# THE PUBLIC WORKS DEPARTMENT (PWD) AND PUBLIC INFRASTRUCTURE REPAIR AND MAINTENANCE OPERATIONS IN COLONIAL SOUTHEASTERN NIGERIA, 1896 -1960

**Lawrence, Chichebem Solomon**
**Department of History and International Studies, Nnamdi Azikiwe University, Awka, Nigeria**
**E-mail: cs.lawrence@unizik.edu.ng or lawrencesolomon2016@gmail.com**
**&**
**Lawrence Hannah Oluwabamise**
**Department of Estate Management, Nnamdi Azikiwe University, Awka, Nigeria**
**E-mail: lawrencehannah2024@gmail.com**

**Abstract**
One of Nigeria's greatest challenges to the realization of socioeconomic development since independence in 1960 is infrastructure deficit. Lack of effective repair and maintenance has enormously contributed to the widening of this deficit which has resulted in the continuous ebbing of the standard of living. This paper examines the operational history of the Public Works Department (PWD), an agency established by the colonial government in 1896 to among other tasks maintain and repair public infrastructure. It aims at gleaning essential repair and maintenance lessons from Nigeria's history to bridge infrastructure gap. Although public infrastructure maintenance and repairs in Nigeria have formed the subject of few scholarly works, hardly any focuses on the colonial era with attention on the PWD . This is owing to the assumption that since colonial infrastructure was exploitative, its history will have but little value. This paper argues to the contrary. More importantly, unlike existing works it seeks solution to infrastructure deficit using the study of a historical model - the PWD. It therefore adds a new flavour and contributes to the literature on infrastructure repairs in Nigeria. The paper adopts historical methodology involving the qualitative analysis of primary and secondary sources presented in descriptive and discursive frameworks. Primary sources used include oral interviews, government documents and archival materials while secondary sources include published books, theses and journal articles. The paper finds that several strategies such as consistency, prioritizing, proximity, supervision among others were deployed by the PWD to ensure repair and maintenance success in colonial Southeastern Nigeria. It concludes that these are still useful today.
**Keywords**: Public Works Department (PWD), Infrastructure, Repair, Maintenance, Southeastern Nigeria

## Introduction

Repair and maintenance have long been part and parcel of human existence. Goods are manufactured regularly to meet human needs and solve their problems. These goods, be they electronic, household goods, health maintaining equipment, public goods like roads, buildings and other infrastructure, need to be maintained and kept in good condition to guarantee their availability and efficiency in solving some human problems. The torn or damaged ones need to be repaired to elongate the period of their usefulness. Early men carried out repairs with simple tools like hand axes and spears. Increase in knowledge through research and experience have continued to reshape man's ways and tools of doing things including repair and maintenance.

In the course of the twentieth century, economic pressures affected repair and maintenance orientation. In the bid to make more sales and gains, manufacturers began to deliberately frustrate repairs efforts. Most of the goods manufactured were deliberately designed to be short-lived making the 21st century society a "throw-away society" thereby increasing solid waste level in the world. Now, it is becoming more fashionable to think that repairing must complement recycling efforts to find solution to waste. Repair is therefore a waste management process which involves fixing of damaged or "broken" things to get them back into use rather than into the refuse.

Although maintenance and repair are different, they have things in common. They differ in the sense that while maintenance is a precautionary, planned and scheduled activity to keep a things working, repair is unscheduled and aims at making things broken down to become useful again. Their point of commonality is the fact that they both aim at avoiding the total invalidation of an equipment and elongating their lifespan.[1] Repair and maintenance are interventionist processes. They are carried out to intervene in elongating the lifespan of things to retain their "thing-ness" not merely their usefulness in any other way as recycling does.

Most of the time, repair is used to address household goods and electronic gadgets. It must however be noted that the "broken world" referring to things that need repair, is a very broad world that embraces a whole lots of things and spheres of life. It also includes public infrastructure such as roads and buildings. Thus, players in the broken world include not just individuals and private groups, but government agencies and their workers. There are two broad categories of practitioners in the broken world. The purposes for which they intervene set them apart. First, there are those who intervene for purely economic reasons and there are those who intervene for environmental reasons. We have decided to refer to the former as the economic or classical repair interventionists while the latter are the environmentalists or environmental repair interventionists. Up to the mid 20th century, the dominant interventionists were economic interventionists. The environmentalists started gaining attention thereafter, especially in the 21st century. Although there are individuals who intervene for environmental reasons, most individual interventionists such as households have remained economic interventionists even in the 21st century, seeking the management of their little resources. Government agencies on the other hand, due to the large nature of what they have to repair and maintain, usually have greater economic and environmental impact through their interventions. Thus, their involvement in repairs and maintenance is very essential and so is the history of their involvement.

During the colonial era in Nigeria, the Public Works Department [PWD] was in charge of the provision and maintenance of public infrastructure, as well as their repair. Economic motive dominated the intervention of the repair activities of the PWD. The colonial government needed these infrastructure to work optimally in order to enhance the smooth administration of the colonial territories and the exploitation of their resources. The goal of this paper is to discuss some of the maintenance and repair operations of the PWD in the Southeastern region of Nigeria, and to show the strategies and principle used in the process. The overall aim is to glean useful lessons for effective management of currently existing public infrastructure.

The area that now forms the Southeastern Nigeria, was a larger part of the old colonial Eastern Region, with very few exceptions. Thus this study, will focus, not on the post-independent politically delineated region now called the Southeast, but on the old Eastern Region which embraces the current Southeast and a little of the South-south. Thus it is a term used loosely to refer to the Igbo land, which is not politically but historically and culturally defined. In this vein, the renowned professor, A. E. Afigbo in one of his books that relates to the Southeastern peoples, identified the peoples populating the Igbo area to include Igbo, Ibibio, Ijaw, and Ogoja.[2] The area is significant because the seat of power for the whole of the Southern protectorate (later Southern Provinces) was located there, in Enugu.

Although a lot of scholars have worked on repairs and maintenance outside and within Nigeria both from historical and other perspectives such as Aaron Perzanowski [*History of Repairs*], Stefan Krebs and Heike Weber, ["Rethinking the History of Repair**:** Repair Culture and the "Lifespan" of Things"], Sunday Odediran, ['Maintenance of Residential Buildings: Users Practices in Nigeria'], Osuagwu Andrew Chima et al ['Current Issues Associated with Public Building Maintenance in South-East Nigeria'] among others, one finds it hard to see works focusing on repairs and maintenance operations of the colonial Nigeria Public Works Department. Generally works on the PWD in colonial Nigeria are hard to find owing partly to the fact that it is usually considered an exploitative creation. It was nicknamed, "**Plunder Without Detection**"[3] However, there is a lot to learn from this Department's maintenance and repair practices for effective management of public infrastructure today. This is where the relevance of this study comes in. The rest of the paper is divided into five sections. The first traces the historical background of the PWD, the second examines the agency's repaisr and maintenance operations; the third highlights its maintenance and repair strategies while the fourth focuses on the its principles of repair and maintenance. The fifth section is the conclusion.

**Historical Background of the Public Works Department**

Although the PWD in colonial Nigeria assumed an independent status as an agency of the colonial government in 1896, the starting point of this study, the establishment of the PWD in Nigeria precedes that date contrary to common belief. Some scholars like Salubi have even suggested 1904.[4] Historical records do not agree with Salubi's date. For example, it is on records, that meteorological services in Nigeria started in 1892 within the premises of the then PWD, at Racecourse, Lagos.[5] 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.[6] 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.[7] The PWD operated, however, not as a fully-fledged department, but under the Survey Department, in the office of the Surveyor-General.

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.[8] Carrying out surveys was very difficult without good access roads into the interiors,[9] the colonial officers therefore embarked on widening existing earth surface roads with the assistance of the various village communities.[10] By 1889, the PWD had constructed a laterite road of 402.33km in Lagos colony.[11] There were also few other laterite 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 labour and local building methods.[12] These can be said to be the major activities and achievements of the PWD during its pre-1896 existence under the Survey Department.

The Brussels Conference of 1890, had re-emphasized the condition of effective occupation given at the Berlin Conference as the valid proof of empire acquisition in Africa.[13] It was, therefore, necessary to speed up infrastructural development to fully achieve this. Hence, in 1896, the PWD was finally separated from the office of the Surveyor-General, to operate as an independent department.[14] 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, headquartered at Race Course, Lagos. The PWD at this time maintained one central office in Lagos with smaller supportive units all over the country, mainly in the South. By 1897, the PWD already had a working staff strong enough to hold a successful strike, called the PWD Lagos Strike even though it affected the regions.

To harmonize roads building efforts which had started in the region since the 19$^{th}$ century, and expedite its course, the Roads and Creeks Proclamation was promulgated in 1903.[15] Through this promulgation, the PWD got more free hands to carry out public works. After the First World War, the colonial administrators seemed to give more attention to roads network development and harmonization. Paid labour was also used to get public works done from the early 1920s. By 1924, the total mileage of roads maintained by the central government (of course through the PWD), was 2,596.[16] By 1925, this had risen to 2,800. 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.[17] 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.[18]

The world economic depression, which lasted from 1930 to 1933, forced the government to stop or reduce construction works and retrench both Nigerian and European employees in the various colonial departments including the PWD.[19] For example, decline in productivity compelled a significant downsizing of Nigerian workers from 39,959 in 1928 to 14,911, representing more than 50 percent slash.[20] It was only in the late 1930s up to 1939 when the Second World War started that public works grew again as a result of trade boom. In April 1939, before the Second World War started, government policy of regionalization helped the Department further decentralize and to employ more staff. Although before the regionalization policy of the government, the PWD, had already decentralized into three regions, the regionalization policy led to the employment of more people into the Department.

However, between 1945 and 1960, there was increased funding of infrastructural projects across the country as a result of trade boom.[21] During the period from 1945 to 1960, some changes took place in the organization of the PWD. First, in 1945, the Richard's constitution was promulgated, paving way for the reo-organization of the country into three regions – North, West and East. This would further concretize the 1939 arrangement of the PWD organizational structure and encourage more employment of labour. In 1954, the colonial government created ministries. As a result, the Federal Public Works Department was renamed the Ministry of Development, in the same year.[22] This was later changed to the Ministry of Works in September 1956,[23] and later to Federal Ministry of Works and Survey in 1958.[24] After the PWD was renamed the Ministry of Works, the Public Works Department became the administrative section of the Ministry and the aspect of road construction was placed under the Ministry of Transport. This arrangement remained until independence in 1960, when the ministry was renamed the Federal Ministry of Works and the road construction responsibility returned.

The PWD had various branches, some of which carried out several constructional, maintenance and repair functions. These included the establishment or core branch which handled roads, buildings, plumbing, other related structures and general maintenance works, electricity branch, the mechanical branch, water works, architectural, accounts, inspectorate. Apart from the last three, the others were directly involved in maintenance and repairs.

**Repairs and Maintenance Operations of the PWD in Southeastern Nigeria**

In colonial Southeastern Nigeria, the PWD carried out a lot of repair operations on buildings, roads, plants/equipment and other related things around which its functions revolved.

The PWD encountered serious termites' challenges in their building operations both in the Eastern and Western parts of the country. In Southeastern Nigeria, the PWD faced the termites challenge as can be seen from the termite nest discovered at Uyo as well as in Ikoyi in 1936.[25] Although there were many specimens of termites that disturbed the works of the PWD, two were the most important. These two specimen types were *Copotermesintermedius* and *Macrotermesbelicosus* (both earth termites) and *Cryptotermes Havilandi* also known as *Kalotermes* (dry wood termite).[26] Thus the two most important specimen types were earth termites which affected the foundation of buildings and dry wood termites, which attacked timber works such as roofs of buildings, furniture, wooden bridges etc. The most destructive were the wood termites, while the most difficult to handle were the subterranean or earth termites.
For buildings already affected by termites, heavy fumigation of the affected parts was also carried out as a corrective measure to combat and stop the damaging activities of earth and dry wood termites. The trenching system was often used for foundations endangered by earth termites. When a foundation came under termites' attack, the result was continuous settlement or sinking of the building. The trenching system involved the opening up to six inches below foundation level all round the building, and fumigating the exposed areas with petrol.[27] For dry wood termites, various wood preserving solutions were used. There was the use of Zinc Chloride solution. Wolman Salts solution, Creosote and water emulsion, mixture of Creosote and crude oil heat to 160 degrees Fahrenheit were used to coat the wood.[28] All these varied in effectiveness but none perfectly protected the woods they were coated with.

The PWD could not boast of totally winning the battle against the termites. It remained a battle they had to fight until the time of independence. If anything, the PWD in its 1936 annual reports hinted that the termites were indefatigable. According to the report, "Until all concrete or steel construction has replaced timber, or a satisfactory deterrent proved, termite damage will continue to affect adversely the course of building maintenance."[29] This condition was not satisfied. So, West African termites continued to be a thorn in the flesh of the PWD as well as task their engineering ingenuity.

Shingles used for roofing were also liable to termite attack. Although treatment with chemicals like 'Creosote' and 'Wolman salt' provided protection, but only for some reasonable period. Reinforced concrete was also used but needed to be covered with felt or bitumen to make it watertight. If no ceiling was used, then the roof was doubled by the placement of pre-cast concrete slabs on the reinforced concrete roof.[30] Thatching generally was of poor quality and had several variations ranging from grass, large leaves and plaited palm fronds in long length or similar to tiles. One major disadvantage of thatch roofing was its susceptibility to attacks by insects. Insects could destroy a thatched roof within one year. However, the use of heat and smoke released into the roof helped to deter the pests from carrying out their ruinous activity and elongating the lifespan of the thatched roofs to two years before re-thatching was done.[31]
PWD buildings were painted, especially permanent buildings built in cities for top government workers. Two major painting materials were used for PWD works. These were the whitewash and paint. The whitewash was cheaper and its ingredients were easily available. It could be used on wood, rough wall and plastered smooth wall.[32] It was easy to compose or make and apply. Whitewash was prepared with lime (white clay) and water and sometimes with disinfectant. The PWD did not experience problem with the whitewash except that it had to be renewed after sometime. While whitewash was often prepared by the PWD officers, paint on the other hand was bought from suppliers mainly from London including Lewis Berger & Sons, Ltd., Robert Kearsley & Co., Atlas Preservatives Co Ltd., Jenson & Nicholson Ltd. Among many others.[33] These companies were all Crown Agent-registered companies. Unlike the with whitewash, the PWD experienced a lot paint failures.

The most serious type of paint failure experienced by the PWD was severe cracking which occurred widely within few months of application.[34] Paint failure was addressed by first scraping away the affected paints from the wall and brushing the wall to get rid of dust. Then, the wall was given enough time to dry because fungi were sometimes

responsible for the failure. The wall or surface to be painted was then primed or given a first protective coating. The paint failures did not always come from the paint, but sometimes from the painted surface. The use of first coating with a primer was therefore introduced as one of the anti-paint cracking measures. Tests were also carried out on paints and the PWD Director had to approve of the type of paint to be used. The service of a Paint Adviser was also secured by the PWD in 1948.[35] The work of the paint adviser was to take and keep record of the behavior and performance of various paints used in various localities over time, and to properly advise on the best type of paint and manner of use.

The PWD also carried out furniture repairs. The PWD had wood-working workshops in the regions or provinces and the central one in Lagos. Furniture used in government buildings that got bad were taken to the PWD workshop for repair.[36] Loosed joints were re-nailed and strengthened and torn cover clothes were mended with needles. If a set of furniture was ascertained to be too bad, beyond repair, and no longer serviceable to the Department by the Board of Survey, the PWD Director had the delegated power from the governor to write off such furniture sets.[37] However, the Director could only exercise this power where the value of the store or furniture did not exceed one hundred pounds, and where no question of fraud or negligence on part of employees was involved. Only the governor could write off anything above that amount.

Another repair operation of the PWD during our period of study was the repair of vehicles used by the Department and other government departments. For the PWD, the vehicles were used for transporting building materials and personnel from one part of the country to the other. PWD plants could develop fault and suddenly stop working. Vehicles conveying materials could also go faulty thereby causing failure in material delivery for timely completion of projects or could get damaged through accident. It was in view of all these that the PWD established the Mechanical Section which handled these kinds of challenges. Vehicles and machines/plants repairs and maintenance therefore constitute an important operation of the PWD.

The PWD had mechanical workshop engineers with assisting staff. These formed the Mechanical Section and were charged with the duty of repairing and maintaining vehicles and machines used by the Department and any other government Department. 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 ad 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. etc.[38]

When any of these machines or vehicles went bad or faulty, they were taken to the PWD workshops for repairs. Repair of PWD vehicles involved in an accident followed some protocols. The law required that the driver or any other person driving the vehicle when the accident occurred should first inform his local Head of Department (HOD) who then got a representative from the headquarters involved in conducting an on-the-spot assessment of what really happened and reporting back to the government.[39]

There were branch/provincial workshops and central ones. Problems that the Inspector of works in charge of the Provincial workshops could not handle were taken to the Central workshops. There were two Central workshops that served Eastern Nigeria. These were the Port Harcourt Central Workshop and the Enugu Central Workshop.[40] The Motor transport repair shop overhauled over 155 engines in 1959, and in 1960, the Plant Section, the new name of the Mechanical Section, completed over 229 heavy repairs, an increase of over 90 on the figure of the previous year.[41] Due to increased efficiency in day to day maintenance, minor repairs reduced considerably. The Department carried out over 19 jobs for other Departments during the year.[42] The department also carried out recurrent house repairs like disjointed window repairs, electrical, plumbing among others.[43]

The PWD also repaired roads. In Southeastern Nigeria, the PWD employed men known as road-men. The major works of the road-men were the repair of potholes as they developed, dealing with drainage problems where standing water had undermined the stability of the carriageway and also to restore a smooth riding surface when corrugations began to develop.[44] Roads were usually graded to keep them even and in good shape. Untarred roads, especially earth roads, required frequent grading and re-grading. Road re-grading and bituminous re-surfacing were also some of the repair

operations carried out on roads to keep them optimally functional. Apart from grading, macadamizing was necessary before bituminous surfacing. It involved the systematic laying of stones or metals in layers on the ground of a road to serve as a strong foundation and to increase the load-carrying capacity of the road. Stones used were obtained either by free labour or through petty contractors.

In terms of maintenance, the PWD was also up and doing. The agency had to maintain a 'stock' of capital works or structures built and acquired over the years. The PWD can be rightly called colonial government's real estate manager. The 'estate' to be maintained was made up of mainly government buildings, roads and equipment.

The government public buildings maintained included departmental buildings, staff quarters, parliamentary buildings and other government buildings, hospitals, schools, prisons, courts, post offices, rest houses, training centres, quarantine stations, markets, social centres among others. The furniture items in these buildings, toilets, kitchen, water systems like taps as well as electrical fittings were also maintained by the PWD. The agency carried out white-washing of walls, fumigation against termites, changing of bad electric bulbs, renewal and renovation of furniture sets among others. For instance, furniture sets in the government buildings that were to be renovated were taken to the PWD workshops where they were worked on. Sometimes the woods of the furniture pieces were re-polished to give a lustrous and glittering look. Sometimes, they were re-clothed when the covers got old. These furniture also had to be sometimes cleaned. Bad doors, windows and louvres were fixed or replaced. Toilet soak-away were evacuated when full. Flowers were also planted around the buildings and maintained through regular watering and frequent trimming. Another maintenance operation of the PWD during the period of our study is the prevention of termites from infesting the foundation, pillars and wooden parts of buildings and the treatment of ones suspected to have the early presence of these termites. As a preventive measure, actions and strategies to eliminate or at least curtail the activities of termites were considered very important. As a preventive measure, site and foundation fumigation and other anti-termites operations were thus considered necessary. The queen termite which was believed to be the chief propagator of the termites found in the nest and its surroundings was usually taken to the PWD head for proper study and preservation.[45] The PWD also maintained government staff quarters. In the process of doing this, the PWD had to manage tenants occupying the buildings. One aspect of maintenance which helps to reduce impairment is humans-management. This is because impairments are usually caused by both human and non-human factors like humidity, pests among others. Ability to effectively manage these causal factors was considered a great maintenance stride. The PWD combined both proactive and responsive methods to get information of the need for repairs in the government staff quarters. Sometimes, they went for supervision and sometimes they were called and had to respond to the calls. The tenants were mandated to report damages within 24 hours of discovery or bear the cost of repairing them. Attending to repair calls on time was seen as necessary to avoid further degradation leading to cost escalation. The PWD thus handled the herculean task of receiving and attending to complaints from tenants regarding the condition of their accommodations in the quarters.

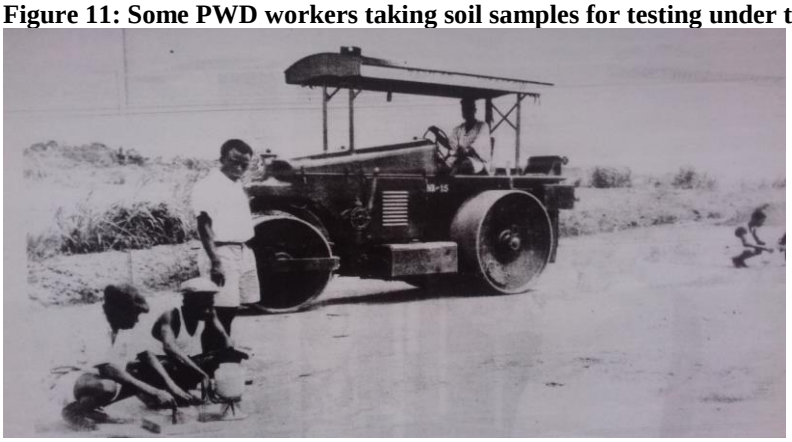
The road maintenance operations of the PWD included clearing of bushes near the road, patching of pot-holes, road inspection and status monitoring, cleaning of the roads, erection of road closure sign during important road repairs, replacement of wooden bridges with steel and iron types, replacement of single-carriage bridges with double-carriage types, highway traffic management which involved taking road traffic density census and using the information to take the best decision on traffic management, alerting road users of dangerous spots etc.[46] Apart from these, the machines and equipment used in the construction of both the buildings and roads were also maintained by the PWD Mechanical branch.

**Maintenance and Repair Strategies of the PWD in Southeastern Nigeria**

The PWD adopted several strategies in carrying out various maintenance and repairs of public infrastructures. One of the strategies the agency adopted to enhance its maintenance and repair efforts was the reliance on research information. The Nigerian PWD had material testing labouratory. The lab helped to test the efficiency of the materials used for both new constructions and for repair works. There was a West Africa Road Research Laboratory (WARL) Scheme which helped in conducting researches on roads across British West African colonies.[47] In the fourth regional conference of the Directors of Public Works in 1948, it was recommended that the Nigeria Public Works Material Testing Laboratory should be developed into a Regional Road Research Laboratory to serve the West African Colonies – Nigeria, Gold Coast, Gambia and Sierra Leone. This was how the scheme came into existence. However, it did not last beyond 1953 due to funding challenges.

With the closure of the WARL, the PWD fell back to the country's labouratory which had become stronger and better equipped. The most frequent problems the labouratory testing addressed 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.[48] The soil testing process involved first, the obtaining of soil samples from the proposed road or building site directed by an expert. 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. The information obtained helped the PWD to carry out informed maintenance and repairs on different roads and foundations of buildings. The image below shows a sand sample taking process:

**Figure 11: Some PWD workers taking soil samples for testing under the direction of a soil expert**



**Source:** PWD Annual Report, 1959-60, sourced from the National Archive, Enugu

Specimen study also helped in maintaining and repairing buildings infested and affected by termites. Study of the termites specimen helped to understand the behavior of termites and by so doing check their activities. Termites found in building sites were sometimes taken and studied as a preventive measure. Sometimes, the queen termite was taken to London and kept in British museum. For instance, when a termite nest was found three inches below the ground surface adjoining the verandah of a bungalow at Uyo in Southern Nigeria in 1935, the queen termite and other specimens found were taken to the British museum for preservation and close study.[49]

Another strategy adopted by the PWD for repair and maintenance execution was the documentation and circulation of information obviously derived from research knowledge to all their workers involved in repair works. A special document was prepared by the PWD which gave notes, data and specifications on how specific works and repair operations were to be carried out. Copies of this document which were distributed to PWD engineers laid specific emphasis on testing the material nature of the soil on which the foundation of a proposed building or bridge was to be built.[50] This helped for harmonization of efforts and less dependence on superior officers who may be engaged in other duties and speedy execution of repairs.

Training was another strategy adopted to enhance maintenance and repair. For instance, an anti-termite gang was formed in 1934 by the PWD.[51] Although the gang focused its activities on Lagos, artisans from various Divisions, including the Eastern Divisions were attached to the gang for three months courses of instruction and understudying of the operation. Training of anti-termites staff was therefore another strategy devised to maintain and repair buildings infested by destructive termites.

Another strategy was regular inspection of the buildings. The PWD had African foremen whose duty was the regular and frequent inspection of properties and writing and keeping of termites records. The record included reports of the number of buildings inspected and trenched and the number of earth and dry wood termites discovered and treated.[52] Reports of the number of termite nests discovered and destroyed were also taken. Continuous inspection by anti-termites staff and other experienced engineers helped to quickly discover parts of buildings showing vulnerability to termites attack or those having early signs of the attack. For wood termites, the application of wood preservatives also helped to keep the termites at bay.

Standardization was another strategy. The PWD tried to keep all the buildings under its care up to a specified standard because it was easier to maintain buildings of a reasonable high construction standard. Since the Department had many buildings to maintain, it had to keep cost of maintenance as low as possible. Buildings of very low standard gulped a lot of money due to their vulnerability to pests, humidity and other depreciating agents or factors. For instance, semi-permanent structures were not maintained directly by the PWD.[53] It was therefore necessary for the PWD to be involved in the acquisition process of any building by the government.

**Principles of PWD Repairs and Maintenance in Southeastern Nigeria**

These were the principles of economy, principle of being systematic, principle of priority, proximity, literacy, and accountability. Economy was a major principle that guided PWD maintenance works. It was believed that lack of maintenance could lead to higher expenditure on repairs. To avoid that, maintenance must be given priority attention. Also, maintenance had to be done within the limits of the yearly financial estimates. When the traffic load of an earth or laterite road reached a certain level, it became uneconomical to continue to maintain it. It was considered more economical to do bituminous surfacing for such roads. When the traffic volume of a laterite road reached hundred vehicles per day, maintaining it was no more economical to maintain it. It was usually advisable to convert such roads to bituminous ones since they were cheaper to maintain.[54]

Being systematic in maintenance was another principle. At the earlier period of colonial rule, maintenance was not very systematic. However, towards the end of the era, maintenance became more systematic. A systematic maintenance practice involves logically determining the needed maintenance works to be done on roads, and the particular roads and its parts that needed urgent attention. Determining the most important maintenance needs of roads is very important as it helps for effective and efficient road maintenance. To be systematic in maintenance, it was necessary for areas of priority to be identified.

Therefore, closely related to the principle of systematic maintenance was the principle of prioritizing. Logically discovering priority needs was important for the PWD. However, discovering these 'logical' priority needs was not easy as the condition of the roads was in a continuous state of flux due to visible and non-visible factors. A rating system, first developed and applied in the USA, was therefore adopted in 1952 to determine the state of the roads and the factors to consider in choosing the roads to give priority to. The rating system was the Highway Sufficiency Rating Surveys (HSRS). A survey was made of the entire existing Trunk 'A' Roads in Nigeria and Southern Cameroon. The survey took three and half months to complete. It was carried out by an experienced engineer of the PWD, driving slowly through the roads and allotting a value to each section of roads bearing similar characteristics. From the results of the HSRS, it was possible to identify logical priorities based on a systematic evaluation combining all characteristics of the Trunk A Road system. This was repeated every two years to capture changes and adjust priorities to meet current needs.

The principle of proximity ensured that public infrastructure works were maintained by the PWD units or branches geographically close to them. In order words, PWD used their branches to carry out maintenance works around them. The Headquarter only provided the finance and also inspected the extent to which the branches were carrying out the assignment. Where technical or any assistance was needed from the centre, it was also given. Although the Trunk 'A' Roads, numbered from A1 to A12 were financially the responsibility of the Headquarters, both for construction and maintenance, the maintenance role was delegated to the branches. Those involved in maintenance and repairs had to be trained to be literate enough to be efficient in the job, and they were made to be financially accountable.

**Conclusions**

This study has historicized the PWD and the engagement of its workers in repairs and maintenance in Southeastern Nigeria. Apart from examining their repair and maintenance operations, the strategies and principles that guided these efforts have been highlighted and explained. This paper concludes that the effectiveness of the PWD in carrying out maintenance and repair operations was borne out of effective strategies such as research, training, knowledge sharing among others as well as pragmatic principles. These are lessons that must be learnt and applied in current efforts at public infrastructure repair and maintenance especially in Africa, given the reality of wide infrastructure deficit in most of the countries making up the continent. The limited number of stock of infrastructure must be well maintained and kept in the right shape while efforts are being made to construct new ones.

Without efficient and functional stock of public infrastructure, the dream of economic development will become a mirage. Although Africa needs a forward leap in infrastructure development, that forward leap must start from the efficient maintenance and repair of its existing stock of infrastructure., not from anywhere else. Apart from improving the economy, effective repairs and maintenance will help to minimize waste disposal and save the environment.

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