

UNIVERSITY OF EDUCATION, WINNEBA
COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

**THE EFFECTS OF MAINTENANCE ON PUBLIC BUILDINGS: A CASE STUDY OF
SOME PUBLIC BUILDINGS IN THE SALAGA TOWNSHIP, EAST GONJA
DISTRICT IN THE NORTHERN REGION**



HENRIETTA MATOAMU SOALE

AUGUST, 2016

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BY

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TECHNOLOGY EDUCATION, Faculty of TECHNICAL EDUCATION, Submitted to
the School of Graduate Studies, University of Education, Winneba in partial fulfillment
of the requirements for the award of Master of Technology Education (Construction)
Degree.**

AUGUST 2016

DECLARATION

STUDENT'S DECLARATION

I, Henrietta Matoamu Soale declare that, this Project report, with exception of quotations and the references contained in the published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE.....

DATE.....

HENRIETTA MATOAMU SOALE

SUPERVISOR'S DECLARATION

I hereby declare that, the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME: **MR M. K. TSORGALI**

SUPERVISOR'S SIGNATURE..... DATE:

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I am very grateful to the Almighty God for allowing me to unearth my potentialities, which were nearly shelved due to certain circumstances. I apologize in advance if your name is not mentioned in the script and hope you will accept my gratitude.

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DEDICATION

I dedicate this piece of work to my parent and my aunty Mrs. Frico Dora who has be behind me offering the needed support and encouragement throughout my course of study.



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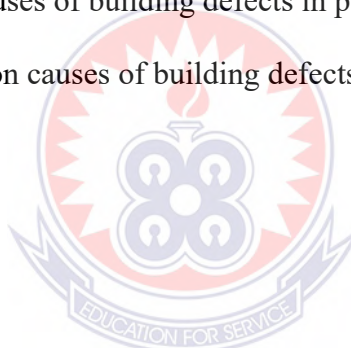
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ABSTRACT

A building fabric is referred to as an “environmental envelope” because it is the means by which the natural or external environment may be modified, to produce a satisfactory internal environment for man to live in and affect the ability of the buildings to perform their functions adequately. The deterioration of buildings hampers its ability to perform adequately, thus it is important to ensure proper maintenance to prevent deterioration. Maintenance of public buildings in Salaga Township is on the decrease regardless of the size, type, location and ownership. Public buildings represent significant investment of the tax payers’ money and therefore preserving these building systems is important. In view of the above, this study was designed to assess the current condition of public buildings, identify the underlying principal causes of poor maintenance of public buildings, analyze the maintenance policy and practice and capacity of the maintenance and estate departments of public institutions and make suggestions and recommendations towards the adoption of effective maintenance policy and innovations that would address the building maintenance problem in public institutions. The field investigations focused on residential buildings of Ghana Education Service, Ghana Health Service, District Assembly, and other departments. Through the application of sampling techniques, 25 buildings were covered in the survey. The survey revealed that there is a real housing maintenance problem in public institutions. The study also established the following factors as being responsible for the poor maintenance of public buildings: The age of the buildings, Lack of maintenance culture, Inadequate funds and high maintenance cost, Pressure on building facilities by number of users and Poor construction work and maintenance work done and others. The study concluded by enumerating a number of recommendations aimed at providing the necessary framework for proper and effective maintenance of buildings.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

British maintenance level standards, Defines “maintenance” as the combination of all the techniques and the associated administrative actions intended to retain an item or restore it to a state in which it can perform its required functions. Maintenance brings about improved utilization of building ensuring the highest safety standards. Nevertheless, building maintenance becomes more difficult according to the age of the structure and this depends on the quality of the original building coupled with the rate of maintenance of the structure (Adenuga, 1999).

Over the years, there has been increasing abandonment of building projects and infrastructure facilities which has led to the dilapidation, degradation and deterioration within the Salaga Township. Throughout the world and in Africa, the main buildings mostly ignored are public buildings of which Ghana is not left out. On the contrary however, these public buildings deserve to receive more attention because they serve the purpose of the general public. On the part of the designers, they forget the durability of the materials and its serviceability before including them in their designs (Adejimi, 2005). While the builders or contractors prefer new projects rather than maintenance work.

A report that was conducted or developed by the building maintenance committee (in the UK) observed that 20% of the average annual expenditure on repairs in a large number of buildings was abnormal and in most cases, could be described as arising from defects. One may attest to the fact that the growing population in Ghana has necessitated the construction of buildings for both domestic and commercial use for which the practice of maintenance of facilities should be paramount. It is therefore of primary importance that building structure

facilities which are owned by the public are maintained in order that they can serve both architectural and aesthetical functions for which they are built.

Design plays a major role in determining the condition of buildings after completion, mainly in aspects of building defects and maintenance (Ahmed, 2006). The condition and the quality of buildings reflect public pride and the level of prosperity in the area. When buildings are neglected, defects can occur which may result in extensive and avoidable damage to the building fabric. Recently, there has been a lot of research investigation and analysis which point to the fact that certain factors such as client's perception, cost of maintenance work, unskilled maintenance techniques, government policies, inability to prepare and follow maintenance schedules are direct causes which lead to dilapidation and deterioration of building structures (Onibokun, 1997). There are other causes of lack of maintenance such as force majeure, cultural problems, state of the economy, the receding global economic meltdown, lack of time, general illiteracy of the occupants of the building and abuse of the facilities.

Government institutions (Ministries, Departments and Agencies) who are managers of public buildings attach little or no importance to the maintenance of buildings that they occupy be it offices, bungalows, schools or recreational facilities. The cost of maintenance of such buildings is far below the cost of constructing new ones, yet public officers refuse to maintain these buildings but rather wait for it to deteriorate and request for new buildings. Every infrastructure has an economic life span that can only be sustained through proper regular maintenance and that lack of strong and universal maintenance in Ghana is due to lack of ethics in effective maintenance. Deterioration of buildings and other fixed equipment is inevitable, for this reason periodic attention is required to keep them in good shape so that they can continue to perform their required function and also sustain the level of utility and value derived from them.

Preliminary survey of some public building structures at Salaga Township shows distinct features associated with lack of regular maintenance. This includes cracks on walls, beams, columns and slabs resulting in the exposure of reinforcement bars. Other problems observed are water leaking from the concrete roof slabs which weaken the concrete and water seeping from external walls, windows, and roof. The seepage causes staining of walls, encouraging the growth of fungus and causing the paints to peel off. Another set of problems identified were blockage of sewage causing seeping of water and growth of weeds around pipe joints, rusting roofing sheets and damage windows, window frame as well as broken louver blades. Outside the buildings, there were rusted light holders and exposed electrical wires on external walls, the environment was weedy and gutters or drains were choked. Some public buildings in Salaga Township are dilapidated to the extent that, they have caused and continue to cause havoc and devastation on the lives and properties of the occupants. This could be attributed to lack of maintenance, apathy of occupants and neglect of the building structures. It is also observed that, most occupants do not attach importance to operation and maintenance plan, let alone its implementation. Public buildings in Salaga Town for far too long have been neglected from maintenance, even though these facilities are valuable assets to the people of the township. In situations where consideration is even given to maintenance of buildings, its expenditure is frequently kept to the minimum without looking at the adverse long term effect of such policies, which at the end cumulatively results in increasing deterioration of the buildings and accompanied by effects on the contents or components of the buildings and the occupants.

1.2 Statement of the Problem

A brief inspection of public buildings in Salaga Township belonging to several state institutions such as the Ghana Education Service, Audit Service Office, Ghana Health

Service, The Police and Fire service shows that such buildings have been for so long neglected from maintenance, even though these facilities are valuable assets to the people in the District. The cost of maintenance of such buildings are far below the cost of constructing new ones, yet public officers refuse to maintain these buildings but rather wait for it to deteriorate and request for new buildings.

Deterioration of buildings and other fixed equipment is inevitable, for this reason periodic attention is required to keep them in a state such that they can continue to perform their required functions and also sustain the level of utility and value derived from them.

Public sector buildings serve as a considerable source of public funds and therefore there is the need to preserve them in a way that would make their benefit felt over a long time. Many constructions have been done since the early days of colonialism to modern times but due to the neglect of maintenance, a lot of these structures are in a very deplorable state. Maintenance is usually seen as a nuisance and is frequently overlooked. Consequently, a small maintenance procedure becomes a major repair work over time which is very expensive to undertake.

It is against this background that the researcher deemed it necessary to conduct a study to investigate the factors contributing to the current dilapidated state of public buildings in the Salaga Township and also to bring out effective and innovative ways to maintain such public buildings in the area.

1.3 Purpose of the Study

The purpose of the study is to assess the effects of maintenance on public buildings.

1.4 Objectives of the Study

The objectives of the study are as follows:

1. To explore the maintenance practices on various public buildings.
2. To examine the causes that lead to the deterioration and dilapidation of public buildings and infrastructure in the Salaga Township.
3. To provide solutions in the form of recommendations to the menace of lack of maintenance of buildings and infrastructure in the Salaga Township and the nation as a whole.

1.5 Research Questions

The following research questions are formulated to guide the study:

1. What is the current state of maintenance work on public buildings in Salaga Township?
2. What factors or reasons account for the non-maintenance of public buildings in the Salaga Township?
3. How can public institutions ensure continued maintenance of their buildings in order to retain and improve upon the conditions of the buildings?

1.6 Significance of the Study

The study is designed to serve the interest of Ghanaians especially policy makers as well as property development companies and the ordinary Ghanaian at large. In so doing, the study will establish the underlying causes and effects of non-maintenance of public buildings, contribute immensely to good maintenance of public buildings in general and suggest pragmatic measures to be put in place to arrest the phenomenon.

The study will also help to affirm the contemporary role of management in effective maintenance practice. It will review the effectiveness and the need to strengthen maintenance practices both internal and external of building structures. Furthermore, the study will serve

as a reference to individuals and other agencies who wish to embark on similar maintenance research in the future.

1.7 Scope of the Study

This study will be limited to the Salaga Township. The study was designed to cover and analyze the effectiveness of maintenance practice on public buildings around Salaga which are in obvious state of disrepair. It would also cover the causes of defects and its effects on the buildings and occupants. This is to ensure that the findings of the proposed problem are accurately tackled and to ensure time proximity.

1.8 Organization of the Study

The write up is organized into five chapters. Chapter one will give the general overview of the intent of the project which includes statement of the problem, objectives, research questions, significance of the study, scope of the study and organization of the study. Chapter two will deal with the review of relevant literature on the study. Chapter three will deal with the methodology which will be used to undertake the study. Chapter four will be dealing with the results and discussion of the data analyzed and chapter five will involve summary of the findings, conclusions and recommendations based on previous chapters.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The principal objective of this study was to assess the impact of maintenance on public buildings in the Salaga Township in the East Gonja District of the Northern Region of Ghana. This chapter of the study provides a theoretical review of literature on the concept of building maintenance, the purpose of maintenance in buildings and challenges of maintenance in the building industry. Again, issues of maintenance such as types of maintenance, causes of building defects, general maintenance issues in Ghana are reviewed.

2.2 Concept of Building Maintenance

The British Standard (BS 3811, 1964), defines building maintenance as “the combination of all technical and associated administration action intended to retain the elements of a building or restore these elements to a state in which they can perform their required functions in an acceptable standard”. It went further to explain the acceptable standard and cost as “one sustain the utility and value of facility, and include some degree of improvement over the life of the building”.

Another useful definition provided by Seeley (1993), is that maintenance is the combination of all technical and associated administrative actions intended to retain an item in or restore it to a state in which it can perform its required functions to an acceptable standard. That is, it is maintained in an efficient working order and in good repair. On the other hand Efobi (1992), refers to building maintenance as a calculated attempt to support, sustain or uphold a given property in order to ensure that the building and high standard facilities are provided. Randall Memullan, (1988), defines maintenance as “the routine repaired and renewal of a building needed to maintain the utility, structural soundness and value of building”.

However, according to the researcher, building maintenance is the works undertaken to keep, restore and improve a building, its components and the surroundings of the building to acceptable standard within an acceptable cost. Maintenance therefore includes all the necessary work done to preserve a building with its furnishes and fittings so that it continues to provide the same or almost the same facilities amenities and serves as it did when it was first build. It includes the expenditure necessary to maintain the rental value of the property and involves,

- Day-to-day repairs such as leaking taps and electrical defects.
- Periodic up-keep such as painting and
- Major repair requiring heavy expenditure and the services of technical experts, example foundation works and re-roofing (Afranie & Osei-Tutu, 1999).

Buildings are very important assets of many nations. The elements and components that make up the building have a lifespan and therefore tend to develop defects over time. These defects may be described as failings or shortcomings in the function, performance, statutory or user requirement of a building. In order for buildings to continue to fulfil their functional requirements, they must be regularly maintained. Maintenance is required to ensure the optimum performance of the building as specified by the users. The building components and elements should not fail at any inconvenient instant as required by users.

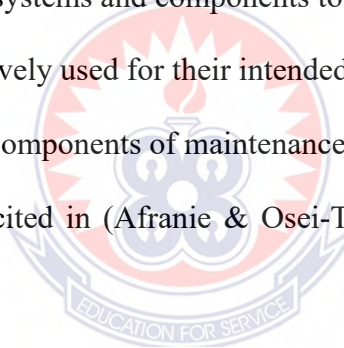
RICS (2009), states that building maintenance has for many years been regarded as the “Cinderella” of the building industry, with little attention paid to innovation and “free thinking” in the delivery of its service. However, it should be pointed out that building maintenance is not the only key to sustaining the built environment, but its value in terms of employment and expenditure in the economy is also significant. The actions referred to are those associated with initiation, organization, and implementation. It envisages two processes: retaining”, i.e. work carried out in anticipation of failure, referred to as “preventive

maintenance” and “restoring”, i.e. work carried out after failure, referred to as “corrective maintenance”.

The committee on Building Maintenance defined „acceptable Standard“ as quoted in the first edition of BS 3811, as “one which sustains the utility and value of the facility” and this is found to include some degree of improvement over the life of a building as acceptable comfort and amenities standards rise. Similarly, the Committee of the Department of Environment (1972) defined building maintenance as Work done in order to keep, restore or improve every facility, i.e. every part of building, its services and surrounds, to a currently accepted standard and to sustain the utility and value of the facility.

Furthermore, the University of Calgary (2013), identified maintenance as work required preserving or restoring building systems and components to their original condition or to such condition that they can be effectively used for their intended purpose.

Intendancies-related concept or components of maintenance involve a considerable amount of work which Harper (1969), as cited in (Afranie & Osei-Tutu, 1999), has been categorized into the following components.



2.2.1 Rectification of buildings

This is response to inherent defects in design, construction or installation stages of the building process. It frequently occurs fairly early in the life of a building due to shortcomings in design, inherent faults or unsuitable material and components that may have been damaged in transit or during the installation process or as a result of incorrect installation (Harper, 1969) as cited in (Afranie & Osei-Tutu, 1999).

Rectification represents a fruitful point at which to reduce the costs of maintenance, because it is available. All that is necessary at any rate in the theory is to ensure that the components and materials are suitable for their purpose and are correctly installed. Rectification work

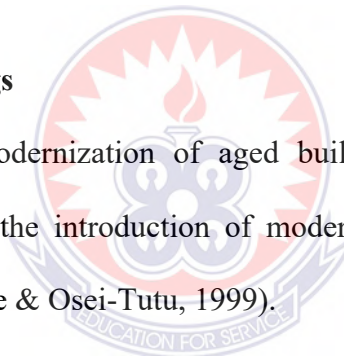
could be reduced by the development and use of performance specification and codes of installation (Lee, 1987).

2.2.2 Replacement of building facility

This refers to removal and substitution of physical broken down materials or elements as well as deteriorations in appearance. Circumstances may necessitate complete replacement of the whole building if finances permit. Replacement occurs at all cost in buildings because service conditions cause materials to decay at different rate. Much replacement work stems not so much from physical breakdown of the element or materials as from deterioration of the appearance (Seeley, 1987).

2.2.3 Rehabilitation of buildings

Rehabilitation is the modernization of aged buildings with or without adaptive alterations for use. It involves the introduction of modern service into buildings without changing its original use (Afranie & Osei-Tutu, 1999).



2.2.4 Renovation of building

Renovation is work done to restore a structure, services and equipment by major overhaul to the original design and specification or to improve on the original design. The work may include substantial additions and extensions to the original structure (Afranie & Osei-Tutu, 1999).

2.2.5 Refurbishment of buildings

Refurbishment refers to replacement of missing parts or introduction of new decorative elements into a structure to upgrade it so that it is bright, clean and fresh again.

2.2.6 Repair of buildings

Repair means, “Such repairs as having regarded to the age, character and locality of the house which would make it for occupants of reasonably minded tenant of the class who would be likely to take it (Proudfoot, 1890). Repair is to re-instate a building into its original state so that it functions as it was first build. It involves a reactive response to deterioration of a building and it is essentially ad hoc in nature.

2.2.7 Servicing

Building services industry is based on engineering principles that are applied to the built environment (Roger, 2013). Servicing is essentially a cleaning operation undertaken at regular intervals of varying frequency and is sometimes termed as day-to-day maintenance. Daily sweeping of floors, monthly washing and cleaning of windows and regular painting for decoration and protection every four years are some examples of servicing. Servicing becomes necessary because of constant use of facilities, the effects of the weather and atmospheric conditions on the components of the building.

Services in building cannot be seen as element of building but plays major role in the acceptance and conformability of the function of the main elements in the building by the occupants.

A building must do what it was designed to do not just provide shelter but also be an environment where people can live and achieve comfort. Building services are what makes a building come to life. These include:

- Energy supply-gas, electricity and renewable sources.
- Heating and air conditioning
- Water, drainage and plumbing
- Natural and artificial lighting and building facades.

- Escalators and lifts
- Ventilation and refrigeration
- Communication lines, telephones and I.T networks
- Security and alarm systems
- Fire detection and protection

Services also have defects like breaks, leakage, removal of parts, and burning in the case gas and electricity.

2.2.8 Factors to consider when deciding to carry out maintenance

A number of factors need to be taken into consideration which deciding whether to carry out maintenance work. It is necessary to understand how these factors inform the maintenance decision making process. According to Derek and Syagga, (1987), the following factors influence the decision to carry out maintenance on a building.

2.2.8.1 Cost of maintenance/Inadequate finance

Maintenance expenditure is investment that should yield returns. In order to yield maximum returns, the most economic method of maintenance must be selected out other alternatives. For instance, economy should guide the choice of type of maintenance over each other. It is necessary to compare cost of maintenance with cost of maintaining similar facilities, replacement cost, cost of construction of a similar facility and the priority of the work to be carried out.

2.2.8.2 Physical Resources That Are Available

Materials to be used to execute maintenance work must be available in adequate quantities and quality. Likewise any equipment needed to carry out the maintenance work or

activities must equally be available. Skills cannot be downplayed. A component craftsman or craftsmen will be needed to execute the works to the required standard of workmanship specified for the specific maintenance work.

2.2.8.3 Interference with Usage of the Facility

Many maintenance works that are undertaken involve demolition which greatly interferes with use of the facility by occupants. Thus, it may be necessary in such an instance to decant. Even where maintenance can be carried out while users are in the building, the option of decanting should be weighed against factors such as vandalism, theft and users' interference with the works.

2.2.8.4 Level of Urgency of the Maintenance Works

Factors such as safety of the public and users, user requirement and user agitation dictate the level of urgency of maintenance works. Postponement of execution of maintenance works to a later date will invariably lead to more expensive works at a later date. Postponement could lead to failure of the structure which could result in serious accidents and necessitating demolition and construction of a new structure. Pressure from users for defects to remedy can dictate the urgency of maintenance works.

2.3 Purpose of Building Maintenance Work

The standard of maintenance achieved has an important influence on the quality of the build-up environment and there seems little doubt that society will continue to expect higher standard in new and existing buildings (Seeley, 1993). These Purposes include;

- Building maintenance is of a great significance to the economy not only because the scale of expenditure involve, but also because it ensures that, the nation's stock of

buildings, both as a factor of production and of accommodation, is used as effectively as possible.

- The prospect of maintenance of buildings is to restore elements of buildings let alone keeping a majority of buildings to an acceptable standard. This is because further serious deterioration is permitted; further generations could be faced with a major capital burden.
- The standard of building maintenance achieved has an important influence on the quality of the build environment and there seems little doubt that the society will continue to expect higher standard in new and existing buildings.
- Building maintenance is mainly done to take care of the physical facilities so as prolong their life span. To maximize the life of the main components and materials, maintenance can reduce cost of subsequent maintenance by extending periods between repairs and replacements.
- To maintain the value of a building. A better maintained building normally has greater value; however, increased value may be marginal as location and size of site all play an important in the determination of values (Afranie & Osei-Tutu, 1999).
- Good maintenance ensures optimum use of buildings and allows buildings to be used to their full potential.
- To create or maintain suitable appearance which can make a positive contribution to external environment and social conditions. The dilapidated buildings can contribute to social derivation and badly maintained services and facilities waste energy and resources and can affect the environment. This would ensure that buildings do not detract from surroundings and also maintain a suitable appearance.

- Good or excellent buildings enhance the productivity of user, particularly students in educational institutions. The efficient functioning of buildings will therefore be necessary to enable users to derive maximum benefits of enhanced productivity.
- Building materials and components have a finite lifespan and cannot remain throughout the life of a building. Building materials and components undergo deterioration under the vagaries of weather. For instance, metals corrode, termites attack wood and crystallization occur with time leading to decay and deterioration of building materials and components use to construct buildings.

2.4 The Construction Industry

Construction industry is one of the most booming industries in the whole world. Building construction is divided into residential and non-residential (commercial/institutional) Roger (2006). Building construction in Ghana is the product of private companies and public authorities, with many individuals and organizations involved in the construction of a single structure, from the manufacture of necessary components to final assembly. Building projects by public entities employ a registered architect or civil engineer under the direction of a project manager, or both, to execute the design and to make sure that it complies with public health, fire, and building regulations. The design must at the same time conform to the requirements of the owner. The architect or engineer converts the requirements into set of drawings and written specifications that are usually are sent to interested general contractors for bids. The successful bidder in turn subcontract plumbing, painting, electrical wiring, structural frame construction and erection, and other jobs to specialist firms (Lee, 1995).

Contractors ordinarily carry out their work under observation of an architect and or engineer, who acts as agent of the owner. Minimum construction standards are presently administered

and regulated by local authorities. They apply to new building work and building work and maintenance works of existing buildings.

The provision of modern accommodation by rehabilitation old outdated buildings rather than constructing new ones has become increasingly popular with developers and there are numerous reasons for this. The enormous scale of the 'housing problem' in England was highlighted by the English House condition survey 1981. It is clear on examining these statistics, that there is an urgent need to inject large sums of money into upgrading the existing housing stock, both now and in the foreseeable future.

Atkinson (2003), explained that managerial errors mostly accounts for more than 82% of all construction errors committed and that managerial errors have hidden or latent characteristics, suggesting that these error are not visible at construction stage and both clients and designer might have huge impact on such defects.

On the part of the designers, they may forget the durability of the materials and its serviceability before including them in their designs (Adejimi, 2005). While the builders or contractors prefer new projects rather than maintenance. The present state of buildings structures could be attributed to lack of maintenance and neglect after being put into use.

2.5 Challenges of Maintenance

Some of the challenges of maintenance include;

- Problems facing the maintenance sector are corruption, lack proper allocation of meagre resources and lack of concrete effort by management of client organizations. For instance Kenny (2007), has stated that corruption in the industry of developing countries is a common place evil and a driving factor behind pressure to overspend on new construction rather than maintenance of the existing stock of infrastructure.

- Inadequate finance - it is generally acknowledged that inadequate finance is a major constraint on effective property management, partly because maintenance budgets are the easiest to cut when money is scarce. According to Miles and Syagga, (1987), maintenance expenditure can be absorbed more easily in commercial and industrial organizations where it may account for as little as 0.5% of turnover, but even these cases maintenance is taken for granted except when it threatens production profitability. However, the situation is more serious in the public sector where damaging effects of poor maintenance are less immediately obvious. Also in the case of housing estates, it is common for organizations to emphasize the provision of new houses, with little funding provided for maintaining existing stock. Not only are day-to-day repairs neglected, but efforts at improvements and rehabilitation are considered lower priority than new construction. This problem of inadequate finance indeed results in rapid deterioration of existing stock resulting in increases in the demand for new houses because poorly maintained houses are not only unpopular; but they soon reach the stage where the structure itself deteriorates and rebuilding has to be considered.
- Poor building design: One of the causes of public housing decay includes “poor workmanship” (Amuneke, 1995). It is not uncommon to find that buildings are inherently expensive to maintain because of inappropriate priorities applied during the design phase. Poor detailing and the specification of unsuitable components and materials are common complaints. In addition construction errors arising from inadequate drawings and specification coupled with poor workmanship because contracts are awarded to incompetent contractors are the frequent causes of rapid physical deterioration in public buildings
- In addition, construction errors that is construction skills (Amuneke, 1995), arising from inadequate drawings and specifications, coupled with poor workmanship

because of contracts awarded to incompetent contractors are frequent causes of rapid physical deterioration in building. Good design should allow accessibility and adequate working space for essential maintenance such as cleaning, and minor repairs to pipes, ducts and cables.

- Non-Availability of physical resources: Non-availability of physical resources affects decisions in that, when suitable materials for maintenance are not available, it becomes difficult to undertake maintenance. Again even if suitable materials are available but not in adequate quantities and the alternative materials are not available, it deters people from undertaking maintenance activities. The level of craftsmanship in terms of both skills and efficient numbers can also affect decisions to carry out maintenance.
- Bad management; Idleness and waste among maintenance personnel. With respect to time management, “whatever time line you set, expect it to take a third to a half-time longer,” said Burnett. Time is essential in planning the future of a facility. Time controls everything from budget and weather issues to equipment, wear and tear and employee patience.

2.6 Types of Building Maintenance

Building maintenance can be classified as planned maintenance and unplanned maintenance by BS 3811. The planned maintenance is also divided into preventive (schedule and condition based) and unplanned maintenance is corrective maintenance.

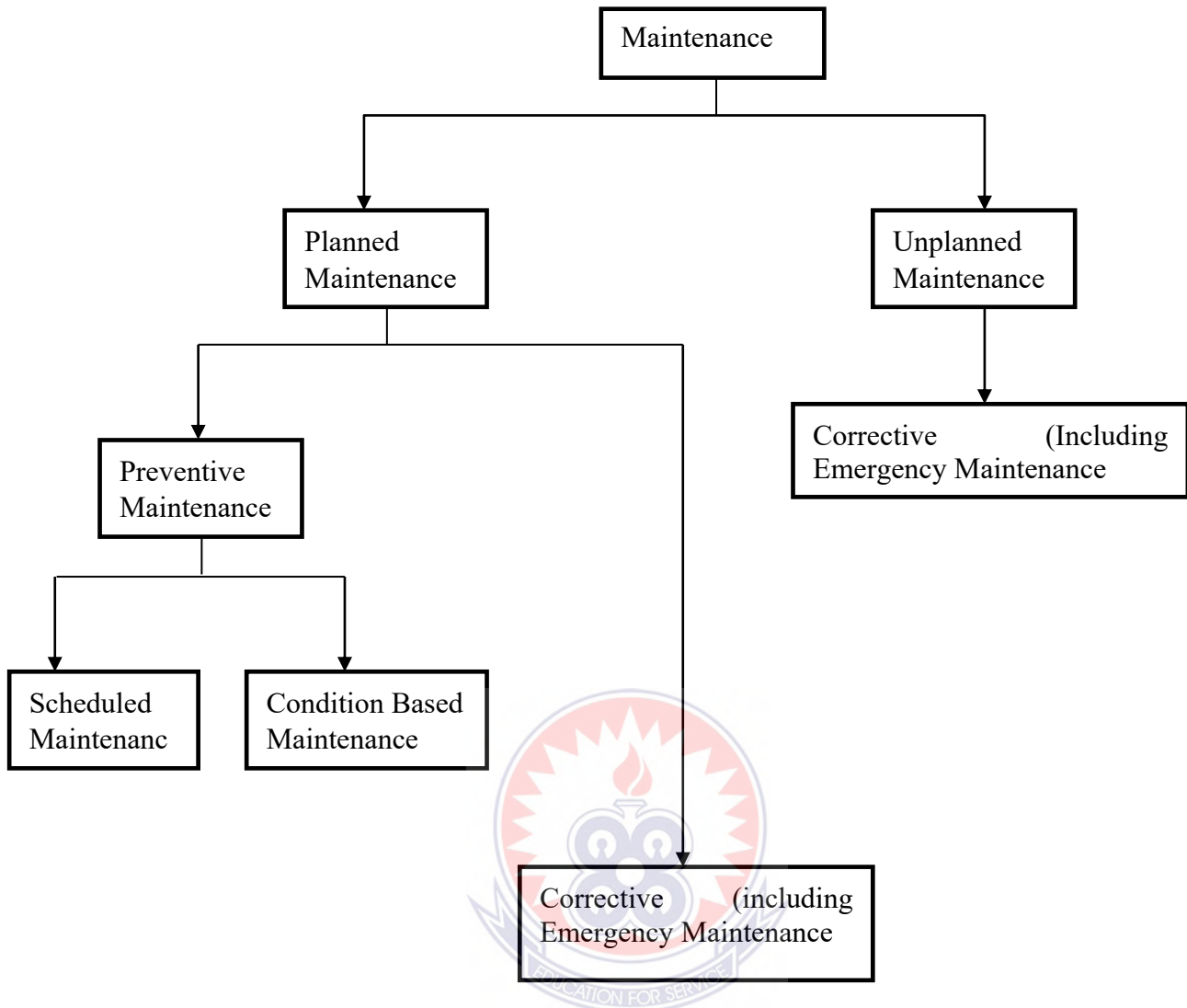


Figure 2.1 Types of maintenance

Source: BS 3811 (1984)

2.6.1 Planned Maintenance

Planned maintenance is “the necessary work organized and carried out with forethought, control and record to a predetermined plan” (Hytchison, 1975). This is also the maintenance organized and carried out with forethought, control and the use of records to a predetermined plan according to Miline, (1985). Planned maintenance involves all maintenance activities whereby predetermined procedures are documented and all resources required to carry out the maintenance activities are known and available but this is not

practiced in the District. The maintenance activities are carried out at regular basis. It can either be a corrective or preventive maintenance. The preventive maintenance can also be a scheduled or conditioned based maintenance. There are four subcategories of planned maintenance namely; planned preventive maintenance, planned routine maintenance, planned shutdown maintenance and planned running maintenance.

2.6.1.1. Planned Preventive Maintenance

Preventive maintenance has been described as “regular periodic work that may be necessary to retain the performance characteristics of a product as well as that required to replace or repair the product after it has achieved a useful life span” (Lee, 1981). It is the planned maintenance carried out at predetermined intervals or corresponding to prescribe criteria and intended to reduce the probability of failure or the performance degradation of an element or item within the expected life of the facility so as to ensure its continuous operation. In this type of maintenance there should be a maintenance policy in place. It aims at preventing unexpected events from occurring and takes the form of replacing parts and/or overhauling at regular intervals to ensure that the building or its components are functioning efficiently. In this type of planned maintenance, deterioration of asset to the point of failure does not happen. Also, top management commitment to planned maintenance is essential for effective implementation of a planned preventive maintenance regime. This can only be done while the facility is in service. In situations where preventive maintenance is seen as a **schedule Maintenance**; the maintenance is carried out to predetermine interval of time, number of operations, mileage etc. And when it is seen as **Conditioned-based Maintenance**; the maintenance is initiated as a result of knowledge of the condition of the facility or item from routine or continuous monitoring. A well-planned preventive maintenance is advocated for its effects on improving equipment’s operating efficiency, preventing premature

replacement of components, and avoiding interrupting for building occupants. This will help buildings function as they were intended and operate at peak efficiency because preventive maintenance keeps buildings functioning as designed. Preventive maintenance is widely through to reduce long-term costs by maximizing the operating capacities of equipment, minimizing down time and avoiding breakdowns that would otherwise lead to higher repair cost in future.

2.6.1.2 Planned Shutdown maintenance

This is work which can only be done when a facility is out of service. This refers to planned maintenance activities which are only carried out while equipment is shutdown (Lee, 1995).

2.6.1.3 Planned routine maintenance

Maintenance is planned and carried out at a regular, predefined interval. Regular subjective inspections and/ or monitoring of the condition of the asset are part of the regular maintenance activities (Lee, 1995).

2.6.1.4 Planned running maintenance

The maintenance activities are carried out to keep the buildings and equipment operating in an efficient manner and include replacement of burned out lights, repair of windows, door locks, light switches, leakages and other fittings and fixtures.

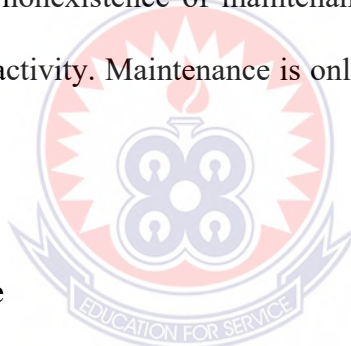
2.6.2 Unplanned Maintenance

It is a maintenance work carried out to no predetermined plan. Lee, (1995) reported in his study that unplanned maintenance is most at times seen as corrective maintenance including emergency maintenance. This is work carried out by unforeseen break down or

damage which can also be termed as unexpected or unavoidable maintenance. It is reactive in nature and maintenance activities are not carried out periodically and invariably action is only taken when assets show symptoms of failure to function at the required standard of performance. Maintenance procedures in this case are not documented and resource requirement for maintenance activities are not estimated and may not be available before the start of maintenance work. There are three subcategories of unplanned maintenance namely; breakdown maintenance, corrective maintenance and emergency.

2.6.2.1 Breakdown maintenance

This is maintenance carried out after part of the building or equipment has failed to function. It is characterized by nonexistence of maintenance schedules and lack of formal documentation on maintenance activity. Maintenance is only carried out during the period of breakdown.



2.6.2.2 Corrective maintenance

This maintenance activity is carried out with the aim of correcting parts of the facility or equipment that has failed or that are in process of failure. Repairs, restoration and replacement of components are characteristic of this type of unplanned maintenance.

2.6.2.3 Emergency maintenance

In this type, maintenance is only carried out after an urgent or emergency situation arises (Lee, 1995). Shutdown of the facility or equipment may be necessary to facilitate maintenance works to be carried out and this may result in lost production and cost of maintenance being prohibitive. This is normally practiced in the District by occupants.

2.7 Maintenance Practices else where

Sustainability of capital investments of any nation has been a major and global dialogue most especially in developing countries where infrastructural development is still at the infancy (Ojara, 2013). This is because most of government expenditures and investments focus on infrastructural development such as road, power, water and housing even though the challenges in the developed nations is sustainability. Most governments concentrate on the award of contracts for new infrastructures, giving near-to-nothing attention to the maintenance of existing ones. One of the ways for sustainability is the maintenance of the existing stock of infrastructural facilities and services. The level of dilapidation of facilities such as kerosene cooking system, flush toilet, generator installation, well water , gas cooking system , bath facilities, in-house portable tap water, public portable tap water, private bath facility, public bath facility, electricity cooking system , spring and stream, pit latrine and pail system were identified by Ojara (2013). According to BS 3811 (1974): maintenance is the work or a combination of actions associated with initiation, organization and implementation carried out to retain an item in or restore it to an acceptable standard in which it can perform its required function. Hence, Kunya (2012), observed the defects in housing facilities. He catalogue peeling of wall surface, rising dampness in substructure, floor slab failure and doors and windows defect, leaking roof while foundation failure and Sagging of beam. He further advocated that maintenance culture requires the correct diagnosis of defects, current remedial measures, sound technical knowledge of material usage, management resources as well as the formulation and implementation of integrated plan and policies to sustain utility. The absence of these qualities has led to the decay of the nation's physical, social, aesthetic and economic environment. Ipingbemi (2010), ascertained the causes of defects in housing facilities to include the using of untested or inferior materials such as cement, aggregate and water, improper management of the facilities such as door lock and louvers, lack of regular

check-up of the facilities, improperly design of fire suppression system, causing un-insulated (PVC) pipes to freeze and burst and lack of qualified professionals.

Ipingbemi (2010), further stated that the emphasis was on the development of new properties with little attention paid to the maintenance of the existing stock and the future maintenance needs of the proposed ones. The general belief now is that the present very prohibitive cost of new buildings has imposed on individuals, corporate bodies and the nation as a whole the need to invest more in maintenance.

Housing maintenance becomes more difficult according to age of the structure and this depends on the quality of the original building coupled with the rate of maintenance of the structure (Adenuga, 1999). Maintenance of building received little attention from the users, designers and contractors (Siyanbola et al., 2013). It should be noted that the maintenance objective is to preserve buildings in their initial functional, structural and aesthetic states. This is to ensure that they continue to remain in such state and retain their investment value over a long period of existence (Ipingbemi, 2010). The users do not always make use of the property and the services in good condition, often users do not obey the information contained in the maintenance manual of the building if it exists at all (Siyanbola et al., 2013). Most property owners sometimes endeavour to keep maintenance expenditure to the least, eliminating the consequences of the long term effect of such action. On the part of the designers, they may forget the durability of the materials and its serviceability before including them in their designs (Adejimi, 2005).

Kunya (2012), identified some solutions to the identified defects such as availability of qualified and competent artisan, taking good care of the building facility such as door locks, examining of building materials before use, regular check-up of facility such as water tank and using of tested materials.

2.8 Causes of Defects on Buildings

All elements of a buildings deteriorate at a greater or lesser rate, dependent on the material and methods of construction, environmental condition and use of the building (Ahmad, 2006; Lee, 1995). Building defects is defined as an imperfection, deficiency or fault in a building elements or component which adversely affects its functional performance or appearance (Lee, 1987). Some defects are natural consequences of aging and normal use but to a lack of proper skills and care. The main causes of deterioration and decay of buildings may be classified as physical, chemical or biological.

Physical causes include abrasion and impart as a result of force applied on the part of a building. Examples include deteriorations in floors as a result of pedestrian traffic and wear of the surfaces of floor, walls and other building elements as a result wear and tear due to movement of machinery and equipment.

Chemical changes are when the deteriorations are as a result of chemical change in the composition of the materials employed in the construction of the building fabric. Examples are corrosion of metal, alkaline attack and certain paint failures as a result of chemical decomposition. By far the major concern is corrosion of metals either through rusting or electrolytic action.

Bio deterioration includes decay of wood and growth of mould or mildew on surface of wood as result of fungi attack and damage to wood by insects such as termites. Also, the effects of roots of trees near buildings cannot be taken for granted as these can cause cracks to develop in buildings. According to Kayan, (2006) the causes of defects on buildings that call for maintenance depends on so many factors but the commonest of all are the following:

- Natural forces
- Poor construction technologies
- Corrupt procurement practice

- Miss-use of facilities
- Natural wear and tear over years
- Violent acts / vandalism
- Lack of adherence to regulation

2.8.1 Natural Forces

According to Kayan, (2006), the following forces come as a result of an act of God such as;

- Wind: strong wind causes movement of large tree roots close to buildings disturbing the foundation of the building leading to cracks. It can also cause the removal of the roof which affects the parts of the building.
- Earth quakes causes the ground movements resulting in settlements (equal and unequal) of building which leads to cracks and partial or total collapse of the buildings.
- Rain: heavy rains causes flooding which result in creating efflorescence, cracks, dumpiness on walls of buildings and erosion of the soil around the foundation of buildings among others.
- Sun bleach causes flaking of paints on surface of building.

2.8.2 Poor Construction Technologies

Kayan (2006), further explained that poor construction technologies contribute greatly to the development of defects on building which might call for an immediate maintenance on the building (Shohet & Laufer 1991), reaching the same results. Construction Technologies are in various forms' or ways, thus design, materials, workmanship and environmental factors. Poor communication between management members of the design on construction teams can lead to defects on buildings.

2.8.3 Errors in Design

The design of a building is the formation of elements or components to a size and shape which is acceptable and can perform the function of the user. When this is not done rightly, the design cannot hold and it becomes a poor design. Faulty or incorrect design details will lead to maintenance problems during the life of the building. This will result in decay and deterioration setting in early in the life of the building. For instance, inadequate cover for mild steel reinforcement will cause corrosion. The quality of work should be correctly specified to ensure that the functional requirements of the building are not compromised. Specification relating to materials and workmanship should be ensuring that reasonably high quality standards are adhered to. It is worth nothing that a poorly designed building is one in which little or no attention is given to maintenance.

2.8.4 Materials

The choice of material and their proportion of mix are very important. If these are not taken into consideration, serious defects are expected on the building during the construction and soon after completion. Thus according to (Lee, 1995), in many countries including Ghana, people depend on wood for roof construction. In the researcher's view this has increased deforestation and has therefore raised the price of timber to a level unaffordable by the poor. This call for cheap wood, insect attached leading to defect on the roofing members and other wooden materials in the building.

2.8.5. Workmanship/Faulty Execution

Workmanship or faulty execution of the work in construction is about the sense of judgment for the formation of component according to the specification of the design of the structure or building. This goes with proportions of materials for the construction which have

been lashed over the years. If these proportions are not followed correctly it ends up giving a weak and defective end product. If specifications are flouted by way of substandard materials and components and/or poor workmanship then resulting work will be of substandard quality. Poor quality of work will increase the rate of decay and deterioration and the formation of defects in buildings. Site supervision and implementation of quality management according to plan and schedule of work on site is necessary to minimize the instance of faulty work.

2.8.6. Environmental Condition

This can also play a major role in building construction. The choice of site for the building construction especially public buildings should be carefully considered. Some lands are better left alone to continue to serve certain communities as water ways and resulted in flooding due to blockage of water flow. In Ghana for example, the climatic condition of the southern part of the country is warm and humidity. Building in these areas should have their components to withstand these weather conditions. In the Northern part of Ghana the climate is hot and dry. Component of buildings in this area should also be able to withstand the weather without any changed.

2.8.7. Corrupt Procurement Practices

Seely (1967), explained Procurement practices as the processes of obtaining goods, works and services. Whenever there are lapses in these practices.

From the perspective of the researcher public institutions are the bodies that are normally involved in procurement practice and sometimes these institutions in procuring; incur unnecessary cost because of the contracting officers;

- Accepting ceiling prices for negotiation on a sole-source basis before obtaining cost data.

- Combined the sole-sources spare ceiling prices with the one competitively established in the original contract.
- Permitted in appropriate transfer of spares to other contracts. These gives room for not enforcing contractual rights and opposing penalties for non-performance. The goods, works and services which are not in conformity with the specification resulting in earlier-than planned rundown and would always call for maintenance on the facility.

2.8.8 Mis-use of facilities

Miss-use of public facilities or buildings is common in most of our public institutions of Ghana and Africa in General (Kayan, 2006).

The badly or worthily use of public buildings deteriorates these buildings at a faster rate but no one cares. In the opinion of the researcher, Ghanaians have the mentality that public buildings are properties of the government and therefore sees government as somebody else but little does he know that it is the user and others that forms the government. The beneficiaries of these facilities out of ignorance allow the facilities to deteriorate out of mis-use of the facilities.

2.8.9 Natural wear and tear over years

A building is made up of some many components, which these components come into contracts with another during usage. Others also by the virtue of the natural climate condition, they undergo chemical reactions (Ahmad, 2006).

This end up developing unaccepted system for the function of these components and affects the general performance of the building. Floor surface for example are susceptible to wear and tear. These comes as a result of usage, there is a friction that take place between the underfoot of human leg and the surface of the floor on which he/she walked or perform

his/her duties. This friction chop away the particles of the materials used for the floor little by little and end up creating very big cut which call for maintenance where even it is no longer friendly in the usage. Mild steel in the components of building elements also when exposed to the weather result in corrosion of the metals.

2.8.10 Violent acts / Vandalism

Building and other facilities suffer greatly whenever there is violence. Most institutions may have laws and policies against violent acts on peoples and properties but these laws are ignored and properties destroyed or taken away as a result of theft, vandalism or other acts of violence.

America for example had its pain from violent act on public buildings when the world trade center was attacked by Osama Bin Laden which saw the collapse of the 110 storey towers into surrounding Manhattan streets. The development of defects in buildings will cause users to develop psychological tension as mentioned earlier in the section on maintenance and project life cycle and if they are not remedied, could lead to vandalism. This point is evident when one considers the frequency and manner in which students put pressure on management of educational institution because of deterioration of buildings accommodating them.

2.8.11 Lack of adherence to regulations, rules and standards

Building regulation specify standards that a building is expected to conform. Conformance with regulations will guarantee the comfort, safely and health of users and the public. Flouting building regulations will have serious maintenance implications as user requirements will not have been met

2.9 General Maintenance Issues in Ghana

Building maintenance as pertaining in Ghana is nothing noticeable to write home about. Most companies including private and public that owned estates of building to ad hoe measures in trying to maintain their properties. The situation is worse when assessing the nature of maintenance in public buildings. Attitude portrayed was negligent to allowed buildings to deteriorate before maintenance was done.

According to Seeley (1985), leaving buildings to dilapidate is a general phenomenon as property owners frequently endeavour to keep maintenance expenditure to a minimum, ignoring or misunderstanding the adverse long-term effects of such a policy.

On the 20th March 2012, at Cape Coast, Mr. Kwasi Ahwoi, the then minister for food and Agriculture has said at a speech and prize giving day of St. Augustine S.H.S that, “the lack of a maintenance culture in the country was causing the nation a great of money which could have been channeled into development in projects”. He noted adding that, this development has devastating effects on the economy. (Elizabeth, *et al.*, 2007; Jalal 2003), has emphasized that the problems of lack of maintenance occur because of low quality of maintenance work, inexperienced and unskilled workers and manpower, lack of supervision from leaders, delay in repairing and replacing assets, insufficient information of maintenance and lack of commitment to maintenance plan.

The current state of maintenance in Ghana leaves much to be desired. Till today, Ghanaians are very ignorant in understanding the concept of maintenance and it still holds with many building owners that, whenever they put up a structure they have built it forever. In effect, no building can be considered maintenance free after its construction or throughout its life span. According to Son and Tuen (1993), ‘maintenance commences with the service life of the building.

Most public buildings such as schools, hospitals, market even the parliament house have been left to deteriorate as well as individual houses and other properties. Lack of commitment from leaders in all spheres of the Ghanaians society as well as the absence of clear policies and financial resources to effect regular maintenance and the failure of managements across the country were worrying, he indicated. The ministry of Finance which approves funds fails to provide for the maintenance budget submitted by the management of the various ministries.

Ghana at the present has no National Maintenance policy which is a strategy within which decisions on maintenance are taken to regulate or control preventive maintenance of buildings institutions. The maintenance policy of the institutions does not however take care of preventive maintenance which is a regularly scheduled inspection; testing and repair of buildings components intended to prolong a buildings life and restore components efficiency. The deterioration of building hampers it ability to perform adequately, thus is important to ensure proper maintenance to prevent deterioration. Public buildings represent significant investment of the tax payers' money and therefore process in the country, a lot of public and residential buildings are in a state of disrepair.

In Ghana, the neglect of housing stock and institutional buildings has resulted in grave concerns about the low priority accorded to maintenance. Lack of maintenance is blamed on little concern shown by the clients particularly government departments and in some cases lack of consideration of maintenance at the design phase by consultants. In Ghana, The Public Works Department (PWD) has since its establishment in the colonial era remained the sole department in charge of renovation of public housing estate though it lacks the necessary resources to carry out this function.

Many government and private buildings deteriorate and need to be maintained at an early stage of the project lifespan before construction is completed. Sadly, one contributory

factor is the willingness of a government to start a new project perhaps to fulfil a promise made during campaign instead of embarking on completion of projects started by an earlier government of a different party.

2.10 Building Components and Their Possible Defects and Others

Building components are commonly foundation, columns, walls, floors and are sometimes referred to as parts of building. The major components or elements of a building according to Lee, (1995), include the following:

- The foundations, which support the building and provide stability
- The structure frame, which supports all the imposed loads and transmits them to the foundations
- The exterior walls, which may or may not be part of the primary supporting structure
- The interior partitions, which also may or may not be part of the primary structure
- The environmental control systems, including the heating, ventilating, air-conditioning lighting, and acoustical systems.
- The vertical transport systems, including lifts, escalators, and stairways

But in the opinion of the researcher Building compounds are foundation, columns, walls, floors, lintel, Beams, roofs, openings (doors and woods), finishing, aprons and drains. There are some features which cannot be seen as elements but plays a major role in functions of a building. This may be referred to as services (electrical, plumbing & telecoms).

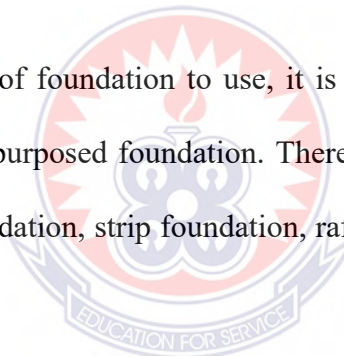
2.10.1 Foundation of Buildings

Foundation (also called a ground sill) is a structure that transfers loads of a building to the earth (Leonard, 1962). According to the “Oxford Advance Dictionary seventh edition” Foundation is a layer of bricks, blocks, stone, or concrete that forms the solid underground

base of a building. Foundation however can also be seen as a solid structure at the base of supports such as walls, columns, post, or stanchions, which transmit the load of these support and other components of the building to the ground. It must provide a level and firm base capable of carrying the superstructure without distortion.

The foundation is an integral part of a building which transfers the structural load to the ground. Selection of the foundation type and design depends on two distinct variables, that is the total building load and the nature and quality of the subsoil which is essential to achieve a satisfactory balance between these two conditions, otherwise overstressing of the soil will lead to excessive building settlement and possible serious structural defects. The total load that a building transfers to the subsoil is composed of dead load, imposed load and wind load.

Before deciding on which type of foundation to use, it is essential to examine the sub soil material below the level of the purposed foundation. There are various types of foundations but the commonest are slab foundation, strip foundation, raft foundation, pad foundation, and pile foundation.



2.10.2 Columns of a Building

Column is a vertical support which is free in all sides, taking the load of beam, slab etc. and transfers that load to the earth independently. It is vertical structural element that transmits through compression, the weight of the structure above to other structural element below (Shohet and Perelstien, 2004). Columns is however a long vertical member, usually square, Triangle, polygon or round in shape used to support a beam, floor, roof and capable of resisting heavy loads. Types of columns are basically classified based on the materials used for the formation. These are Timber column (post), Concrete column, Arches, Stanchion (steel column).

Cracking and disintegration of concrete caused by weak concrete due to improper mix design, unsuitable aggregates or cement ratio inadequate compaction and curing. Rust staining of concrete cover caused by corrosion of steel-cover concrete of inferior quality or inadequate thickness, mechanical damage of exposed angles and inadequate cover to reinforcement or poor quality porous concrete. The most common defects that can be found on columns are cracks, separation of aggregates, twisting, bowing, rusting in terms of stanchions and reinforcements in concrete columns, punching where there are no mat at base and hanging where the base is cut off from the main column.

2.10.3 Walls of a Building

Wall is an element or component of a building which has a number of functions. It may be required to divide up space into areas of convenient size, keep out dust and rain and yet let in air, provide shade, coldness, privacy, shelter and protection.

Wall can of course be purely ornamental. Many walls however, apart from performing some of the above functions, are required to provide support for upper floors or roofs that are to be load-bearing.

Walls classification and design conveniently divide into two categories; external and internal walls. Most external walls support the upper floor and roof and internal walls are self-supporting only, functioning as a means of dividing space. The strength of mortar is a very important consideration. It should successfully join bricks while maintaining a constant separation without failure.

Walls of a building can be put under many varieties but the most common ones are Stone wall, concrete wall, Sand Crete block wall and Brick wall. According to Arch et al (2004)", Sand Crete block is widely used in Ghana as walling units. The quality of blocks produce, however, differs from each manufacture due to the different methods employed in the production and the properties in the constituent material. This is a block found to be suitable for load bearing wall when well produced.

It is however a mixture of sand (fine Aggregate), cement and water. When properly produced, meet BS2028 recommended for density and compressive strength of structural masonry (Amad, 2006).

Walls as a building element have some possible defects which in one way or the other affect the total performance of the building. Some of these defects are cracks, domain, cosmic strings, monopoles and textures. Those made of stone, required more closely – spaced joist. If the span of the load bearing walls is too long for joist to safely support, then a heavy cross beam may be used.

Diagonal cracks following horizontal and vertical joints, outward bulging of wall between ground level and eaves with gap internally between wall and edge of upper floors, general surface dampness, cracks in soffit due to faulty lintel settlement of foundations, displacement of wall, condensation through inadequate heating or ventilation.

2.10.4 Floors of a Building

The construction floor depends largely on its purpose and the materials available. The chief factors affecting its design are strength, comfort, coolness, sound insulation and in earthquake areas, flexibility. Local by-law will probably demand that a floor should be capable of carrying a certain load according to its designation.

According to Seely, (1967), floor is the walking surface of a room. A floor varies from simply dirt in a cave to many layered surface using modern technology. Floor may be stone, wood, bamboo, metal or any other material that can hold a person or any other load material that the floor is design to carry.

2.10.5 Lintel and Beams

Lintels are horizontal members over a building void supported at the end by two more vertical columns, wall or posts. This architectural system and building method has been commonly used for centuries to support the weight of the structure located above the opening created by windows and doors in a bearing walls Kayan, (2006). According to the researcher, lintel is a horizontal member made from concrete, timber or metal use to bridge an opening in a load or non-load bearing wall building without the door or window necessary carrying any load.

A beam on the other hand is a horizontal member that transfers loads from above to the foundation through columns, or post in a network of structure elements. The idea behind sizing beam is straight forward, add to gather all lives loads and dead loads that act on the structure and then resist the load through the help of columns or posts. Beams must be strong enough so that, it does not break. It must again be stiff enough so that, it does not deflect excessively under the load. However, in the researcher's opinion the process for sizing this structural element can be complicated if you are not an Engineer. Also, according to Kayan,

(2006), a beam is a horizontal structural element that is capable of withstanding load primarily by resisting bending. The bending force induced into the materials of the beam as result of external load, own weight, span and external reactions to these loads and it is called bending moment. Beam generally carry vertical gravitational force but can also be used to carry horizontal loads. Beam types can be concrete, wood, or steel.

There are so many defects in lintel and beams. In concrete lintel and beam there are common defects like knots, bowing, shrinking, trademarks, cupping, fungi attack, twisting and rots. In case where metal is used for lintel and beams, the commonest defects that are usually found are bending, rusting and cracks.

2.10.6 Roof of Buildings

A roof is the covering on the uppermost part of a building. It protects the building and its component from the effect of the weather. Structures that require roofs range from letter box to cathedral or stadium or dwellings being the most numerous (Chanter. & Swallow, 1996).

Roof structure is designed principally to prevent penetration of inclement weather and to provide an adequate barrier against heat loss. Other considerations include an acceptable appearance, the facility to absorb thermal and moisture movement, a durable finish and sufficient strength to accommodate maintenance and snow load.

Roof structures are classified according to the interrelationship of components which make up their frame work.

- Single roofs produced in a variety of forms, all having the common property of two dimensional supports, except at ridge board and wall plate levels and simple in design.

- Double roofs span is beyond 4.5m may be achieved by the sectional area of the rafters and its ties
- Others include flat roofs, lean-to roof, couples and closed-couple roofs, collar roof, triple roof or frame and tiles and asbestos slate roof

In most countries roof of a building protects primary against rain. Depending upon the nature of building, the roof may also protect against heat, sunlight, cold, snow and wind.

Roof can basically be split into two parts, thus the roof cover and the roof structure.

2.10.7 Windows of a Building

Window is a transparent or translucent opening in a wall that allows the passage of light and if not closed or sealed, air and sound. Window are usually glazed or covered in some other transparent or translucent material like a float glass. Windows are held in place by frames which prevent them from collapsing inn. Many glazed windows may be opened to allow ventilation, or closed to exclude inclement weather (Shotet & Laufer 1991).

The materials for window production are principally timber and steel. Aluminum Plastics (PVC) are now quite common, either as a coating to steel or timber or in hollow extruded tabular form as complete profiles. Corners are miter cut and welded and reinforced with steel brackets.

2.10.7 Doors of a Building

A door is a movable structure used to close off an entrance, typically consisting of a panel that swings or hangs or slides or rotates inside and outside. According to Reginald (1987), a door is a movable barrier for opening and closing an entrance which commonly turns on hangs or slides in grooves. Also according to Merriam Webster, a door is usually swinging or sliding barrier by which an entry is closed and opened”.

Additional functions include security, weather resistances, fire resistance, thermal insulation and sound insulation. Windows and doors as building components generate some degree of defects which have effect on the building. Some of these defects are rotten window and door frames, defective ironmongeries, broken window and door glasses, opening of joints in wooden doors and windows by hot weather, rusting of metals in doors and window when exposed without preservatives and sometimes braking of plastic windows and doors by heat.

2.11 Finishes of Building Components

These are the decorative texture or appearance of a surface of a building (Reginald, 1987). The choice of finishing depend on many factors, thus cost, durability, colour, hardness, slipperiness, resistance to oil, acids, heat, sunlight, abrasion, noise absorption, ease of maintenance and so on. The elements on which these finishing are applied are floor, walls and ceiling. The most common defects that shows on finishing are cracks, pilling, rusting, bleaching, splitting, hogging, bowing, warping, cupping and twisting. Blistering of paint films cause by moisture entrapped under paint film vaporizing under direct heat and sun, bleaching, chalking, and cracking flaking, wrinkling and faint brown patches soon after first decoration due to salts from some types of bricks and clinker blocks leaching through gypsum plaster.

2.12 Aprons and Drains

These are external features of a building which can also be seen as an element of a building. Aprons and drains are drainage systems around a building to direct and control rain water that might come from the roof of a building (Lee, 1987). The main purpose of these elements are to prevent soil erosion at the under part of a building. The defects that come on this elements are cracks, unequal settlement, efflorescence and erosion.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents a discussion on the methods and methodology employed by the researcher in the conduct of this study. This section focuses primarily on the research design used and the methods employed in collecting data for the study. It gives a description of how data was collected, the population, sample and sampling procedure, data collection instruments and techniques, and techniques used in the analysis of the data.

3.2 The Research Design

Research design is a framework or blueprint for conducting a research project. It specifies the details of the procedures necessary for obtaining the information needed to solve the research questions posed by the study (Bickman & Rog 1998).

This study was intended to investigate the effects of maintenance on public buildings and explore the maintenance practices of stakeholders in public buildings in the Salaga Township. In this regard, the researcher employed the descriptive survey design which allows for the collection of large-scale data upon which a basis can be drawn for interpretation and generalizations. Again, the quantitative research approach was used since the researcher sought to collect numerical data which could be easily analysed using descriptive statistics. With regards to the timeliness of the study, the researcher conducted this study as a cross-sectional research since it would not be replicated over time.

3.3 Population

The population in research according to Burns and Grove (1997) is the entire aggregation of subjects that meet the designated set of criteria for a particular study. The

target population for this study consists of stakeholders who are directly or indirectly concerned with the maintenance of public buildings in the Salaga Township. This include heads of public educational institutions, management and staff of the District Assembly, the Public Works Department, the staff and management of the District Hospital, the Police Service and opinion leaders such as chiefs, assemblymen, religious leaders and PTA of the various schools in the study area. In all, the total population under the study area is estimated to be about five hundred and eighty (580).

3.4 Sampling Technique and Sample Size

In research, the quality of a study stands not only by the appropriateness of methodology and instrumentation but also by the suitability of the sample and sampling strategy that has been adopted (Cohen, Manion & Morrison, 2007). For ease of accessibility and convenience, the researcher used simple random and purposive sampling techniques to select a total of seventy five (75) respondents for the study. The sample consisted of heads of institutions and departments, procurement officers, estate officers, engineers and staff of public institutions in the Salaga Township in the Northern Region of Ghana.

The purposive sampling was used in the selection of institutions based on the criteria that they were public oriented and had buildings which needed to be maintained. After the institutions were chosen, the simple random technique was used to choose an appropriate number of staff who were in managerial or operational positions. The sample consisted of fifty (50) operational staff members and fifteen (15) management staff members and ten (10) estate officers of the institutions selected for the study.

3.5 Data Collection Instruments and Techniques

The main instruments used for the study to collect information are questionnaires, interview and observation. Secondary sources of data were also used; these include the use of publication, text books, journals, newspapers, articles and the internet.

3.5.1 Questionnaires

Hendricks (2009) describes a questionnaire as a set of carefully designed questions given in exactly the same form to a group of people in order to collect data about some topic(s) in which the researcher is interested. Questionnaires were designed to help gather information to answer the research questions posed in the study. The questionnaires were made up of structured questions and this was designed to find out what factors contributed to the problem of poor maintenance of public buildings. The questionnaires designed were basically close-ended type for quick responses.

The administration of the questionnaires covered a period of two months. It was done through personal visits to the institutions (public buildings), schools and others of each of the respondents. The researcher visited the establishments and briefed the heads of institutions on the purpose of the study and its educational implications after permission was sought. The respondents were then allowed some time to raise questions on areas they did not understand. The researcher employed the services of two national service persons in the administration of the questionnaires. The national service persons were trained by the researcher on how to approach respondents and assist them in completing the questionnaires. A follow up with telephone calls was made to remind the respondents after distributing the questionnaires. In all, sixty five (65) questionnaires were administered.

3.5.2 Interview

Interview was also conducted to collect data which could substantiate the results obtained from the questionnaire administration. The interview was conducted for heads of institutions and estate officers in the various public institutions sampled for the study. Some of the issues covered in the interview were, the maintenance practices on various public buildings, causes that lead to the deterioration and dilapidation of the building, what maintenance strategies, procedures and practices adopted to ensure maintenance management on public buildings and more.

3.5.3 Observation

The researcher carried out an observation exercise on the public buildings in Salaga Township specifically looking at the state of public buildings and evidence of maintenance works carried out on such buildings. Observation about maintenance measures and activities in the establishments were closely made. In the observation, the researcher was allowed to inspect the buildings herself and record her findings in accordance with the observation guide check-list developed for that purpose. The observation was done on the public schools, the district hospital, the Ghana Education Service office, post office, Ghana Audit service office, National services office, public bungalows and others.

At the public schools, the research observed the roof, foundation, wooden members, the rails and more at the classroom, dormitories, dining hall, wash rooms and the administration as well. At the district hospital, the researcher observed the parts of the stores, x-ray department and some of the wards such as the wooden members of the building, the roof, finishes, ceiling and other services. At the Ghana Education Service, Ghana Audit Service, post and National Service offices, the researcher looked at the finishes, the openings, ceiling and others.

For the public bungalows, the roof, foundation, finishes, drainages, wooden members, the openings, ceiling, wash rooms and other services of the building were observed by the researcher. Some pictures were taken to show the state of the public building during the observation

Table 3.1 Indicators for measuring (observation) public Building Maintenance

Building elements and facilities	Indicators of Measuring maintenance of buildings
Roofs	Leaky, rusty, partly ripped off, completely ripped off, in good condition
Windows and doors (wooden members)	Partly broken down, completely broken down, no problem
Painting	No painting, faded painting, dirty, well painted
Floor	Developed cracks, peel-off, partly broken down, no problem.
Walls	Partly broken down, develop cracks, peel-off, tilted, in good condition
Foundation	Exposed, hanging, weak, strong
Age of building	Old (above 50years) medium aged (20-50yrs) and younger buildings (less than 20 years)
Domestic facilities (toilet, water, bathroom, electricity)	Good, fairly good, bad

Source: Author's Construct, 2016

3.6 Data Analysis

Data analysis is the process of evaluating data using analytical and logical reasoning to examine each component of the data provided (Burns & Grove 1997). Data analysis procedure helps in making meaningful inferences, predictions and conclusions from collected data. It also helps in converting data into information and again explores the relationships between variables. Burns and Grove (1997) further argued that “information gathered during data collection may lack uniformity.” Some information given may need reconstruction.

After collecting the data, it was first edited. During editing, relevant and appropriate errors were found and modified. The edited questionnaires were then organized and coded.

Coding involves assigning numbers or symbols to each response category in order to translate the raw data into a form that could be counted, tabulated or fed directly into a computer (Agyedu, Donkor & Obeng, 2010). The researcher used tabular graphs and percentages in analysing the data. The organized and coded data was then fed into the Statistical Package for Social Sciences (SPSS Software) for analysis and interpretation. The analysis and interpretation is presented under Chapter Four of this study.

3.7 Ethical Considerations

In the conduct of this study, the researcher paid attention to research ethics. To make this study conform to ethical principles and practices, the rights to self-determination, anonymity, confidentiality and informed consent were observed (Kusi, 2012). The respondents were informed of their rights to voluntarily participate or decline. They were informed about the purpose of the study and were assured of not reporting any aspect of the information they provided in a way that will identify them. They were assured that there were no potential risks involved in the process. Again, to avert any issue of plagiarism, the researcher rightfully acknowledged all sources from which references were made both in-text and reference list.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

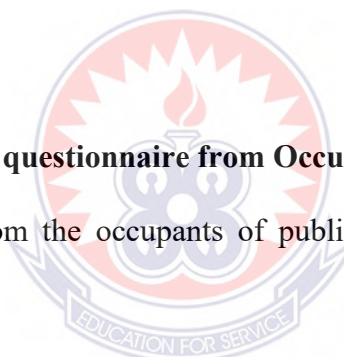
This chapter of the study is devoted to the results and discussions as obtained from questionnaires, interviews and observation.

4.2 Results and Discussion of Questionnaires

The results of questionnaires were obtained from fifty (50) occupants and ten (10) estate officers. Out of the sixty (60) questionnaires administered fifty eight (58) were successfully retrieved. This section presents the results obtained from the questionnaire administration.

4.2.1 Results and Discussion of questionnaire from Occupants of Public Buildings

The results of questionnaire from the occupants of public buildings are presented in this section of the study.



Demographic Characteristics of Respondents

The characteristics of the respondents covered areas such as the gender distribution of the respondents, highest academic background, years in establishment and working experience of the respondents. Table 4.1 presents the background information of respondents pertaining to gender, age, educational background and work experience in their present institution.

Table 4.1 Demographic data of respondents

Characteristics	Frequency (<i>f</i>)	Percentage (%)
Gender		
Male	43	86%
Female	7	14%
Age		
Below 25years	-	-
26 – 30years	4	8%
31 – 39years	8	16%
40 – 49years	19	38%
50 – 59years	7	14%
60years and above	2	4%
Highest Educational Qualification		
Primary school	-	-
Middle school	-	-
Junior high School	2	4%
Senior high school	10	20%
Tertiary school	38	76%
Experience (Number of years in institution)		
0 – 10 years	12	24%
11 – 20 years	15	30%
21 – 30 years	12	24%
Above 30 years	11	22%

Source: Field survey, 2016



From the data presented in Table 4.1, it is seen that an overwhelming majority of 86% of respondents are males whilst the remaining 14% are females. This is an indication of the fact that the public sector and in particular the building construction industry is heavily dominated by males with females playing minority roles.

The age distribution as presented in the table shows that 19 out of the 50 respondents, which represents a majority of 38% are in the age range of 40 – 49years. The age group which has the next highest percentage is 31 – 39years, recording a percentage of 16% which corresponds to a frequency of 8 out of 50. The remaining age groups of 50-59years, 26 – 30years, 60years and above and below 25 years recorded respective percentages of 14%, 8%,

4% and 0% in that order. From the age distribution, it can be rightly inferred that the respondents for this study are moderately matured and hence could be trusted with fair assessment of the issue of building maintenance in their institutions of work.

The highest educational qualification of respondents is also presented in Table 4.1. From the table, it is seen that all the participants of the study have received some form of formal education, at least to the junior high school level. The data indicates that a majority of 38 respondents representing 76% have tertiary education qualification whilst 10 representing 20% have senior high school education and the remaining 2(4%) have attained junior high school education. Again, the foregoing further indicates that the respondents are very well educated and as such would have a very fair assessment of the maintenance practices and state of buildings in their institutions.

Respondents were further asked the number of years they had been in their current institution or simply their work experience. From the data obtained, 12 respondents representing 24% had spent about 0 – 10years within their respective organisations and as such are considered modestly experienced. The majority of respondents, 15 representing 30% had an experience range of 11–20years which was considered as reasonably experienced. Twelve (12) respondents and 11 respondents representing 24% and 22% had respectively been in their establishments for 21 – 30 years and above 30 years. Considering the data presented, it is fairly assessed that the respondents are very well experienced.

General State or Condition of Public Buildings

The current general state of public buildings in the Salaga Township in the East Gonja District of the Northern Region was sought from the perspectives of the respondents. This information is presented in Table 4.2.

Table 4.2 Condition or state of public buildings in Salaga

	Frequency (<i>f</i>)	Percentage (%)
Having records of facility before occupancy		
Yes	6	12%
No	44	88%
Estimated Age of Building		
0 – 10 years	10	20%
11 – 20 years	13	26%
21 – 30 years	12	24%
Above 30 years	15	30%
Use of Building Facility		
School	23	46%
Hospital	5	10%
Offices	3	6%
Bungalows (residential)	8	16%
Social centre	11	22%
Observed Defects on building		
Yes	47	94%
No	3	6%
Kinds of defects observed on building		
Plumbing and sanitary services	3	6%
Electrical installations	2	4%
Cracks in walls	9	18%
Cracks in floors and exposed foundation	27	54%
Leakage from roof and ceiling	3	6%
Deteriorating wooden members (doors and windows)	6	12%
Occurrence of domestic accidents due to building state		
Yes	37	74%
No	13	26%

Source: Field survey, 2016

A cursory look at Table 4.2 shows that 88% of respondents were not given any records on the state of the facilities and the building prior to their assumption of duty in the building. However, 12% of respondents said they were briefed on the state of the building and accompanying facilities and equipment.

The age of any building, whether residential or institutional directly correlates with the amount of maintenance work needed to be performed on the building over time. To this end, the researcher sought from respondents the estimated ages of the buildings which housed their respective institutions. From the data presented in Table 4.2, majority of the buildings 15(30%) were estimated to be above 30years old whilst 24% had an estimated age of 21 – 30 years. Again, 26% of buildings were estimated to be 11 – 20years whilst the least aged buildings, i.e. within the range of 0 – 10years were 10 representing 20%. From this information, it can be concluded that the public buildings in the Salaga Township are fairly old and as such much attention needed to be paid to such buildings in terms of maintenance and renovations.

The use to which a building is put also directly contributes to its deterioration and maintenance needs over time. From the table, it is seen that majority, 23(46%) of public buildings in the study area were used as school buildings whilst 22% are used as social centres. It is seen that, 16% of public buildings are used as bungalows for residential purposes of staff whilst 3(6%) and 5(10%) are used as offices and a hospital respectively.

When asked whether respondents had observed defects on the buildings which housed their institutions, a majority of 47 out of 50 respondents which represent a percentage of 94% responded in the affirmative whilst only 3(6%) of respondents responded in the negative.

This result suggests that the public buildings in the Salaga Township are in need of general and comprehensive repair/maintenance works.

Probing further, respondents were asked to indicate which kinds of defects they had observed on the buildings. From the data, majority of respondents indicated that they identified cracks in floors and foundations of the buildings. This was the opinion of 27(54%) of respondents. Cracks in walls were the next major defect as observed by respondents in the public buildings of their institutions. To this, 9 (18%) of respondents responded in the affirmative. The other minor maintenance issues detected by respondents in their public buildings are plumbing and sanitary services, electrical installations, leakage from roof and ceiling, and deterioration of wooden members i.e. doors and windows. This result underscores what Yusif (1998), stated that though highly desirable, it has not yet been feasible to produce maintenance free buildings. The reality is that all the elements and components, which make up a building unavoidably deteriorate with time due to the inherent defects in design and construction and the effects of environmental agents and user activities.

Following up on the defects or maintenance problems observed in public buildings, respondents were asked whether there had been occurrences of domestic accidents due to these building defects. From the table, the results indicate that 37(74%) of respondents confirmed that there had been domestic accidents related to the building defects whilst only 13(26%) reported no such accidents emanating from building defects. Upon enquiry, it was revealed that these accidents have been caused by faulty electrical installations, leaky roofs and cracked/peeled off floors.

Maintenance Work Done on Public buildings

According to the BS 3811 (1973), maintenance is any activity that restores or puts buildings to their condition of first construction. The researcher sought to find out the kinds of maintenance activities that are commonly carried out on the public buildings in the Salaga Township.

Table 4.3 Maintenance work done on public buildings

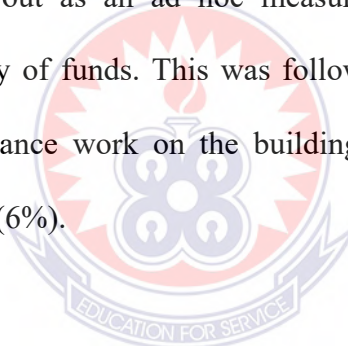
Variables	Frequency (<i>f</i>)	Percentage (%)
Type of Maintenance work undertaken		
Daily sweeping/cleaning	10	20%
Repainting	14	28%
Installation of broken equipment	3	6%
Mending broken walls, floors, foundations, etc	21	42%
Major repairs (eg. Reroofing, etc)	2	4%
How Often Maintenance is carried out		
Once in three months	3	6%
Once in six months	6	12%
Yearly	11	22%
Ad hoc (as and when defects are discovered) and funds available.	30	60%
Responsibility for maintenance of building		
Estate officer	10	20%
Government	20	40%
Institution	13	26%
Public Works Department (PWD)	7	14%
Source of funding for Maintenance		
Internally Generated Funds (IGF)	8	16%
Government	42	84%
NGOs	0	0%
Effect of Maintenance situation on work output		
Yes	44	88%
No	6	12%

Source: Field survey, 2016

Per the results presented in Table 4.3, the main kind of maintenance work undertaken on public buildings is mending of broken walls, floors and foundations. This received a

percentage of 42% whilst the next common kind of maintenance work was repainting, also receiving 28% of responses. The third commonest maintenance activity was daily sweeping or cleaning of the buildings. This was only accepted by 20% of respondents since most of them did not consider cleaning and sweeping as maintenance activities whilst installation of broken equipment and major repairs each received 6% and 4% respectively. This is probably because of the heavy financial responsibilities involved when carrying out major repair works on a building.

The researcher sought to know how often maintenance was carried out by respondents working in public buildings. From the results, majority 30(60%) of respondents indicated maintenance was only carried out as an ad hoc measure i.e. as and when defects are discovered subject to availability of funds. This was followed by 22% of respondents who indicated that they did maintenance work on the buildings annually, once in six months (12%) and once in three months (6%).



Again the survey showed that, 20 respondents representing 40% indicated that, the government is responsible for maintenance works; while 10 respondents representing 20% indicated that the estate officer is the one in charge of maintenance. Another 26% indicated that the institution is responsible for maintenance works; this is followed by 14% who indicated that, maintenance work is carried out by the Public Works Department (PWD). From the data above, maintenance work is highly dependent on the central government.

For any institution to realise its maintenance objectives, funding is a very important catalyst. No maintenance work can go on successfully to its completion without adequate funding. As regards the source of funding for maintenance works in public institutions, the result strongly

indicates that the institutions rely on government funding to carry out maintenance activities on the buildings. From the data, 84% of respondents intimated it is the government who funds maintenance activities whilst only 16% indicated that such works are funded by internally generated funds (IGFs).

Respondents were asked whether the maintenance situation had an effect on their work output. According to the data, 44 respondents representing 88% responded 'Yes' confirming that the maintenance situation had an effect on their work output. However, only six (6) respondents representing 12% responded that the maintenance situation had no effect on their work output. The data presented in the table reveals that work output is heavily affected by the poor state of unmaintained buildings hence leading to low productivity.

Condition of Building Elements

A building is made up of several elements (or parts) with each performing specific functions. These parts such as the foundation, flooring, walls, roofing, wooden members, etc. all play crucial roles in keeping the integrity of a building. The effective functioning of these elements together harmoniously determines the overall condition of a building. The researcher sought to assess the individual elements of the public buildings captured in the study in order to get a fair picture of the general conditions of these buildings. The data obtained are presented in Table 4.4

Table 4.4 Maintenance condition of public building elements

Building Element	Frequency (<i>f</i>)	Percentage (%)
Foundation		
Cracks developed	24	48%
Exposed/hanging	8	16%
Weak	11	22%
No problem	7	14%
Roof		
Leaky	25	50%
Rusty	14	28%
Partly ripped off	6	12%
Completely ripped off	0	0%
No problem	5	10%
Floor		
Showing cracks	26	52%
Peeled off	20	40%
No defects	4	8%
Walls		
Partly broken down	8	16%
Developed cracks	24	48%
Peeled off	8	16%
Tilted	2	4%
No defects	8	16%
Painting		
No painting	8	16%
Faded painting	23	46%
Dirty painting	12	24%
Well painted	7	14%
Windows and Doors (Wooden members)		
Partly broken down	30	60%
Completely broken down	11	22%
In good shape	9	18%
Electric Installations		
Cables exposed	32	64%
Not functioning	13	26%
In good shape	5	10%
Plumbing/Water		
Broken down	16	32%
Leaking	28	56%
In good shape	6	12%

Source: Field survey, 2016

From Table 4.4, the first item depicted is the foundation of buildings. Foundation is the skeleton of buildings. It provides a solid basis and/or framework for any given structure. Primarily, it is the foundation upon which the building's strength resides. A weak sub-structure or foundation cannot support any super structure no matter how well the building is constructed. Much attention is therefore given to the foundation of a building represent between 20-30 percent of the cost of any build environment (Afrane & Osei Tutu, 19997).

From the Table, 24 respondents out of 50 respondents representing 48% responded that the foundations have developed cracks; followed by 22% who indicated that the foundations are weak, whilst 16% responded that the foundations of their building have been exposed. Another group consisting of 14% indicated that there was no problem with the foundation. From the data gathered above, it can be seen about 86% of respondents have problems with the foundation of the buildings they occupy.

From the table, the next item to be considered is the roofing of buildings. The data on roofing state of public buildings indicate that only 10% of public buildings had their roofs intact with no problems. A majority of as high as 50% of public buildings had leaky roofs whilst 28% were rusty and 12% being partly ripped off. No public building had their roofs completely ripped off. This indicate that the general roofing condition of public buildings in the Salaga township was unsatisfactory with a good percentage of more than 50% needing major maintenance attention.

With respect to the flooring conditions of public buildings, more than 90% of public buildings floors were in bad condition whilst only 8% of them were in good shape. This implies that the flooring of public buildings in the study area need major maintenance works to be carried out.

The survey indicated that the commonest problem with the walls of public buildings is the development of cracks. From Table 4.4, 48% of the walls of buildings surveyed have

developed cracks, whilst 16% of buildings had partly broken down walls. However, a small percentage of 16% of surveyed buildings had their walls in good conditions, and as such needed little maintenance attention.

Data from Table 4.4 again indicates that, with respect to painting, only 14% of public buildings surveyed were considered well painted whilst 16% of the buildings had no painting at all. Also 46% of the buildings surveyed however had their painting faded whilst 24% had dirty painting. An implication of this result is that, almost about 86% of public buildings surveyed needs major painting attention with only 14% needing no painting attention at all.

The condition of windows and doors (wooden members) of the public buildings surveyed was generally in bad condition. From the table, 18% of the buildings had good windows and doors whilst 60% were reported to be partly broken down. Also, 22% of building had their doors and windows completely broken down. This implies that only about a little above 80% of public buildings need to have their windows/doors replaced.

The electricity of public buildings in the study area was also surveyed for their present state/condition. Approximately 64% of the schools had electricity with cables exposed whilst 26% had non-functioning electric installations. Only 10% of respondents reported that they had fairly good electricity installation. The general electrical condition in the buildings surveyed was considered very worrisome.

Causes of Non Maintenance of Public Buildings

Governments since independence have put up buildings for use by public institutions. Some of these properties even date back to the colonial era. Public institutions are therefore expected to have the natural tendency to preserve, protect and maintain these infrastructures. Unfortunately, that is not the case as seen in Salaga and most places around the country. The

researcher therefore decided to investigate into the causes of non-maintenance of these buildings.

Table 4.5 Factors causing non-maintenance of public buildings

Variables	SA		A		D		SD	
	<i>f</i>	%	<i>f</i>	%	<i>F</i>	%	<i>f</i>	%
Lack of maintenance culture	22	44%	26	52%	2	4%	0	0%
Inadequate funds and financial challenges	12	24%	19	38%	17	34%	2	4%
Bureaucratic reporting processes	12	24%	10	20%	28	56%	0	0%
Pressure on facility/building due to number of occupants	2	4%	8	16%	31	62%	9	18%
Poor work done (initial construction) on building	22	44%	20	40%	8	16%	2	4%
Non response of authorities to maintenance requests	14	28%	30	60%	6	12%	0	0%

Key: SA = *Strongly Agree*, A = *Agree*, D = *Disagree*, SD = *Strongly Disagree*.

Source: Field survey, 2016

From Table 4.5, respondents agreed that the major and foremost factor causing non-maintenance of public buildings is the lack of maintenance culture by people who occupy public buildings. To this assertion, an overwhelming combined majority of 96% ‘strongly agreed’ and ‘agreed’ whilst only 4% disagreed.

It is also seen from the table that, 88% of respondents are of the opinion that the non-response of authorities to maintenance requests play a significant role in the non-maintenance of public buildings in the study area. To this assertion, only 12% of respondents disagreed.

The next big cause of non-maintenance of public buildings is the poor work done (initial construction) on buildings. This statement was affirmed by 84% of respondents whilst 16% disagreed.

From the table, it is seen that 62% of respondents are rather of the view that the lack of funds or financial challenges play a key role in non-maintenance of buildings. This is especially so

in the case of public institutions because, most of the times the institutional budgets do not make budgetary allocations for maintenance works and so when defects do occur, they have to wait for government funding which is never easy to get.

Another factor that can be deemed as also accounting for the maintenance challenge of public buildings in the nation is the bureaucratic reporting processes in the nation. This assertion was however not supported by respondents since only 44% responded affirmatively to it whilst 56% said that was not the case.

4.2.2 Results and Discussion of Questionnaire from Estate Officers

Due to the critical roles played by estate officers in public institutions and their oversight responsibilities held for the maintenance of these institutions, their views were sought and discussed. Out of a total of ten (10) estate officers sampled for the study and issued with questionnaire, only eight (8) were successfully retrieved.

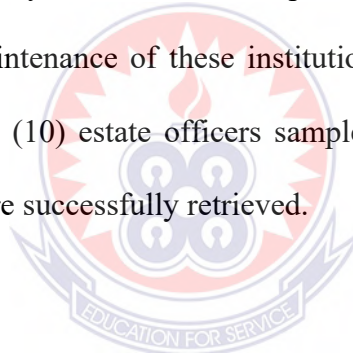


Table 4.6 Demographic information of Estate Officers

Characteristics	Frequency (<i>f</i>)	Percentage (%)
Gender		
Male	6	75%
Female	2	25%
Age		
Below 25years	0	0%
26 – 30years	2	32%
31 – 39years	5	55%
40 – 49years	1	13%
50 – 59years	0	0%
60years and above	0	0%
Highest Educational Qualification		
Primary school	0	0
Middle school	0	0
Junior high School	0	0
Senior high school	0	0
Tertiary school	8	100%
Working Experience		
0 – 10 years	0	0%
11 – 20 years	5	55%
21 – 30 years	2	32%
Above 30 years	1	13%

Source: Field survey, 2016



From the table, it is seen that 75% of the estate officers surveyed were males whilst only 25% were females. With regards to the age group of estate officers, the table shows that no estate officer was found in the age category of 60years and above, 50 – 59years and below 25 years. However, 55% were aged 31 – 39 years, 32% also in the age group of 26 – 30 years and 13% fell within 40 – 49 years. Analysis of the highest academic background of the respondents revealed that all 8 of the respondents surveyed representing 100% had tertiary education.

The working experience of estate officers as shown in the table indicates that majority of the respondents were very much experienced. This is because, 55% of respondents had 11 – 20 years' experience whilst 32% had 21 – 30 years' experience. Again, only one person was reported to have work experience of above 40 years.

Maintenance Issues Confronting Estate Officers

Estate officers are responsible for the oversight of construction of new buildings and the maintenance of old buildings in public institutions. Table 4.7 presents their views on the maintenance issues that they are confronted with in their line of duty.

Table 4.7 General maintenance works undertaken by estate officers

Characteristics	Frequency (<i>f</i>)	Percentage (%)
Availability of Maintenance Policy		
Yes	1	13%
No	7	87%
Type of maintenance practice adopted		
Preventive maintenance	0	0%
Corrective maintenance	5	55%
Planned maintenance	2	32%
Unplanned maintenance	1	13%
Frequency of maintenance activities		
Once in three months	0	0%
Once in six months	0	0%
Availability of funds	3	36%
When reported	5	64%
Causes of building defects		
Design errors	0	0%
Lack of maintenance	3	37%
Poor construction	4	50%
Misuse of building	1	13%
Criterion used for selecting buildings to be maintained		
Conduct Maintenance assessment	4	50%
Perform cost benefit analysis	2	25%
Availability of resources	2	25%

Source: Field survey, 2016

From the results presented in Table 4.7, it is obvious that most institutions where the estate officers worked do not have maintenance policies. From the table it is seen that, 87% did not have maintenance policy whilst only 13% had maintenance policy.

A quick look at the table also indicates that the main type of maintenance practiced by estate officers in public institutions was the corrective maintenance. This is where buildings are neglected and allowed to develop defects before action is taken to repair such defects. From the table, 55% of respondents intimated that they engaged in corrective maintenance practices whilst 32% said they conducted maintenance on a planned basis with the remaining 13% indicating that their form of maintenance was mainly ad-hoc and unplanned.

When asked of the frequency of maintenance works carried out by estate officers in public buildings, 5 respondents representing 64% said that they only respond to maintenance issues when they are reported whilst 36% responded that maintenance is done based on availability of funds.

Further, the researcher sought to know from the opinions of estate offices, the causes of building defects. The responses provided in the table shows that 50% of respondents attribute maintenance defects to poor construction whilst 37% are of the view that maintenance problems are due to lack of maintenance culture on the part of building occupants. However, only 13% of respondents said that maintenance defects occur as a result of misuse of the buildings.

When asked for the criteria based on which buildings are selected for maintenance work, 50% of respondents indicated that they conduct maintenance needs assessments on the buildings to see which ones are in need of immediate maintenance whilst 25% each responded that they perform cost benefit analysis and availability of resources respectively.

Table 4.8 Financing of maintenance work

Characteristics	Frequency (<i>f</i>)	Percentage (%)
Problems in financing maintenance work		
Yes	8	100%
No	0	0%
Means of obtaining finance		
Internally	7	87%
Externally	1	13%
Grants	0	0%
Mode of obtaining finance for maintenance		
Upon request	6	75%
Through budgetary allocations	2	25%

Source: Field survey, 2016

Maintenance work is a capital driven activity which relies on availability of funding. Due to this, the researcher sought from respondents whether they encounter problems in financing identified maintenance works. To this question, 100% respondents responded in the affirmative which indicates that funding is a huge challenge when it comes to the funding of maintenance works on public buildings.

On the issue of means through funding is obtained, 87% of respondents indicated that they use internally generated funds to finance maintenance works with only 13% indicating that money for funding maintenance work is obtained externally.

As regards the mode of obtaining finance for maintenance, 75% of respondents which represent a frequency of 6 intimated that funds are given upon request whilst the remaining 2 representing 25% responded that the funds are provided through budgetary allocations.

4.3 Results and Discussion of Interview

The researcher conducted interview for occupants of public buildings and estate officers to solicit their opinions on the maintenance issues prevailing in public institutions buildings.

The following sections present the discussion of these issues below:

4.3.1 Results and Discussion of Interview from Occupants

The results and discussion of interview were obtained from management staff of public institutions who occupy public buildings. Eight (8) occupants using the public buildings who were in high officers were interviewed on some of the causes and effects of defects on public buildings and also the effect of maintenance on public buildings as well.

All the occupants attributed the causes and effects of defects on public buildings to lack of maintenance on the public buildings. They said the defects include, cracks on the wall, fading of paint on the wall, rusting of metal members, rotten wooden parts and others. These defects are caused by movements of occupants, mis-use of facility, poor procurement, poor construction, natural forces and no maintenance culture is practiced.

They also said the public buildings in the town had no maintenance office to ensure that maintenance works are done when needed regularly. Occupants only do maintenance when it is agent and the emergency maintenance is used.

Funding of maintenance activities of public building include daily maintenance, minor repairs and major system replacement requiring huge capital outlay, public institutions rely on central government funds to cover maintenance expenses.

It was also released that the rate of maintenance in public institutions happens in years as majority of the respondent say.

Putting all their views together, the following key causes were identified as being responsible for poor maintenance of public buildings; lack of maintenance culture, apathy and ignorance

of maintenance responsibility, inadequate funds and high cost of maintenance and capacity of maintenance personnel.

Causes of Building Defects

Buildings defects are caused by a combination of factors. Some are internal whilst others are external. The researcher collected responses from occupants to find their views on the actual causes of non-maintenance of public buildings in the study area. The results are presented in Table 4.9

Table 4.9 Occupants view on causes of building defects in public buildings

Causes of building defects	Frequency (<i>f</i>)	Percentage (%)
Design defects	5	33.3%
Construction defects	5	33.3%
Lack of building maintenance	3	20%
Weather conditions	2	14.4%
Others	0	0%
Total	15	100%

Source: Field survey, 2016.



The defects were ranked as follows in order of prominence. From the table, design defects ranked the highest with approximately thirty-three (33%), alongside construction effect with is also 33.3%. The next common cause was lack of building maintenance with 20%. Weather conditions was also ranked 4th with 14.4%.

4.3.2 Results and Discussion of Interview from Estate Officers

Also from the interview with other officials, it was learnt that maintenance works are under taken when disaster occurs or accidents as a result of non-maintenance. It was realized that, not all designs are deemed sound at the design stage due to complexity in design and

inadequate briefing to enable a proper design to be prepared. Another cause is the lack of qualified tradesmen in the institutions resulting in poor workmanship and defects on buildings.

Again interviews conducted revealed the followings as some of the problems attributed to financing maintenance works

- Budgetary allocation is inadequate for maintenance works
- Rent paid by occupants goes to the government;
- The rate of deteriorating is fast and high

Estate department officers were also interviewed to find out the effects of maintenance on public buildings. Out of seven estate department offices interviewed, three (3) said the cause of defects on the public buildings are caused by misuse of facility, two (2) said poor procurement and construction, one (1) also said natural wear and tear over time and one (1) person said environmental conditions (natural forces). They also said this causes cracks on the wall, leaking of the roof, corrosion of metal members, rotten wooden parts, exposure of the foundation and others.

Table 4.10 Estate officers view on causes of building defects in public buildings

Causes of building defects	Frequency (<i>f</i>)	Percentage (%)
Misuse of facility	3	42.8
Poor procurement and construction	2	28.6
Natural wear and tear	1	14.3
Environmental conditions	1	14.3
Total	7	100%

Source: Field survey, 2016.

From interviews conducted, it came to light that it is very difficult to strictly adhere to laid down maintenance schedules. Also, on the question of criterion used for selecting buildings for maintenance works, the following reasons were cited:

- When problems are reported;
- When new occupant are ready to occupy the buildings;
- When there is an accident due to non-maintenance

Interview and discussions with stakeholders point to the facts that government in a bid to see to the welfare of workers and enhance their efficiency provide accommodation for public institutions. However once these buildings are built, government desire to acquire or build more houses over shadows its role of maintaining these already existing ones thus, leading most of them, in to a state of deterioration and in some instances disrepair calling for outright demolition.

Again because new construction often receives more attention than on going building maintenance the government may find it difficult to draw adequate attention to maintenance needs.

On the need to improve maintenance in the nation at large, the interview revealed that most respondents saw education as the best way to go. They attributed the apathy of occupants and stakeholders of public buildings to ignorance and illiteracy. They were also of the view that the government should make available funds for maintenance works as soon as they are requested and verified.

From the interview, it came to the fore that maintenance plan should be drawn and included as part of the building construction design with timelines attached to them. Another suggestion obtained through the interview was that the government should enact legislation or rules that would make maintenance mandatory for all public institutions. This they argued

would go a long way to boost the maintenance culture of Ghanaians in this country and help the nation at large.

4.4 Results of observation

An observation guide was prepared based on the effects of maintenance defects, causes of defect and others. This was used as a checklist against whatever observation was made during the process of the interview, administering of questionnaires and some few rounds made by the researcher.

Observation carried out before and after the interview revealed that most public building lack maintenance. The departments and agencies using public building are in bad shape and little or no attention is paid to preventive maintenance such as sweeping, dusting, removal of cobwebs, frequent oiling and gracing of hinges and levers, cutting down grasses around buildings and planting of trees to serve as wind breaks.

It was also observed that most of the facilities were in very bad shape such as cracks on the walls, faded paints on walls, corrosion of metal members, rotten wooden members, exposure of foundation, removal of some parts of the roofing sheet, plastering, and others.

Among all the building elements of the buildings surveyed, painting, wall, windows and doors, the roof, the foundation and the floor had the most maintenance problems. The most revealing maintenance problems are cracks in walls, faded painting, partly broken windows and doors, exposed foundation and leaking roofs affecting public buildings surveyed.

During visual inspection on the buildings under study pictures were taken that shows some of the defects on the buildings. Refer to next page for the pictures defects on buildings.



Figure 4.1 Leaking and Rusting of Roofed Members at Junior High School



Figure 4.2 Peeling off of paint on walls at the District hospital



Figure 4.3 Exposed Electrical Cables and Fittings at the Senior High School



Figure 4.4 Dilapidated Structures at the Audit and National Service Office and the Senior High School



Figure 4.5 Decaying wooden Members and Crack Floor at the Teachers Bungalow

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the summary of the findings, conclusion and recommendation of the study.

5.2 Summary of findings

The following are the summary of the findings from the study:

- There is generally lack of maintenance culture on the part of both the institutions and the occupants holding the view that it is a government property and that whatever that belong to the state is no business of theirs.
- The study showed that, most of the public establishment in the area of study had no maintenance officers to ensure that maintenance works are carried out regularly due to lack of major skills in assessing existing building and staff shortage.
- The study also revealed that, the misuse of facility, violent act, non-regular preventive maintenance, poor construction technology, poor procurement practices, natural forces and natural tear and wear over years as possible causes of defects on buildings.
- There is also much pressure on the building facilities by number of users. This increases the pressure on the facility which also increases the rate of tear and wear of the building.

- Another problem of maintenance of public buildings is funding. Inadequate funds and delay in the release of funds have contributed significantly to the resent state of public buildings.
- The study has showed that maintenance on most public buildings are not planned and scheduled. Due to this, most public establishments do not allocate maintenance costs in the annual budgets of the establishments.
- In addition, Most of the establishment in the township did not have operation and maintenance plans in the establishment by the maintenance group or management.
- The study revealed that, the current state of public facility in the Salaga Township has a lot of defects on them. Cracks were the current major defect on the public building, peeling of finishing, corrosion of metal works, warping/coping/twisting and bowing of wood work, erosion under foundations, leakage of roof, bleaching of wall surface and collapse of facility which indicated that the facilities hold average strength to withstand the defects.
- There is also lack of effective national maintenance policy, laws and regulations to compel both managers of public buildings and occupants to undertake maintenance.

5.3 Conclusion

The findings of the study have proven beyond reasonable doubt that the current level of maintenance practice in the public sector is nothing to write home about. Public buildings that required maintenance in the Salaga Township are many and in fact the list seems to be endless due to the lack of maintenance culture and maintenance policies within the various sectors and institutions who oversee the management of these facilities.

From the analysis of the findings of the data it is established that the only type of maintenance practice adopted is the unplanned maintenance, which embraces emergency and corrective maintenance.

There is total absence of scheduled planning of activity as to when maintenance works can be carried out and even if it exist at all, this was not followed, hence minor defects which are detected earlier could have been put right at a very lower cost are allowed to degenerate into serious problem which will require a large sum of money for repair works to be carried out. From the field work it became clear that the only time maintenance are undertaken depended on availability of funds and not on maintenance schedule or the extent of defects on the building.

Although, the study reveals that, there are few operational and maintenance plans at some of the institutions or sectors who managed public buildings, the budgetary allocation for maintenance is insignificant as compared to allocation for new projects and other works or programs.

Less control on the mis-use of facilities has also been identified as one factor that contributes greatly to the deterioration of public building, even though, natural wear and tear over the years occurs on building components, some practices like violet acts and poor construction technologies (the selection of building materials by designers, contractors and

clients for the construction of public buildings) contribute in one way or the other for the generation of defects on these buildings.

Also from the literature review, it became clear that defects on buildings could start at the design stage which could stem from insufficient brief and analysis of the design data. Again at the construction stage, defects could be as a result of the use of the damaged material and inappropriate assembling of components, Poor workmanship and poor quality of material.

It also became obvious that due to financial constraints, authorities do not inspect buildings and do not also adhere to any maintenance schedule, even if it existed. Preventive maintenance is also lacking in most of the public sectors and institutions. This come as a result of ignorance and the perception of people that, public buildings belongs to government.

5.4 Recommendations

The following recommendations are made to address the findings of the study.

- Ghanaians need to cultivate a maintenance culture. We need to change our attitude to government property and treated as if it were ones private property. They should use government property lawfully, appropriately and efficiently.
- Secondly, maintenance units in the public institution should be restructured monitored periodically and recruit personnel with requisite knowledge and skills to fill the gap created in the maintenance department.
- Training, seminars and workshops should be organized for maintenance officers to enhance their knowledge and skills worth regards to effective maintenance.

- Prompt response should be under taken when reports are made on defects on buildings to prevent minor defects from developing into serious deterioration resulting in large sums of money for maintenance works.
- Users of public buildings must always measure the performance of their buildings in terms of various criteria that are consistent with their various systems.
- Furthermore, the administration should use the right way of procuring goods or materials for construction work.
- Again, quality construction technology should be adapted by contractors in putting up buildings.
- Also, maintenance buildings starts right from the drawing board, it is therefore necessary include maintenance experts in the design team so as to put in place practicable maintenance policies right from the inception to the end.
- Finance is the live wire of every institution and really holds the institution together. Adequate funds should be made available for maintenance of these buildings and make sure that such funds are judiciously utilized.
- Though planned maintenance seems to exist, it is not practiced. It will be better that the estate departments adopt planned preventive maintenance police and should follow the maintenance schedules for maintenance works to be undertaken periodically.
- Effective national maintenance policy, laws and regulations should be drawn to force both managers of public buildings and occupants to undertake maintenance work.

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APPENDIX A**QUESTIONNAIRE FOR OCCUPANTS (MANAGEMENT AND STAFF) OF PUBLIC BUILDINGS**

I am a final year M. Tech. Construction student of the University of Education, Winneba – Kumasi campus. I am currently conducting a study into the effects of maintenance on public buildings and I would like to solicit your inputs on the subject. Your participation in the research will be appreciated by responding to the attached questionnaire which has been designed to collect data. All information provided and responses shall be treated with confidentiality and will only be used for the purpose of this research. If you have any further questions and contributions about this research please do not hesitate to contact me on my contact or email. Thanks.

Name : Soale Matoamu Henrietta

Contact No. : 05071732333

Email : soaleherli@gmail.com

**SECTION I: DEMOGRAPHIC INFORMATION**

1. Gender

Male []

Female []

2. Age

Below 25 years []

26 – 30 years []

31 – 39 years []

40 – 49 years []

50 – 59 years []

60years and above []

3. Highest Educational Qualification

Primary []

Middle school []

Junior High []

Senior High []

Tertiary []

4. How many years have you been in this institution?

0 – 10 years []

11 – 20 years []

21 – 30 years []

Above 30 years []

SECTION II: GENERAL STATE OR CONDITION OF PUBLIC BUILDINGS

5. What is the estimated age of the building since its construction?

0 – 10 years []

11 – 20 years []

21 – 30 years []

Above 30 years []

6. What is the building used for?

School []

Hospital []

Social gathering []

Offices []

Residential []

Other (specify)



7. Do you have records of the state of the building and facilities in it before you came to occupy it?

Yes [] No []

8. Have you observed any defects on the building?

Yes [] No []

9. If yes to question 8, which of these defects are present?

[] Plumbing and sanitary services [] Electrical installations

[] Cracks in walls [] Cracks in floors and foundation

[] Leakage from roof and ceiling [] Exposed foundation

[] wooden members (doors and windows)

10. Have you experienced any domestic accidents due to the condition of the building?

Yes [] No []

11. What type of maintenance do you undertake?

Daily sweeping/cleaning []

Repainting and reinstallation of broken equipment []

Mending of broken walls, floors, foundations, etc. []

Major repairs (eg. reroofing, etc) []

12. How often is maintenance work carried out on the buildings?

Once in three months [] Once in six months []

Yearly [] Bi-annually []

13. Who is responsible for the maintenance of the buildings?

Estate officer [] Government []

Institution [] PWD []

14. What is the source of funding for the maintenance work?

Internally Generated Funds []

Government []

N.G.Os []

15. Does the maintenance situation affect your work output?

Yes [] No []

16. What should be done to improve upon the maintenance problem in the nation?

Educate stakeholders on the effects of non- maintenance []

Central government should release fund for maintenance work []

Maintenance should be considered and included during the design stage []

Enactment of mandatory maintenance legislation []

17. What is the condition of the foundation?

Cracks developed [] exposed/hanging []

Weak [] No problem []

18. Condition of the roof.

- | | | | |
|-------------------|-----|-----------------------|-----|
| Leaky | [] | Rusty | [] |
| Partly ripped off | [] | completely ripped off | [] |
| No problem | [] | | |

19. Condition of the floor.

- | | | | | | |
|--------|-----|------------|-----|-----------|-----|
| Cracks | [] | Peeled-off | [] | No defect | [] |
|--------|-----|------------|-----|-----------|-----|

20. Condition of the walls.

- | | | | |
|------------------|-----|----------------|-----|
| Part broken down | [] | Develop cracks | [] |
| Peel-off | [] | Tilted | [] |

21. Condition of painting

- | | | | |
|----------------|-----|----------------|-----|
| No painting | [] | Faded painting | [] |
| Dirty painting | [] | Well painted | [] |

22. Conditions of the windows and doors

- | | |
|------------------------|-----|
| Part broken down | [] |
| Completely broken down | [] |
| In good shape | [] |



23. Conditions of the electricity installations.

- | | | | | | |
|----------------|-----|-----------------|-----|---------------|-----|
| Cables exposed | [] | Not functioning | [] | In good shape | [] |
|----------------|-----|-----------------|-----|---------------|-----|

24. Condition of the Plumbing/water.

- | | | | | | |
|-------------|-----|---------|-----|---------------|-----|
| Broken down | [] | Leaking | [] | In good shape | [] |
|-------------|-----|---------|-----|---------------|-----|

CAUSES OF NON-MAINTENANCE OF PUBLIC BUILDINGS

Please, indicate the extent to which you disagree or agree with the following factors as causes of non-maintenance of public buildings in the Salaga Township.

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree.

No.	Cause of non-maintenance	SA	A	N	D	SD
25	Lack of maintenance culture					
26	Inadequate funds					
27	Bureaucratic reporting processes					
28	Pressure on facility/building due to number of occupants					
29	Poor work done (initial construction) on building					
30	Non response of authorities to maintenance requests					



APPENDIX B

QUESTIONNAIRE FOR ESTATE OFFICERS

SECTION I: DEMOGRAPHIC

1. Gender

Male []

Female []

2. Age

Below 25 years []

26 – 30 years []

31 – 39 years []

40 – 49 years []

50 – 59 years []

60years and above []

3. Highest Educational Qualification

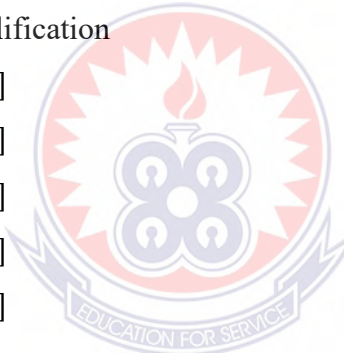
Primary []

Middle school []

Junior High []

Senior High []

Tertiary []



4. Working experience

0 – 10 years []

11 – 20 years []

21 – 30 years []

Above 30years[]

5. Does your organisation have a general maintenance policy

Yes [] No []

6. Which of the following maintenance practices is adopted by your institution?

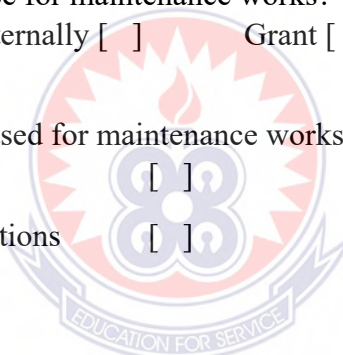
Preventive []

Corrective []

Planned []

Unplanned []

7. How often is maintenance work undertaken in your institution?
Once in three months Once in six months
Yearly Bi-annually
8. What is your opinion on the causes of building defects?
Design errors Poor construction
Lack of maintenance Misuse of building
9. What criterion do you use in selecting buildings for maintenance works?
Conduct maintenance assessment
Perform cost benefit analysis
Availability of resources
10. Do you encounter problems in the financing of maintenance works on public buildings?
Yes No
11. How do you obtain finance for maintenance works?
Internally Externally Grant
12. How often are funds released for maintenance works?
Upon request
Through budgetary allocations



APPENDIX C

INTERVIEW GUIDE FOR RESPONDENTS (HEADS OF INSTITUTIONS)

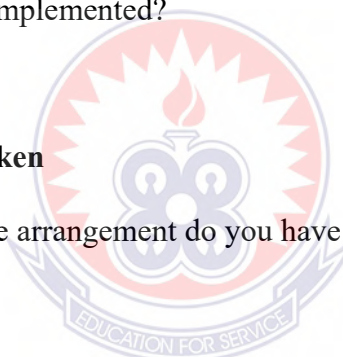
Maintenance of Buildings of Public Schools

Name of Institution.....

1. What is your position, job description/qualification, please?
2. How will you classify your buildings according to the period of existence
Eg: Old (above 50 years),
Medium aged (20-50years) or
Young (below 20years)?
3. Does your institution have a maintenance policy or plan?
4. If yes, in (3) above, is it implemented?

Types of Maintenance undertaken

5. What type of maintenance arrangement do you have in place?
Periodic
Routine
Non Preventive
6. Do you inspect the building to determine its maintenance needs? If yes how often and if no please assign reasons.
7. Who is ultimately responsible for the maintenance of the institution building?
8. How is maintenance funded?
9. Do technicians and managers receive training to conduct the condition assessments of the buildings?
10. How well are you equipped in terms of personnel and equipment for the maintenance task confronting the institution?



11. What in your opinion accounts for the non-maintenance of public buildings in this area?

Lack of maintenance culture []

Inadequate funds and financial challenges []

Bureaucratic reporting processes []

Pressure on facility/building due to number of users []

Poor initial construction work done []

Non response of authorities to maintenance requests []

12. What measures would you suggest to curb the maintenance problems in public institution buildings in Ghana?

.....
.....



APPENDIX D

OBSERVATION GUIDE FOR MAINTENANCE PROBLEMS IN PUBLIC BUILDINGS

Element/Facility	Current State
Roof	
Wall	
Windows/Doors	
Floor	
Pipe/water/Plumbing	
Electricity	
Painting	
Toilet	
Bathroom	
Drains/gutters	
Foundation	

