

The Public Works Department, Infrastructure Development and the Question of Environmental Sustainability in Nigeria, 1931 - 1960

***Solomon Chichebem Lawrence,
Nwachukwu J. Obiakor***

&

Stella Chimezie Agbanyim

*Department of History and International Studies
Nnamdi Azikiwe University, Awka*

Abstract

There is no doubt that the world has woken to the reality that human existence is inextricably tied to environmental sustainability. Discourses revolving around environmental sustainability have therefore become increasingly important globally. How to maintain environmental sustainability while carrying out necessary human activities has become the concern of policy makers as well as scholars. History has an important role to play in addressing this concern. This is because history holds in store an array of methods that various generations have used to solve a similar or related problem with moderate modifications. Given the exploitative nature of colonialism, it can be confidently asserted that the sustainability of the Nigerian physical environment was to a larger extent than ever before compromised and undermined during the colonial era. One of the major activities of the colonial government that affected the physical environment than any other was the construction of physical infrastructure like roads and houses. However, the colonial officers knew the implications of the construction operations and activities on the environment and also took measures to mitigate them, at least to make the environment last for their use. This paper studies the construction practices of the PWD, how and to what extent they affected the environment and how the PWD attempted at mitigating these effects to conserve the environment. The essence of the study is to reveal recyclable measures that can be used to check current construction-related threats to the environment and ensure its sustainability. The study adopts a historical method and relies on primary and secondary sources of information.

Keywords: PWD; Road; House; Construction Practices; Environmental Sustainability

Introduction

Infrastructure development occupied an important place in colonial activities. Its importance to the colonial government stems from the fact that the colonial officers needed basic infrastructure to survive. The aim of colonialism stood a great chance to be

defeated without the necessary infrastructure to exploit the wealth of Africa. With this understanding, the colonial officers embarked on the construction of infrastructure. This was done through the Public Works Department [PWD], the agency saddled with the responsibility of planning and executing infrastructural and other public works projects. While doing this, the PWD encountered challenges from the physical environment. In the process of circumventing and navigating through those challenges, the integrity of Nigeria's physical environment was tampered with. Therefore, the construction practices of the PWD did not just produce physical structures, some with relevance spanning beyond the colonial era, but also to a large extent negatively affected Nigeria's physical environment.

It could be argued that to a larger extent than ever before, Nigeria's physical environment was tampered with, undermined and its sustainability compromised during the colonial era. This was done not only through the construction processes, but also through the utilization of the Nigerian resources which had close link with her environment. The PWD infrastructure constructions came with large consumption and depletion of natural resources Nigeria which endangered the environment. The PWD was thus one of the key players in the early undermining of the integrity of Nigeria's physical environment and the compromising of its sustainability.

One of the major activities of the colonial PWD that affected the physical environment than any other was the construction of roads and houses. Although the PWD constructed other infrastructural facilities, these two took preeminence as they were needed more by the colonial officers who were resident in the country both for mobility, accommodation and administration. The pre-construction, construction and post-construction operations involved in the production of these infrastructural facilities all had effects on the environment as this study will show. However, it must be noted that the colonial officers knew the implications of their construction operations and activities on the Nigerian environment and also took measures to mitigate them, at least to make the environment last for their use.

Studying how the integrity of the country's physical environment was compromised as a prelude to the current environmental challenge as well as the mitigative measures applied over time is very crucial. It will provide hints on managing the current environmental challenges. A study of this nature falls under environmental history which is as a sub-field of economic history. Environmental history is the study of human interaction with the natural world over time. In other words, it studies what man did to nature while eking out a means of livelihood and what nature did to man in return, the influence it has exerted on human affairs over time and *vice versa*. Studies in this sub-field will contribute in no

small way in addressing the environmental challenges currently staring the world in the face. Unfortunately, Nigeria's environmental history has been grossly understudied.

Economic historians have studied and shown the connection between colonialism and the gross underdevelopment of Africa, especially how the resources of Africa were exploited for the economic wellbeing and development of Europe. This has been largely restricted to human, capital, mineral and other resources without much emphasis on the physical environment. Probably, because the effects of the activities of colonial exploiters did not pose immediate environmental challenge of any significant magnitude as it has done now, it did not attract any serious scholarly concern. Also, historical studies have tended to focus on the end products (roads, houses etc), while the building operations that produced them have been largely glossed over or out-rightly neglected. Meanwhile, these operations have significant implications for the environment. The failure to call attention to it and raise alarm made the post-colonial administrators to be lackadaisical about it until recently that the problem assumed a horrific magnitude, threatening even the existence of man.

There is now a new awakening in the study of the environment. Environmental issues have brought stakeholders together round the table to talk, gathered heads to think of the way to best manage the situation. A lot of conferences have been called to discuss how environmental disasters can be managed and mitigated showing the sense of urgency that the issue of environment now demands. It is such a sensitive subject matter that this paper addresses.

History scholars, starting from Kenneth Dike, through his seminal work, *Trade and Politics in the Niger Delta*, have also lent their voices to the discourse on environment. Most of the extant literature on colonial Nigeria environmental history focuses on the ills and undoing of the colonial officials. They emphasize how the colonial officials mindlessly exploited Nigeria's natural resources for the colonizers' advantage. It is assumed that these officials did nothing to make the environment sustainable. Also, most works do not focus on construction practices as a way through which the exploitation of Nigeria's mineral resources were exploited. This paper addresses the matter of environmental sustainability practices of colonial rule from a different angle. It examines it from construction practices angle. Also, while it examines the colonial negative environmental practices, it also shows that the colonial officials did contribute their quota, no matter how small to making the environment sustainable through their construction practices.

Brief History of the PWD Up to the Early 1930s

The Public Works Department (PWD) first started operation in Nigeria from the coastal area of Lagos. This is similar to the experience in Ghana, where the department started operating from the coast as early as the 1850s.ⁱ This is so because the colonial officers first gained access to the coastal areas of West African territories, from where they later got to the hinterlands. Easy movement through the waterways that crisscrossed the coastal areas and the European-friendly climate of those areas made them the first port of call. Even when access was later gained into the interior, the British colonialists and their merchant counterparts preferred to reside in the coastal areas. Infrastructure development thus started from the coast and later diffused to the interior.

The PWD predates the 20th century. It is on records, that meteorological services in Nigeria started in 1892 within the premises of the then PWD, at Racecourse, Lagos.ⁱⁱ This means that the PWD was already in operation by 1892. The establishment of the department is not a 20th century event, but an event that took place in the 19th century. British presence was already significantly registered in Lagos since the middle of the 19th century, even though serious measure to provide for public works was largely lacking at that time.ⁱⁱⁱ The formal establishment of the PWD in the area now called Nigeria took place on July 24 1874, when Lagos was made part of the Colony of the Gold Coast under the Sierra Leone Colony. The subordination of Lagos to the Gold Coast and Sierra Leone and the appointment of W.C.E. Lees as the Administrator of the settlement of Lagos, led to the establishment of the PWD among other departments after the practice in the Gold Coast.^{iv} The PWD operated however not as a fully-fledged department, but under the Survey Department, in the office of the Surveyor-General.

The year 1885 was the year that witnessed the giving of more attention to roads and other public works at least on paper. An Ordinance 'to provide for the construction of roads and public works' was passed by the colonial Lagos government in that year.^v However, the major infrastructure that engaged the attention of the colonial officers at this early stage of infrastructural development was railway. Before the creation of a Railway Department, the PWD still carried out oversight function over railway construction. The PWD was thus given its first major assignment in 1885 by the colonial office, which was to carry out a survey for the building of railway.^{vi} However, the railway construction did not commence immediately. Carrying out surveys was very difficult without good access roads into the interiors,^{vii} the colonial government therefore embarked on widening existing earth surface roads with the assistance of the various village communities.^{viii} By 1889, the PWD had constructed a late-rite road of 402.33km in Lagos colony.^{ix} There were also few other late-rite roads in Lagos and Calabar before 1900. Some houses were also built at this time for colonial government staff, (and for military use), using local

labor and local building methods.^x These can be said to be the major activities and achievements of the PWD during its pre-1896 existence under the Survey Department.

However, the reluctance of land owners to release portions of their lands for roads construction and government buildings contributed to the slow pace of infrastructural development and infrastructural development challenges.^{xi} Company rule that lasted till the late 1890s, which limited the authority of the government to make any significant move towards infrastructural development also contributed to it. Moreover, it must be noted that selfish interest of some colonial officers and some interesting power plays in London over the proposed Lagos Railway were much more responsible for the delay than indigenous people's reluctance in releasing their lands. These power games informed by self-seeking interest of some top shots in the Colonial Office and Crown Agents are well documented.^{xii} Permanent officials of the Colonial Office^{xiii} were expected to understand the ramifications of public works execution and monitor and supervise them. With time however, they took undue advantage of this privilege and positioned themselves to influence the planning, funding and selection of the method of execution of the projects.^{xiv}

In 1896, the PWD was finally separated from the office of the Surveyor-General, to operate as an independent department.^{xv} There were no ministries at that time, there were only departments saddled with one responsibility or the other. With its separation from the office of the Surveyor-General, in the Land and Survey Department, PWD became an independent and full-fledged government department that oversaw the development of public infrastructure. It was headquartered at Race Course, Lagos. It was in this year that the construction of the Lagos railway started effectively. Although it started in December of the previous year, survey having been concluded in May 1895, approximately a decade after the survey started,^{xvi} many scholars prefer 1896, being the year effective work started. The PWD at this time maintained just one central office in Lagos.

As at 1900, the area now called Nigeria (then with an estimated population of 16.8 million people),^{xvii} had four administrative units - the Crown Colony of Lagos, Independent Egba United Government and the Protectorates of Southern and Northern Nigeria.^{xviii} It was in 1906, that the colonial government amalgamated Lagos colony with the Southern protectorate, thereby reducing the 1900 four administrative units to two – the Protectorates of Southern and Northern Nigeria.^{xix} The PWD had to construct administrative buildings where these two administrative units were to be headquartered, and also where the colonial officers had to live in.

During the period 1900 to 1905, the PWD remained centralized and operated from Lagos. Only that in 1903, as a follow up on the Roads and Creeks Proclamation, Superintendents of roads, was sent to different regions to coordinate the public works there. For instance,

one superintendent of road was stationed in Calabar with a small staff for survey and construction of roads.^{xx} However, when in 1906, the whole Nigerian territory was divided into the Northern and Southern Protectorates.^{xxi} Consequently, the PWD became decentralized, with each Protectorate having its headquarters. This led to the establishment of the PWD's headquarters in Enugu, and the formal registration and establishment of the presence of the Department in the Southeast. Enugu became the headquarters for the PWD in the Southern Protectorate. It was from this date that the PWD began to make significant impact in the Southeast.

After the First World War, the colonial administrators seemed to give more attention to road networks development and harmonization. By 1924, the total mileage of roads maintained by the central government (of course through the PWD), was 2,596.^{xxii} By 1925, this had risen to 2,800.^{xxiii} In 1925, the government commissioned Mr H.E. Walker, the then director of PWD to prepare a scheme for a trunk road system, to enable the general road system to become harmonized.^{xxiv} The roads were categorized into trunk A, B and C. The PWD was then given the responsibility of building and managing the Trunk A Roads, which provided the main grid.^{xxv}

From the 1930s, the Department went through reorganization to survive the then prevailing economic depression. Although the period witnessed reduction in the pace of the development of roads and other infrastructure facilities, more aggressive use of and experimentation with local materials came to characterize the PWD more. The depression and the Second World War affected the external and capital market and thereby discouraged any incentive to raise funds for infrastructural development.^{xxvi} Although the economic depression was for a short time lasting between 1930 and 1933 shortly after which trade began to boom again, it set the stage for a greater use of local materials by the PWD in the years to come with greater impact on the environment. It was aimed by the use of such local materials to reduce the cost of building materials and construction by extension. However, the increased consumption of local materials held significant negative consequences for the Nigerian environment.

The paper begins from 1931 because from then more use of local materials for infrastructure development became more prominent than ever before. In that year, a Committee on Workshops and Foundries carried out a survey and test of the timbers available in Nigeria as substitutes for the various classes of imported ones, and recommended the use of several in the workshops of the Public Works Department, Railway and Marine.^{xxvii} This was in 1931, when the economic downturn was biting hard on the colonial economy and the cost of imported materials had risen significantly

The Road and House Construction Operations of the PWD and their Effects on the Environment

Road and other construction operations of the PWD had serious implications for land resources and the physical environment in Nigeria. It is understandable that the consequences were not very significant during the colonial era. This is due to the fact that the implications of such operations such as land clearing, wood exploitation, soil excavations, earthworks, road cuttings and embankments among normally take time to manifest. Today the consequences are manifesting especially with the increase in construction to meet the housing and road needs of the growing population of urban areas in Nigeria. These operations have led to land silting, landslides as well as road failure and severe erosion of the soils, exposed during road construction and environmental degradation.^{xxviii}

The construction of PWD buildings came with large consumption and depletion of natural resources of Southeastern Nigeria which endangered the environment. One of the approaches employed to solve the problem of the scarcity of building materials and to reduce their cost was the resort to local sourcing and production. Apart from the 1931 meeting stated above which led to more use of local materials, a committee that met in 1947 to look into the problem of building materials specifically bricks, considered it appropriate to re-open the local block-producing factories in the country.

Consumption and depletion of natural resources in house and road construction was very minimal during the pre-colonial era, and this helped to keep the balance between man's safe habitation and that of the plants and animals. Colonial government construction practices broke all these environmental safety precautions and exposed the landscape of Nigeria to climatic disaster.^{xxix} These construction-related practices or operations whether material based or not are discussed in this paper under pre-building and building/construction operations. Some of the PWD pre-building operations such as the cutting of forest woods, which were later processed and used for furniture and other construction works, were ways they contributed to the depletion of the protective elements of the environment.^{xxx}

Land reclamation was one pre-building operation of the PWD. This was not common in the Eastern region because of the absence of many water bodies, but there were however some cases of reclamation. A good example is the Port Harcourt Wharf age Works. During the construction of the wharf, some dredging was done to reclaim some lands for the construction of the wharf and its access roads. A consulting engineer was contracted for the technicalities involved in the work. The reclaimed sand was pumped ashore at the northern extreme end of the wharf to form Traders' Waterside Plots.^{xxxi} In the West,

especially Lagos, much of land reclamations were done which affected the environment badly. Among other things, it took up space for the dumping of refuse before the colonial era and so contributed immensely to the worsening of the problem of solid waste management.

The PWD also got involved in land-clearing. Some of the roads passed through thick forests with many big trees which had to be cut down. Trees felling, stumps uprooting and removal from the construction site were all part of the land-clearing operation. When the Calabar-Manfe road was to be built, it had to pass through thick forests. Simple cutting machines like telesaws, pitsaws, etc were used for felling and deep-pit-sawings.^{xxxii} Clearing was not always limited to the portion of land needed for work. Trees within 20' 0" of a proposed building were also sometimes to be felled.^{xxxiii} The roots were to be grubbed up and cleared away. Also, during land-clearing, the PWD officers displaced and sometimes killed animals in the bush thereby causing ecological disruptions. Newly cleared sites were also sometimes fumigated to destroy termites and, in the process, other organisms and animals were affected. Sometimes, specimens of such termites were taken overseas for preservation under the guise of going to study their behaviour thereby stealing from Nigeria's ecological wealth to populate and enrich that of Britain.¹⁵⁵

Beyond these, the large land space taken up for road and building constructions led to the destruction of valuable agricultural lands in the rural areas. This has led to the depletion of soil quality, reduction of biodiversity and so on. All these reduced the fertility of the soil for agricultural purposes.^{xxxiv} Apart from the mere environmental challenges posed by these, they have contributed to food insecurity which threatens human survival. It has also increased rural-urban migration thereby heightening the population pressure on the urban areas and creating more prospects for environmental degradation.

Forest Exploitation and Wood Processing/Working was another pre-building operation of the PWD. Most of the trees from which timbers were derived for construction were cut from the Nigerian forest. They were used for electric poles, mile poles, building bridges, roofing, walling, making furniture for government houses, and so on. Timbers were felled and processed more in the west, because of the big wood workshops in the PWD Headquarters in Lagos. The main wood-working workshops and saw mill were situated in Ijora, mainland of Lagos. The Central wood workshop in Lagos got involved in the exploitation of timbers of the Southern Provinces and in designing of proper methods of seasoning and working those timbers.^{xxxv}

One of the great roles the workshops played was the reduction of timber importation for construction and furniture works. One type of timber that was imported in a large quantity was pitch pine. Due to its high cost, efforts were made by the PWD workshop managers

to discover suitable local timbers to serve as its substitute. The PWD workshop managers did this in collaboration with the forest authorities.^{xxxvi} Trees commonly used for building in the target provinces were subjected to tests to determine their sustainability for big construction works, even though they were all used for local building constructions. What acted as restraints however were religious and food issues. Trees known to represent gods or trees in which particular gods resided were forbidden to be used for construction works even if they passed the PWD usability test. Food producing trees were used with caution.^{xxxvii}

However, the PWD exploited and manufactured forest woods more in Lagos. The PWD engaged in the overexploitation of resources wherever they found it in abundance rather than explore other centers. As noted earlier, there was much use made of the stones in the Abakiliki, the same was done in the case of forest wood exploitation, Lagos and its environs bore the weight of wood/timber exploitation. Owing to the cheapness of local timber in Lagos, most manufacture of wood works were carried out in Lagos and transported to the area offices in the various regions. This large consumption of wood resources depleted the protective elements of the environment and also led to the scaring away or killing of bush animals leading to bio-diversity loss.

The PWD also got involved in quarrying activities in the bid to get stones for construction works like roads. This has also been observed to be contributory to environmental degradation. Quarrying is the “excavation, extraction and breaking of rocks or stones into aggregates for construction purposes such as bridges, houses, roads, railways and others.”^{xxxviii} Gravels were also generated through the process of quarrying. In the Eastern Region for instance, the PWD established a quarry at Aro, in the present-day Abia State. The Aro Quarry supplied stones, concretes, gravels, granites and other stone-related materials used by the PWD in the Eastern Region. Apart from the Quarry at Aro whose activities were always reported in the PWD Annual Report, there were other PWD quarrying centres in Nigeria.

The need for cheap stones to build houses, administrative buildings and road infrastructure made the PWD to resort to forced labour. The PWD officials coerced the indigenous populace to provide them with lumps of stones cracked manually from the existing surface sedimentary rock deposit at Juju Hill.^{xxxix} Before the advent of colonial rule what later became quarry stones were used mainly for traditional and domestic purposes, such as tripods for kitchen fire, in sharpening knives and cracking palm kernels e.t.c. The PWD however found new use for them, mainly house and road building.^{xl} This led to a greater consumption of these stones.

Increasingly, stones for masonry, concrete, road-making and for foundation of buildings were obtained through rock excavation by the PWD. Most of the excavations done earlier were by drilling, and hand drillers were often used. With the increase of the scale or quantity of rocks or stones needed, the quarrying was more organized and also mechanized. Machines were used to blast rocks and cut them into usable sizes, while human labour complemented by either breaking small-sized stones or packing and separating the quarried stones into various end-products. Some of the machines used as at the 1940s were Blasters, Drillers, Crushers, Compressors and Drill Sharpening Plants.^{xli} Stones were first distributed using mammy wagons, but the use of lorries gradually replaced them starting from the 1940s.^{xlii} Thus, both the quarrying process and its transportation which involved machines affected the environment in form of noise and air pollutions.

Clay-mining was one of the material sourcing operations of the PWD. Clay was mined by the PWD for making burnt clay bricks used for building staff quarters, departmental offices and very important government buildings and projects.^{xliii} Before the colonial era, clay mining, which was mainly about soil excavation in search of clay soil, was undertaken in various parts of Nigeria.^{xliiv} Clay was mined and used for pottery and building of houses in Igbo land, especially in places with abundant clay deposit.^{xlv}

A substantial portion of land was mined by the PWD during the colonial period. Clay mining started right from the surface of the earth and continued up to about 20 meters below the surface of the earth.^{xlvi} Although there is no record of the exact land breadth and depth covered by the PWD, estimated figures of about 100 meters square and 8 meters respectively have been given.^{xlvii} The clay mining process later led to land-silting which has led to substantial soil erosion. Brick making from mined clay was also done by the PWD. The use of clay for building houses among the Igbo no doubt has a long history. However, in the early 1920s, the PWD introduced new method of transforming the clay mined into bricks for erecting modern buildings. Before then, brick-making had been experimented locally in some places in the Southeast,^{xlviii} but not largely with clay, and not on very large scale. The technology of molding burnt bricks on a very large scale was first introduced by the PWD to reduce the expenses incurred on building materials. There was one of such factories at Ishiagu established in the 1920s,^{xlix} Also, unlike in the pre-colonial era when clay used for wall buildings were not fired, the PWD introduced the technology of firing clay used for building purposes.

The clay was sifted, mixed with water to get an adhesive texture, packed with shovel or trowel into brick moulds and firing into hardened reddish colour.^l The whole process had implications for the environment. The mining exposed the land area from where the clay

was obtained to silting and erosion. The firing process produced smoke that affected the environment.

During building/construction operations, the PWD also harmed the environment. The PWD encountered serious termites' challenges in their building operations. The two most important specimen types were therefore earth termites, which affected the foundation of buildings and dry wood termites, which attacked timber works such as roofs of buildings, furniture, wooden bridges and so on.^{li}In various parts of Nigeria, the PWD faced earth termites' challenge. This can be seen from the termite nest discovered at Uyo,¹⁵⁴ and a termites cell taken up from a nest found to contain five queens and one king of the *microtermesbellicosus* (earth termites) in Ikoyi in 1936.¹⁵⁵

When a foundation came under termites' attack, the result was continuous settlement or sinking of the building. Actions and strategies to eliminate or at least curtail the activities of termites were therefore considered very important. Both preventive methods applied during foundation laying and preventive methods were used. These methods were not environment friendly. In both methods, fumigation was involved. The preventive method was applied in the foundation of buildings. The foundation ground of proposed buildings was excavated and indiscriminately and heavily gassed/ fumigated with petrol and other admixtures before the excavation was closed up after several foundation testing operations.¹⁶³

The curative or remedial method was used more during building maintenance operations. Buildings attacked by termites were heavily fumigated. Other measures included the forming of anti-termite gangs whose main duty was to destroy termites. For instance, an anti-termite gang was formed in 1934 by the PWD.¹⁵⁹Site fumigation and other anti-termites operations were thus considered necessary. These operations have caused ecological disruption and destruction of wildlife habitats and ecosystems. The PWD, for instance, engaged in the destruction of white ants and other termites. The foundation was indiscriminately sprayed with anti-termite chemicals or disinfectants such as petrol and other chemical admixtures.^{lii} Sometimes, already standing buildings infested with termites were also fumigated. This had implications for both humans and ecological survival.

The fumigation polluted the air for humans and killed different species of termites and other micro-organisms thereby affecting bio-diversity. Although insects can be destructive, they also have economic values. They fertilized land areas, made the soil chemistry conducive for vegetation, serve as food, manure, scavengers (by scavenging, they clean up the environment) and so on. Attempts to destroy termites by all means also had the effect of destroying other microorganisms and animals that helped to enrich the fertility of the soil of the surrounding area.

Actual road and building constructions of the PWD involved the use of heavy machines. The machines used by PWD were many. They included Rollers and M.12 Graders for road grading, Power Excavators for carrying out excavations, Bull-dozers and Scrapers, caterpillars for clearing swamps, Hill Lorries for the transportation of materials, tipping lorries, tipping trailers, earth movers, water tankers, concrete mixers, land rovers, drillers, crushers and granulators used in the quarries, piling machine, compactor and super-compactors used for pressing down earth materials, laterite, asphalt or bitumen surface and making it compact and water-tight among others.^{liii} Apart from the noise pollutions caused by these machines, they also polluted the air. The use of these machines polluted the air by the dust they raised while being used for grading on earth roads or for new constructions. They were also powered by diesel and released carbon monoxide into the air. There were also construction waste generation which contributed to solid waste management challenges.

PWD Environmental Sustainability Practices/Operations

The PWD maintained a level of order in the use of the environment. During land-clearing process for construction works, PWD were expected to observe some environmentally sustainable practices. When termites were found during the clearing for instance, care was taken to discover their nest which was thereafter opened up. The queen termite in any termite nest was extracted and properly kept.¹⁵⁶ The queen termite which was believed to be the chief propagator of the termites found in the nest and its surroundings was then taken to the PWD head for proper study and preservation.¹⁵⁸ After this, the rest were to be killed with petrol.^{liv} Sometimes, specimens of the termites were taken to British museums abroad for proper study and preservation.^{lv}

The PWD took necessary steps to ensure that the environment around the building sites of the PWD was safe. During construction, building sites were to be kept in a tidy condition. All under-grasses were to be removed and rubbish cleared out of the site.^{lvi} Also, all temporary facilities needed during the main construction process such as buildings, scaffolding, timbering, borrow pits, trenches among others were to be made safe and all designs for them were to be submitted to appropriate authorities for approval before they were commenced.^{lvii} Anything that could lead to fire incident capable of not just affecting the immediate construction works but also affecting the physical environment was discouraged from the site except such things as needed for work on the site, and in that case had to be kept as far as possible from the structures that could be inflamed.

Also, the site was to be kept in a clean and sanitary condition. Defecating around the site was not allowed. Separate temporary toilets were built for workmen, staff and work inspectors as required by the Health or Sanitary authorities. Before work began in any

site, Health Officer or other sanitary authority was informed and he visited to check the site and give certain health instructions which were to be complied with while the work was in progress.^{lviii} When work was in progress, rubbish was to be cleared from time to time and not permitted to accumulate to create a nuisance. The PWD also inspected and monitored the state of the houses and other buildings to know their states and when necessary, repairs were needed to be done. Yard inspection by PWD Yard Superintendents was also part of the operations carried out to ensure that government buildings were in good shape. Tenants who were discovered to be contributory to damaging government properties in the building and by so doing, worsened the state and condition of the buildings were served queries. Sometimes punitive measures were taken against such people. For instance, they were sometimes made to pay for damages when they could not reasonably prove that they were not in any way responsible for the damage. Planting and maintaining flowers around government buildings was another building maintenance operation of the PWD. Although this was primarily aimed at beautification, it was also used to refresh the atmosphere and reduce air pollution. After the main building, the PWD also planted flowers around the buildings.

Conclusion

The choice of methods used in carrying out infrastructure building operations must be environment-friendly. Operations such as bush clearing, trees felling, land reclamations among others have negative implications for the environment and have to be minimized. One of the ways to do this is to carry out Environmental Impact Assessment (EIA) studies on locations where constructions are to be done. Various strategies ranging from demand-side intervention (various rent subsidies, mortgaging e.t.c.) to supply side interventions (various loans and subsidies on building materials and site assistance), which may not even cost the government much or even anything in the long-run since the loans are eventually recovered, should be used to provide housing for the people.

One important area where the PWD failed was in carrying out Environmental Impact Analysis [EIA] before their construction works. Although the Department had a Material Section which monitored material quality and the behavior of the materials, the environment was not the focus but the durability of the construction works. Actually, the PWD Material Section was divided into two main sub-divisions viz Field Control and Headquarters Laboratory.^{lix} The Field Control Unit was responsible for preliminary investigations and quality control of materials used during construction, and observation for the behavior of the materials after construction.^{lx} The most frequent problems were whether the soil would be suitable as a sub-grade for a road or runway or whether the soil could be satisfactorily stabilized with cement.^{lxi} By 1960, the Headquarters Laboratory

had conducted tests on hundreds of samples of soils, aggregate, building blocks, concrete cubes, steel, soil-cement and bituminous materials. Other building materials like paints, iron rods, roofing sheets, timbers *et cetera* were subjected to tests to ascertain their quality and behavior over time how the materials like soil behaved in terms of ability to withstand pressure was the focus and not really what the impact on the environment would be.

Endnotes

ⁱKathy Curnow, "Kumase Public Works Department," *Bright Continent*, accessed May 18, 2018, <http://access.thebrightcontinent.org/items/show/14>.

8. T. Adogbeji Salubi, "the Origin of Sapele Township", *Urhobo Historical Society*, Originally Published in the Journal of the Historical Society of Nigeria, Vol2, No. 1 (December, 1960), 115 - 135

ⁱⁱ NIMET, "History of Nigerian Meteorological Agency" accessible at www.nimet.gov.ng/history-nimet

ⁱⁱⁱR. Olufemi Ekundare, *Economic History of Nigeria, 1860 – 1960*, (London: Methuen 1973), 72

^{iv}M. Fasheke, *The Civil Service in Nigeria: A Historical Perspective*, (Ibadan: Rex Charles Publication, 1998), 3

^v Ekundare, 72

^{vi} Salami, "British Colonial Architecture," Transnational Architecture Group

<https://transnationalarchitecturegroup.wordpress.com/author/ibiyemi7/>

^{vii}As a matter of fact, the survey was not concluded until May 1895. (See Wale Oyemakinde, "Railway Construction and Operation in Nigeria, 1895 – 1911: Labour Problems and Socio-Economic Impacts" in *Journal of the Historical Society of Nigeria*, 1974, vol 7, No.2, 303-324; accessible at <https://www.jstor.org/stable/41857015>

^{viii} Ekeoma Valentine, Madubuko, "Development and Impact of Maritime Transport in Nigeria, 1900 - 2000", A Ph.D Thesis Submitted to the Department of History and International Studies, University of Nigeria, Nsukka, July 2013, 43

^{ix} Ibid., 42

^xSalami, "British Colonial Architecture: Exports Only?" Transnational Architectural Group, accessible at [<http://dx.doi.org/10.1080/13602365.2016.1179662>, posted online on April 2, 2013, accessed 23rd July 2018

^{xi} Okechukwu Edward Okeke, "A Political and Administrative History of Onitsha, 1917- 1920," A Ph.D Thesis Submitted to the Department of History, University of Nigeria, Nsukka, July 2003, 39

^{xii} David Sunderland, *Managing the British Empire: The Crown Agents* (Woodbridge: Boydell Press, 2004), 57-62, 110-116; John M. Carland, *The Colonial Office and Nigeria, 1898-1914* (Hong Kong: Hoover Institution Press, 1985), 154-157; Casper Andersen, *British Engineers and Africa, 1875–1914* (London: Routledge Press,), 78-83

^{xiii}The Colonial Office, based in London was a heavy weight office that influenced some major decisions in the Colonies. This office, charged with administrative functions that affected the colonies, saw its last night on July 1966, when like a scaffolding it was 'dismantled' or disbanded having over stayed its usefulness. See David Goldsworth, *Colonial Issues in British Politics, 1945-1961: From Colonial Development to 'Wind of Change'* (Oxford: Clarendon Press, 1971), 48

^{xiv} Carland, *The Colonial Office and Nigeria*, 135

-
- ^{xv} Francis Jaekel, *The History of the Nigerian Railway, vol.1: Opening the Nation to Sea, Air and Road Transport* (Lagos: Spectrum Books, 1997), 81
- ^{xvi} Oyemakinde, *Railway Construction and Operation in Nigeria*, 303
- ^{xvii} A. A. Lawal, "The Economy and the State From Pre-colonial Times to the Present", in Akinjide Osuntokun and Ayodeji Olukoju, eds., *Nigerian Peoples and Cultures* (Lagos: Department of History, University of Lagos, 1997), 187
- ^{xviii} Rufus.T. Akinyele, "The Growth of Nationalism and the Political Evolution of Nigeria," in Osuntokun and Olukoju, eds., *Nigerian Peoples and Cultures*, 286; (Note that some authors however prefer to stay with three administrative units, believing the Egba was under the Southern Protectorate. For example see J.G. Nkem Onyekpe, "Western Influence on Nigeria in the Era of New Imperialism," in *Nigerian Peoples and Cultures*, 224)
- ^{xix} Akinyele, "The Growth of Nationalism," 286
- ^{xx} Akintunde Akinfemiwa, 'A Special List of Records On the Subject Roads and Bridges From the Nigerian Secretariat Record Group', National Archives Headquarters, Ibadan, 1965, 5
- ^{xxi} Onyekpe, "Western Influence on Nigeria," 225
- ^{xxii} Lawal, "The Economy and the State," 190
- ^{xxiii} Ibid., 187; However, by around 1937/38, the total mileage had risen to 3, 829
- ^{xxiv} Akinfemiwa, 'A Special List of Records, 5
- ^{xxv} Akinfemiwa, 'A Special List of Records'
- ^{xxvi} Lawal, "The Economy and the State, 195
- ^{xxvii} Nigeria Colonial Annual Report, 1931
- ^{xxviii} P. C. Onokala, "Transportation Development in Nigeria," 35
- ^{xxix} Demas Nwoko, "The Built Environment and the Arts," 17
- ^{xxx} Demas Nwoko, "The Built Environment and the Arts," 17
- ^{xxxi} Nigeria Colonial Annual Report, 1929, 7
- ^{xxxii} NAE/CP 3804/1 Calprof 7/1/1720, Post-War Development and Welfare
- ^{xxxiii} Eastern Region of Nigeria, Ministry of Works, "General Specifications of Works to be Executed and Materials to be used in the Construction of Magistrate's Court and Headquarters at Onitsha," February, 1960, NAE, Minworks 1/4/5, 13
- ^{xxxiv} P. C. Onokala, "Transportation Development in Nigeria," 38
- ^{xxxv} Nigeria PWD, "Report of the Advisory Officer, PWD, 1930," compiled by G.M. Hoey, Printed by the Government Printer, Kaduna, 1931, 14, accessed at the National Archives Enugu, R/FG/80, GR12/3
- ^{xxxvi} Ibid.
- ^{xxxvii} Ibid.
- ^{xxxviii} L.C. Amajor, "Stone Turbidite-Like Deposit. An Example from the Turanian Ezaku Formation, at Nkalagu South Eastern Nigerian" *Journal of Mining and Geology*, Vol. 28, June 1989, 2
- ^{xxxix} Ibid. The Juju Hill, which had a significant deposit of sedimentary rocks, is located at the back of the present Ebonyi State Government house
- ^{xl} L.C. Amajor, "Stone Turbidite-Like Deposit," 2.
- ^{xli} Nigeria Annual Report of the Public Works Department for the Financial Year 1944-45, 15
- ^{xlii} Nigeria Annual Report of the PWD for the Financial Year, 1949/50, 39

^{xliii} J. C.Chukwu, “Mining Operations in Ishiagu,” 15

^{xliv}Localities in Eastern Nigeria that got involved in pottery included but not limited to Inyi, Ibeku, Anam, Ekwe, EhaAlumona and Ohuhu. Pottery producing centers in Yorubaland included Oshogbo, Oyo-Ile, Abeokuta and Ilorin in Yorubaland; Jebba Island, Baro, Badagi and Bida in Nupeland and Rahama, Kwom, Naraguta, Birom and Abuja in the North. For more information, see.O.N. Njoku, “Women in Traditional Igbo Economy” in A.E. Afigbo ed., *New Bridges, More Hopes: Igbo Women in Socio-Economic Change Before the Dawn of the 21st Century*, Published by the Institute of African Studies, University of Nigeria, Nsukka, 2008, 113; there were probably scores of others but the ones here mentioned are those best known in published literature. (O.N. Njoku, “Economic History of Nigeria, 19th and 20th Centuries (Enugu: Magnet Business Enterprises, 2001), 57

^{xlv} Ibid., 28

^{xlvi} Ibid.

^{xlvii} Ibid.

^{xlviii} Ibid.

^{xlix} J.C. Chukwu, “Mining Operations in Ishiagu,” 35

ⁱIbid., 61, 62

ⁱⁱNigeria PWD Annual Report, 1935, Printed and Published by the Government Printer, Lagos, 1936, 15

ⁱⁱⁱOne of these other chemical solutions manufactured to fight termites was DIELDRIN then manufactured by Shell Company of West Africa Limited. The product was diluted with water in the proportion of one gallon to 80/100 gallons of water and was applied strictly according to the manufacturer’s instructions.

ⁱⁱⁱⁱ See list in p.28 of the Annual Report of the PWD, 1956/57, Printed by the Government Printer, Eastern Region Enugu, NAE, AR/EN/A69, 26 See also Annual Report of the PWD for the year 1949-50, 34; Federation of Nigeria,Annual Report on the PWD for the Year, 1955-56, Federal Government Printer, Lagos, 1957, 24, NAE, AR/FG/A94

^{liv} Ibid., 13

^{lv}Nigeria, Annual Report of the PWD, 1935, Printed and Published by the Government Printer, Lagos,1936, 15 accessed at the National Archives Ibadan (NAI)

^{lvi} Nigeria PWD, N.P.W Specifications: Notes and Data, Government Printer, Western Region, Nigeria, 1955, 1

^{lvii}Eastern Region of Nigeria, Ministry of Works, “General Specifications of Works,” 7

^{lviii} Ibid., 8

^{lix}Federal Republic of Nigeria, Annual Report on the Works Division of the Federal Ministry of Works and Surveys, 1960-61, 13, Published by the Federal Ministry of Information Printing Division, Lagos, 1964

^{lx} Ibid.

^{lxi}NAE,Annual Report of the PWD for the year 1949-50, 40