTENANCE AGENCY (FERMA). LED BY OUR NATIONAL CHAIRMAN, ENGR. SAIDU HASSAN, FNSE, FNIHTE.




NIHTE 2023 CONFERENCE & FELLOWSHIP CELEBRATION IN PICTURES

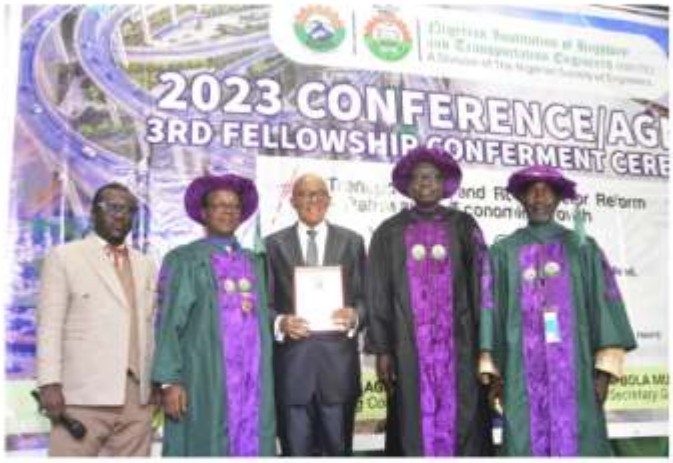








NIHTE 2023 CONFERENCE & FELLOWSHIP CELEBRATION IN PICTURES



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her as a true a visionary leader and change maker.

Similarly, on Monday, April 22, 2024, the Executive Secretary, Engr. Joshua Egube, FNSE led the National Secretariat Staff members on a Celebratory visit to Madam President's Office. A special birthday card was presented to her during the visit, bearing a special message as follows: -

"Our Dear Madam President, we the entire NSE Secretariat staff extend our heartfelt felicitations to you on this occasion of your 60th birthday anniversary. Madam President, you have inspired us tremendously with your unique style of leadership since assumption of office as the 34th President of the Nigerian Society of Engineers. There is no doubt that your vision, resilience and dedication over the years have deservedly brought you the good fortune of becoming the first female President of the Society. Your emergence has shattered the glass ceiling and opened doors of endless opportunities for women in the engineering profession in Nigeria".

2024 FIRST QUARTER NSE PRESIDENTIAL MEDIA PARLEY

The President of the Nigerian Society of Engineers (NSE), Engr. Margaret Aina Margaret Oguntala FNSE, on Monday, April 8, 2024, held a media parley with correspondents from different national print and electronic news organisations at the National Engineering Centre (Headquarters), Abuja.

It will be recalled that Tuesday, April 9, 2024, marks Madam President's 100 days in office. The media parley served as a channel for Madam President to air the views of the Society on pertinent national matters as well as bring to the fore, some of the milestones recorded by her administration as the 34th President so far.

At the event with Madam President were: The Executive Secretary, Engr. Joshua Egube, FNSE; Engr. Dr. Wilson Alli, FNSE; Chairman, Nigerian Institution of Transportation and Highways Engineers, Engr. Saidu Hassan, FNSE, FNIHTE; Chairman, Nigerian Institution of Agricultural Engineers, Engr. Prof. Joshua Olaoye, FNSE; Chairman, Nigerian Institution of Facility Engineers, Engr. Dipo Mabogaje, FNSE; Vice Chairman, Nigerian Institution of Environmental Engineers, Engr. Caius Umekesiobi, FNSE; Chairman, NSE Maitama Branch, Engr. Henry Okoye, FNSE; Vice Chairman, NSE Abuja Branch, Engr. A. S. Y. Kutigi, MNSE; and the Coordinator, Young Engineers' Future Leaders Committee, Engr. Destiny Ikkake, MNSE.

NIHTE FELLOWSHIP CONFERMENT IN PICTURES

The Nigerian Society of Engineers

PRESS RELEASE

ADVANCING NIGERIA'S POWER SECTOR: The Nigerian Society of Engineers Calls for Transparency and Accountability in Tariff Adjustments

The Nigerian Society of Engineers (NSE) stands at the forefront of advocating for transparency and accountability in Nigeria's power sector, particularly in light of the recent tariff adjustments affecting customers falling under Band A.

Amidst the adjustments, it is imperative for regulators to outline clear guidelines and measures to ensure accountability among distribution companies (DisCos) and safeguard the interests of consumers.

As an organisation representing the engineering community in Nigeria, the NSE emphasises the following key points:

1. Sanctions Framework:
The regulator must establish a robust sanctions framework to hold DisCos accountable for any deviations from agreed service levels. Specifically, clear sanctions should be outlined for instances where customers are not supplied with the agreed number of hours under Band A. These sanctions should serve as a deterrent against lapses in service delivery and promote accountability within the sector.

2. Minimum Time for Fault Repairs:
Timely resolution of faults is paramount to minimising disruptions and enhancing customer satisfaction. Therefore, the regulator should define minimum timeframes for fault repairs, ensuring that DisCos prioritise the prompt resolution of issues affecting service delivery. By setting clear standards, consumers can expect improved reliability and efficiency in power supply.

3. Customer Service Applications:
Accessible channels for customers to report faults and service interruptions are essential for maintaining effective communication and addressing consumer concerns promptly. The regulator should mandate DisCos to provide user-friendly customer service applications, enabling customers to log faults and track their resolution status efficiently. This transparency fosters trust and enhances the overall customer experience.

4. Metering Solutions:
Customers falling under Band A without meters should not be disadvantaged. The regulator, in collaboration with DisCos, should expedite metering initiatives to ensure accurate billing practices and transparency in electricity consumption. Every customer deserves fair treatment, and access to reliable metering solutions is essential for achieving this goal.

The NSE urges regulators and stakeholders to prioritize transparency, accountability, and consumer protection in the implementation of tariff adjustments and other policy measures within the power sector. By working together, we can build a sustainable energy ecosystem that meets the needs of all Nigerians and drives socio-economic development across the nation.

Signed:
Engr. Margaret Aina Oguntala, FNSE

GREAT COURTESY VISIT TO FIRST-EVER FEMALE NSE PRESIDENT, ENGR. MARGARET AINA OGUNTALA, FNSE BY NIHTE REPS. LED BY ENGR. SAIDU HASSAN, FNSE, FNIHTE

NIHTE REPS. AT THE BURIAL OF LATE ENGR. ELD. (DR,) ENEBONG ARCHIBONG BASSEY NYA, FNSE, MNIHTE, MIHE, AT UYO, AKWA IBOM STATE, ON 13/01/24

NIHTE 2023 CONFERENCE & FELLOWSHIP CELEBRATION IN PICTURES

The Nigerian Society of Engineers

REQUEST FOR CLASSIFIED ADVERTS FOR THE NIGERIA ENGINEER MAGAZINE

In our bid to fulfil one of the terms of reference of the Editorial Board which is to generate funds and make The Nigeria Engineer magazine self-financing, we seek the dissemination of e-mail to all corporate members to notify them of the committee's request for classified Adverts for the next edition of the Magazine. The size of the advert should be 4.123 by 3.924 inches and will cost Fifty Thousand (50,000.00) only per advert.

Evidence of payment and advert should be forwarded to editorialcommittee@nse.org.ng

All adverts should reach the committee latest 10th September-December, 2022, this is to enable the committee complete the production of the magazine by the 15th of September-December,.

Thank you and regards

Engr. Dr. Felicia Agubata, FNSE
Chairman, Editorial Board Committee

The Nigerian Society of Engineers

announces its

2024 INTERNATIONAL ENGINEERING CONFERENCE EXHIBITION AND ANNUAL GENERAL MEETING

"ABUJA 2024"

Theme:

"SUSTAINABLE ENGINEERING SOLUTIONS TO FOOD SECURITY AND CLIMATE CHANGE"

DATE:
18th - 22nd November, 2024
VENUE:
International Conference Centre, Abuja.

Nigerian Institution of Highway & Transportation Engineers (NIHTE)

(A Division of the Nigerian Society of Engineers)

A Four-Monthly Journal of NIHTE

January - April, 2024 | Vol. 6 | 7th Edition | *Think, Transform & Transcend*

MADAM PRESIDENT 60TH BIRTHDAY ANNIVERSARY

The Executive Committee Members and Members of Staff of the Nigerian Society of Engineers (NSE), have separately celebrated with Madam President on her attainment of sixty (60) years. On Monday, April 15, 2024 being the exact date that Madam President, Engr. Margaret Aina Oguntala, FNSE turned sixty (60) years, members of the National EXCO took a full - page colour newspaper advertorial to express their felicitations.

The advertorial, signed by the Deputy President, Engr. Alimasuya Rabiu, FNSE, FAEng, MFR on behalf of all EXCO members, conveyed a message that eulogized

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