MAINTENANCE OF BUILDINGS OF PUBLIC INSITUTIONS IN GHANA. CASE STUDY OF SELECTED INSTITUTIONS IN THE ASHANTI REGION OF GHANA.

By

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DECLARATION

I hereby declare that this thesis is the result of my own original research towards the MSc and that to the best of my knowledge no part of it has been published by another person or presented for another degree in this university or elsewhere except where due acknowledgement has been made in the text.

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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. The deterioration of buildings hampers its 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 preserving these building systems is important. Due to the neglect of the maintenance component of the housing process in the country, a lot of public and private residential buildings are in a state of disrepair.

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, analyse 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 GPS, GHS nurses quarters and UEW-K. Three different housing types were defined for data collection and analyses including: bungalows, tenement houses and single unit houses. Through the application of multi-stage cluster sampling and purposive and random sampling techniques, 176 buildings were covered in the survey. The survey revealed that there is a real housing maintenance problem in public institutions in Ghana. The study revealed that on the whole, 83 percent of all residential buildings of public institutions surveyed have maintenance problems with maintenance problem being more prominent in GPS and UEW-K with 41.2 percent and 30.8 percent of their buildings in a bad condition, with 14.3 percent of those of GHS in the same situation.

Maintenance problems by housing types in public institution revealed that building maintenance problems are more pronounced in single unit houses than tenement houses and bungalows with 48.4 percent, 37.5 percent and 5 percent respectively in bad condition. However, tenement houses had the highest buildings with good condition, with 37.5 percent of all tenement houses surveyed in good condition requiring the least or no maintenance.

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 by maintenance personnel of the institution. Stakeholders in the housing sector also added to the problem has arisen as a result of lack of preventive maintenance plan, low capacity of maintenance personnel in terms of staffing and training, absence of a national maintenance policy and apathy and lack of patriotism on the part of some public employees occupying government bungalows.

The study concludes by enumerating a number of recommendations aimed at providing the necessary framework for proper and effective maintenance of buildings. These are: the need for public institutions to embrace preventive maintenance practice as a high priority rather than adhoc maintenance. Managers are to oversee periodic inspections of buildings' conditions and create an inventory of buildings' components and equipment. Public institutions should ensure that their maintenance department is adequately staffed. There is also the need for a national policy on maintenance to be formulated to protect buildings, institution of a maintenance awards scheme for public institutions and establishing a maintenance fund to be managed for maintenance of public buildings in the country.

DEDICATION

I dedicate this thesis to my dear father, Mr. John Kendall Cobbinah who nurtured in me the unwavering interest in the value of education. Also to my mother in-law Mrs. Elizabeth Osei Boateng who provided the support and encouragement that, enabled me to complete my M Sc programme.

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BACKGROUND TO THE STUDY AND PROBLEM CONTEXT

1.1 Introduction

Physical infrastructure constitutes a high proportion of the country's investment. It is therefore of primary importance that these facilities which include public buildings are maintained in order that they can serve both the architectural and aesthetical functions for which they are built. The physical appearance of buildings housing public institutions in part constitutes the basis upon which the society makes their initial judgment of the quality of services to be offered.

One of the critical problems confronting the housing industry in Ghana is the poor maintenance practice (Afranie and Osei Tutu, 1999). The role of Public Institutions in National development cannot be over-emphasized. However, in spite of the heavy investment in public buildings, Public institutions allow their structures to care for themselves without any sustainable maintenance plan to preserve the quality of the buildings. The continued efficient and effective performance of public institutions depends on the nature of their buildings in addition to other factors such as enhanced conditions of service, provision of the requisite tools etc.

Public Institution buildings consist of both dwelling (residential accommodation) and non-dwelling (office accommodation). Both residential buildings as well as office buildings are prone to defects due to their permanent and lengthy usage. All elements of buildings deteriorate at a greater or lesser rate dependent on materials and methods of construction, environmental conditions and the use of the buildings (HMSO 1972).

According to Seeley 1987, neglect of maintenance has accumulative results with rapidly increasing deterioration of the fabric and finishes of a building accompanied by harmful effects on the contents and occupants. Therefore, buildings are too valuable assets to be neglected in this way. In his hierarchy of needs theory Maslow (1954) identifies five basic needs which are organized into successive level of importance in an ascending order. He identified physiological needs as the most

basic needs of human beings which include air, food, water, shelter (housing), sex and sleep.

BS 3811(1984), define 'maintenance' as "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 function."

Maintenance brings about improved utilization of buildings ensuring the highest safety standards. It must be emphasized that more rather than less maintenance work is necessary if the value and amenity of the nation's building stock was to be maintained. A good maintenance system is also a good disaster mitigation system. Moreover, a well operated system of maintenance for buildings and equipment has the effect of being a very effective disaster mitigation measure in terms of cost and facility usage. It ensures the most economic way to keep the building and equipment in the best of form for normal use, given the original design and materials (http\\www.oas.org\en\cdmp).

Maintenance, which can also be explained as the continuous protective care of the fabric, contents and settings of a place can be categorized according to why and when it happens, as corrective maintenance, which is necessary to bring a building to an accepted standard. Planned maintenance is work to prevent failure, which recurs predictably within the life of a building such as cleaning gutters or painting. Emergency Corrective Maintenance deals with work that must be initiated immediately for health, safety, security reasons or that may result in the rapid deterioration of the structure or fabric if not undertaken (for example, roof repairs after storm damage, graffiti removal, or repairing broken glasses).

When buildings are neglected, defects can occur which may result in extensive and avoidable damage to the building fabric or equipment. Poor maintenance has resulted in damage and deterioration to some public buildings in Ghana. Neglect of maintenance especially in relation to replacing electricity cables after thirty of use can also give rise to fire and safety hazards, which could result in the Institution owning the buildings being found liable for any injuries and damages. Another case in point is the Job 600 built by Ghana's first President Dr. Kwame Nkrumah to host the Organization of African Unity meeting in 1965 has its main building quite rundown

and has been under renovation for many years now. The present state of this public building could be attributed to lack of maintenance and neglect after being put into use.

1.2 Problem Statement

Many Ghanaian public structures are often inadequately maintained and windows and doors and other building elements and facilities frequently show evidence of lack of maintenance and repair.

Some residential and office buildings of public institutions have not seen any significant maintenance or show little signs of maintenance since they were constructed, some dating back to the colonial era. This has resulted in such buildings being in a dilapidated state with some being abandoned. This lack of maintenance by the authorities and occupants of these facilities often leads to reduced lifespan of these buildings (Melvin, 1992), which invariably defeat the purpose for which they are put up i.e. to ensure that the nation's stock of buildings, both as a factor of production and accommodation, was used effectively as possible.

The problem of ownership of these buildings, where occupants regard it not as their own property but a state property and handle it without due care largely have resulted in the state in which most public buildings find it. In some cases occupants do not recognize the building as their property and hence have passive attachment in relation to the efficient use and maintenance of the building.

Most offices, especially those outside the capital city, Accra, are dilapidated and lacked the basic necessities and facilities such as toilet due to its state of deterioration of a functioning office. However new buildings are being put up every now and then without giving a thought to the maintenance of the old structures which have been neglected. Frequent visits to the Ministries area of the Kumasi metropolis which houses these public institutions by this researcher depicts the abhorring situations in some public institutions with the buildings showing cracks on the walls, rotten wooden members, leaking roofs and missing louver blades, faded and discoloured surface coating (painting).

Lack of maintenance of some police buildings including police cells in recent times have resulted in jailbreaks in some police stations in the country leading to the escape

of hardened criminals in custody, some educational institutions especially basic schools holding classes in the open air at the mercy of the weather.

Vital documents in some of these public institutions have not been spared due to poor or non-maintenance of the building. The dilapidated nature of the residential facility has also left the properties of the occupants at the mercy of the weather. These problems arising out of the present situation as far as maintenance of building in the public sector is concerned lowers morale of the labour force and goes a long way to reduce the efficiency of the personnel.

In view of these, it has been considered necessary to study the maintenance of public building in Ghana to identify the factors contributing to the current state of building in the public institutions since building owners are increasingly beginning to accept that it is not in their best interest to carry out maintenance in a purely reactive manner but that it should be planned and managed as efficiently as any other corporate activity.

1.3 Research Questions

In embarking upon such study, certain questions should be answered before any credible conclusions can be drawn. The following questions were posed.

1. What are the current state/ level of non-maintenance of residential buildings of the public institutions in Ghana?
2. What are the reasons or factors that have accounted for non maintenance of public buildings?
3. What maintenance policies and practices are in place as far as public institutions are concerned and the capacity of human resource of their maintenance department?
4. How can public institutions ensure continued maintenance of their buildings in order to retain their current stock of buildings as well as improve on their condition?

1.4 Research Objectives

1.4.1 General Objective

The study is generally expected to evaluate the building maintenance practices being employed in public institutions and its effect on the structure as the users of the building.

1.4.2 Specific Objectives of the study are to:

1. Assess the current condition and state of buildings of public institutions
2. Identify the underlying principal causes of poor maintenance of public buildings.
3. Analyse the maintenance policy and practice and capacity of the maintenance department of public institutions.
4. Make suggestions and recommendations towards the adoption of effective maintenance policy and innovations that would address the building maintenance problem in public institutions.

1.5 Research Justification

This study is essential in the sense that it would not only contribute to knowledge and theory, but will also contribute to good maintenance practice in the public institutions in Ghana. This is because the study will attempt to find out the factors that have contributed to the present state of non-maintenance of public buildings some of which have been abandoned due to its state of deterioration and recommend appropriate remedial actions to be taken.

Furthermore the study will assist managers of public institutions to become aware of the current state of their building infrastructure and its effect on the safety and health of personnel and also to put in place adequate innovative measures to prevent new buildings put up to suffer deterioration which ultimately lead to increased cost in restoring these buildings to their original state.

It will provide a critical and analytical perspective for appreciating the factors affecting the decisions to carry out maintenance. In addition, the study will bring to the fore the major inhibiting factors in the maintenance of public buildings in Ghana.

With increasing demand for efficiency and effectiveness from workers in the public sector by the populace, this study will attempt to establish the linkage between the present states of public buildings in relation to the social and economic impact to public workers.

1.6 Scope of the Study

The study was limited to residential buildings of selected public institutions in the Kumasi Metropolis of the Ashanti Region of Ghana. It examined the maintenance of residential buildings of the Ghana Police Service, the Ghana Health Service Nurses quarters and those of University of Education-Winneba, Kumasi campus.

1.7 Limitations of the Study

Data gathering suffered due to delay in getting responses due to the schedule of work of especially personnel of the GPS. In addition records keeping was a problem for all the institutions surveyed such that in some situation researcher had to collate the number of buildings himself. This also resulted in difficulty in identifying the buildings.

Notwithstanding the above limitations, the study results have not been affected and thus are credible, reliable and useful for any purposes of evaluation and feedback. This was made possible because researcher assisted especially the GPS in putting up a data base for its residential buildings in the study area.

1.8 Organisation of the Report

The study has been organized under five chapters. Chapter one, covers the introductory part and it includes the problem statement, research questions, objectives, significance of the study, the scope and the limitations. The second chapter deals with the review of relevant literature on the subject. Thus, ideas of some researchers and authors have been reviewed.

Chapter three focused on the methodology adopted in undertaking the research. The analysis of the data gathered is dealt with in chapter four, whilst chapter five presents a summary of the key findings, recommendations and conclusion.

CHAPTER TWO

THE CONCEPT OF BUILDING AND THE NATURE OF BUILDING MAINTENANCE

2.1 Introduction

This chapter reviews literature on the issues of the concept of building and nature of maintenance of buildings. It covers secondary materials related to the conceptual issues as well as definitional and other factors affecting maintenance of buildings.

2.2 The Concept of Building

2.2.1 Definition of Building

A building is an edifice erected by art, and fixed upon or over the soil, composed of stone, brick, wood, or other proper substance connected together, and designed for use in which it is so fixed (Wikipedia)

2.2.2 Lives of Buildings

The lives of existing buildings are difficult to assess as all properties from the date of their erection, have been the subject of varying amounts and standards of maintenance, besides being constructed with the intention that they should last at least sixty (60) years and many exceed this period (Seeley, 1987).

Stone (1983) in Seely (1987) asserts that even cheaper buildings generally have a substantial life in the order of fifty (50) to sixty (60) years. And that this possible physical life is often much greater but may be demolished before the end of this period to permit a more profitable use of the site, or because it is found more economical to clear and rebuild rather than to adapt the building to meet changed requirements, because of physical or technical obsolescence.

The life of a building can be categorized into ‘structural life’ and ‘economic life’. The structural or physical life is the period which expires when it ceases to be an economic proposition to maintain the building, while economic life is concerned with earning power and it is that period of effective life before replacement; replacement taking place when it will increase income absolutely. However, the actual physical life of a building is frequently much greater than its economic life, but buildings are often

demolished before their physical life is expired in order to permit a more profitable use of the site, or because it is found cheaper to clear and rebuild rather than to adapt the building to the changed requirement (Seely, 1983) As a general rule the capital asset of a building is so valuable and is often appreciating, so that in practice maintenance is frequently directed to prolonging effective life.

2.2.3 Public Residential House Types in Ghana

i. Detached Bungalows: These are houses designed or built to be occupied by a single household. They are regarded as bungalows, because they stand detached on individual plots of varying sizes. The dwelling unit is organized into specific rooms for receiving visitors and relaxation (living rooms), eating, carrying out other indoor family activities, cooking (kitchen), ablutions (bathroom and toilet) and sleeping (bedrooms). In addition to these basic rooms, one finds spaces such as garages, store rooms, terraces etc in some of these house types.

ii. Semi-Detached Houses: It is basically two houses put together with a common partition wall. Similar to the bungalow type, the dwellings are selfcontained.

iii. Blocks of Flats: This type of houses provides self-contained dwelling units of different sizes for single-households placed on multi-levels without any defined private courtyard space. Balconies are provided on the ground floor for the occupying households. In some cases, lockable garages and storerooms are provided on the ground floor for the occupying households.

2.3 Definition of Maintenance

British Standard (BS 3811: 1964) defines maintenance as ‘a combination of any actions carried out to retain an item in or to restore it to, an acceptable standard’.

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’. There is also the concept of an ‘acceptable standard’ which may be construed as acceptability to the

person paying for the work, to the person receiving the benefit or to some outside body with the responsibility for enforcing minimum standards. Additionally it can also be construed more widely as acceptability to the public at large or to specific sections of the public. Clearly however there are no absolute standards which would be equally acceptable to everybody or which would remain acceptable to the same group of people over a period of time.

The standards acceptable at the time of undertaking the work may be higher or lower than the initial design standards. In many cases, the standards deemed acceptable would be higher than that originally provided and the work would include an element of improvement. Buildings, however with the passage of time are modified to accommodate new uses and it becomes increasingly unrealistic to think in terms of keeping or restoring the initial standards. Clearly, the standards would be related to safety and efficiency, and determined by the amount of money allocated rather than as a result of assessing the benefits obtained from maintaining the building to a particular state.

According to the British Standard (B. S. (3811) 1974), as cited in (Afranie and Osei-Tutu, 1999,), maintenance is defined as work undertaken in order to keep or restore every facility (i.e. every part of the site, building and content) to an acceptable standard and cost:

- To keep here means that defects are prevented from developing
- To restore means that minor defects, if they are allowed to occur, are then corrected;
- Acceptable standard and acceptable cost indicate that maintenance work is tailed to suit individual needs and conditions.

Seely (1993) defines maintenance as 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.

Maintenance has also been defined as ‘All actions taken to retain material in or to restore it to a specified condition. It includes inspection, testing, servicing, and

classification as to serviceability, repair, rebuilding, and reclamation' (Collins English Dictionary, 2003).

It includes the routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously utilized, at its original or designed capacity and efficiency, and for its intended purpose (Dictionary of Military and Associated Terms, US Department of Defense 2005).

A more functional definition proposed by White (1969) as cited in Lee (1986) is that 'maintenance is synonymous with controlling the condition of a building so that its pattern lies within specified regions'. The word 'control' suggests a positive activity which is planned so as to achieve a defined end result while the term 'specified regions' presumably has a similar meaning to 'acceptable standards'. His definition envisages a range of acceptability with upper and lower limits between which the conditions of the building must be maintained.

Maintenance therefore is 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 built. 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 effects;
- Periodic up-keep such as painting; and
- Major repair requiring heavy expenditure and the services of technical experts, for example foundation works and re-roofing. (S. Afranie and E. Osei-Tutu, 1999)

2.4 Types of Maintenance

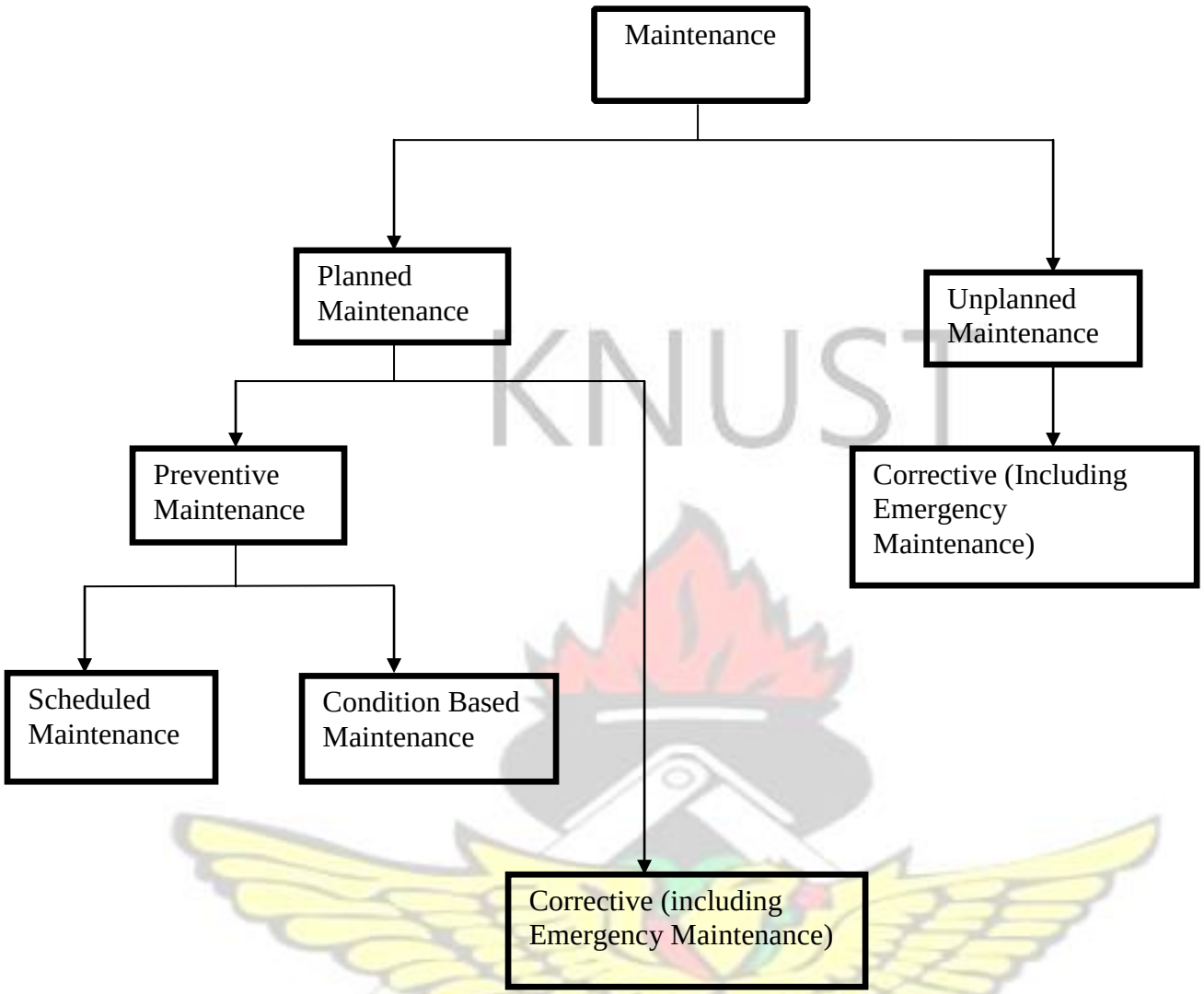


Figure 2.1 Types of maintenance (source: BS 3811: 1984)

BS 3811 categorizes building maintenance by means of the following terms and definitions.

i. Planned maintenance: 'The maintenance organized and carried out with forethought, control and the use of records to a predetermined plan."

ii. Unplanned maintenance: "The plan carried out to no predetermined plan." It refers to work necessitated by unforeseen breakdown or damages. For example, the ripping-off of a building, through the action of a storm, and its remedial action constitute unforeseen damages. It can also be termed unexpected and unavoidable maintenance.

iii. Preventive maintenance: "The maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or the performance degradation of an item."

iv. Corrective maintenance: “The maintenance carried out after a failure has occurred and intended to restore an item to a state in which it can perform its required function.”

v. Emergency maintenance: “The maintenance which it is necessary to put in hand immediately to avoid serious consequences.” This is referred to as dayto-day maintenance, resulting from such incidents as gas leaks and gale damage.

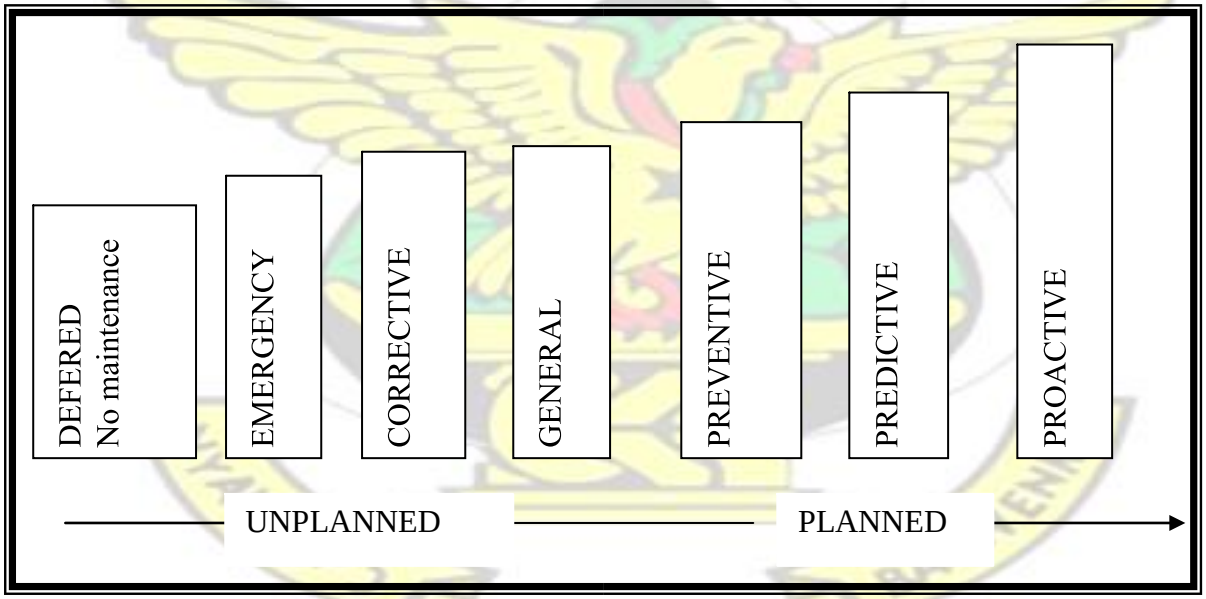
vi. Condition-based maintenance: “The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.”

vii. Scheduled maintenance: “The preventive maintenance carried out to a predetermined interval of time, number of operations, mileage, etc.”

viii. Running maintenance: “Maintenance which can be carried out whilst an item is in service.”

The Office of the Legislative Auditor, Minnesota, U.S.A also identifies a continuum of building maintenance as illustrated in Figure 2.2

Figure 2.2 Continuum of Maintenance for Buildings



Source: Office of the Legislative Auditor, Minnesota, U.S.A

At one end is deferred maintenance, which occurs when projects are identified as necessary but put off due to lack of resources. Next along the continuum are unplanned activities including emergency maintenance, such as restoring lost electrical power, and corrective maintenance, such as fixing a broken window. Emergency and corrective maintenance occur as the need arises; neither is planned far in advance.

Planned maintenance follows on the continuum, although the maintenance categories are not mutually exclusive. General maintenance is the upkeep of building components to restore them to their original conditions or to keep them in good working condition. Preventive maintenance follows on the continuum.

Preventive maintenance is a planned program of periodic inspections, adjustments, and replacements. Preventive maintenance means the regularly scheduled repair and maintenance needed to keep a building component operating at peak efficiency and extend its useful life. It includes scheduled activities intended to prevent breakdowns, such as periodic inspections, lubrication, calibrations, and replacement of equipment. Replacing filters in an air-handling unit on a regularly scheduled basis is an example of preventive maintenance. Because prolonging the life of major building systems requires periodic replacement of equipment, preventive maintenance typically requires both capital and operating expenditures. Preserving these assets—including the buildings' roofing, plumbing, heating, ventilation, air conditioning, electrical systems, exteriors, and interiors—is a primary objective behind preventive maintenance.

Predictive maintenance presents another degree of planned maintenance. It uses techniques, such as vibration analysis of moving parts while equipment is operating, to detect trends that indicate excessive wear. This allows repairs to be made before equipment fails, but only when conditions warrant the repair, not on a regularly scheduled basis as with preventive maintenance. Predictive maintenance helps avoid unnecessary overhauls when analysis indicates the equipment is in good condition and does not need work. One example is analyzing the vibration frequencies of fans or gears to detect changes in amplitude that may signal bearing damage or other degradation.

A step beyond that is proactive maintenance, a highly structured practice that uses information from analyzing equipment to identify origins, not just symptoms, of equipment problems. Proactive maintenance would, for example, identify whether excessive wear resulted from defective installation, unsuitable design, or some other cause. Because it addresses the root sources of equipment problems, proactive maintenance eliminates recurring problems and the downtime and other costs associated with those recurrences.

Maintenance work has also been categorized as 'predictable' and 'avoidable'. Predictable maintenance is 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 lifespan. Avoidable maintenance is the work required to rectify failures caused by poor design, incorrect installation or the use of faulty materials.

With building services, minimal neglect can result in potential danger. 'Appropriate condition' could be interpreted as the maintenance of building in a state, which allows them to be used for the purpose for which they were provided for the minimum capital expenditure. The appropriate condition will be influenced by many factors, including the function of the building, its public image, or even national prestige. The prime aim of building maintenance should be to obtain good value for money spent on maintenance.

Another approach to maintenance classification has been adopted by Speight (1982) as cited in Seeley (1987), subdivided maintenance into three broad categories:

1. Major repair or restoration: such as re-roofing or rebuilding defective walls and often incorporating an element of improvement.
2. Periodic maintenance a typical example being annual contracts for decorations and the like.
3. Routine or day-to-day maintenance: This is largely of the preventive type, such as checking rainwater gutters and servicing mechanical and clerical installations.

2.4.1 The value of preventive maintenance

A well-planned preventive maintenance is advocated for its effects on improving equipment's operating efficiency, preventing premature replacement of components, and avoiding interruptions for building occupants. Preventive maintenance is widely thought to reduce long-term costs by maximizing the operating capacities of equipment, minimizing downtime, and avoiding breakdowns that would otherwise lead to higher repair costs later.

Preventive maintenance may indirectly affect occupants' productivity and health. For example, a study of public school conditions in the District of Columbia found that, while controlling for other factors, students in schools with excellent building conditions had higher standardized achievement scores than students in schools with fair building conditions and even higher scores than students in schools with poor conditions. Certain preventive maintenance can improve the quality of indoor air, and insufficient preventive maintenance can be detrimental to it. For instance, lack of preventive maintenance may result in roof leaks, creating conditions for mold growth and potentially affecting some users' respiratory systems. The costs of poor indoor air are potentially dramatic, as exemplified recently by the Capitol Square building in St. Paul, which had problems that forced the relocation of its occupants and led to its demolition in early 2000 (office of Legislative Auditor, Minnesota U.S.A).

Maintaining good indoor air can have direct, positive effects on building occupants. As an example, one study-quantified savings from improved worker productivity and health associated with making indoor air quality improvements in government, school, and other non-industrial buildings. The study in the District of Columbia, estimated that a one-time upgrade of HVAC systems, including the preventive maintenance required to sustain the upgrade over 20 years would provide net benefits of $13.31 per square foot and $11,227 per worker (Seeley, 1987).

Successful preventive maintenance programs should achieve these goals:

1. **Preserve taxpayers' investments in public buildings.** Preventive maintenance can extend the life of building components, thus sustaining buildings' value and the significant tax dollars they represent.
2. **Help buildings function as they were intended and operate at peak efficiency, including minimizing energy consumption.** Because preventive maintenance keeps equipment functioning as designed, it reduces inefficiencies in operations and energy usage.

3. **Prevent failures of building systems that would interrupt occupants' activities and the delivery of public services.** Buildings that operate trouble-free allow public employees to do their jobs and serve the public. Because preventive maintenance includes regular inspections and replacement of

equipment crucial to operating a building, maintenance staff reduces the problems that might otherwise lead to breakdown in operations.

4. **Sustain a safe and healthful environment by keeping buildings and their components in good repair and structurally sound.** Protecting the physical integrity of building components through preventive maintenance preserves a safe environment for employees and the public.

5. **Provide maintenance in ways that are cost-effective.** Preventive maintenance can prevent minor problems from escalating into major system and equipment failures that result in costly repairs. In avoiding costs of major repairs, preventive maintenance creates efficiencies. Increasing preventive maintenance can reduce time spent reacting to crises, which is a more costeffective way to operate buildings. Deferring preventive maintenance can generate higher costs over the long term.

2.5 Components of maintenance

Maintenance involves a considerable amount of work which Harper (1969) as cited in (S. Afranie and E. Osei-Tutu, 1999) has been categorized into three components namely; Servicing, Rectification and Replacement.

2.5.1 Servicing

Servicing is essentially a clearing operation undertaken at regular intervals of varying frequency and is sometimes termed 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. However, as more equipment that are sophisticated are introduced so more complicated service schedules become necessary. Servicing becomes necessary because of constant use of facilities, the effect of the weather and atmospheric conditions on the components of the building.

2.5.2 Rectification

Rectification work usually occurs fairly early in the life of a building; but it can also occur some time within the life span of the building .it arises from shortcoming in design, inherent fault in or unsuitability of component, damage of goods in transit or installation and incorrect assembly. 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 theory is to ensure that components and materials are suitable for their purpose and are correctly installed. Rectification work could be reduced by the development and use of performance specifications and codes of installation (Lee, 1987 P. 23). Rectification is the response to inherent defects in design, construction or installation stages of the building process. This provides an opportunity to "trade off" current capital expenditure against future maintenance costs.

2.5.3 Replacement

Replacements occur at all costs in buildings. It is inevitable because service conditions cause materials to decay at different rates. Much replacement work stems not so much from physical breakdown of the materials or element as from deterioration of the appearance (Seeley, 1987). This is because the extent of exposure of materials to the vagaries of the weather varies, and the weather in specific locations also vary whilst the capacity of elements of buildings in withstanding changes and different intensities of the weather vary. This therefore becomes necessary as a result of material decay due to these differential rates of weather conditions. Physical breakdown of materials or elements as well as deterioration appearance may necessitate replacements.

However, this brings the problem of distinguishing between maintenance and improvement, which has not been resolved satisfactorily by many definitions. It is however, generally conceded that maintenance should include reasonable elements of improvement, for example, the replacement of worn out component with up-todate version. Where the intention of work done is to increase efficiency in the use of the building by adding facilities, which were not previous present, the work should be classify as improvement. However, it is logical therefore to extend the meaning of maintenance to cover some localized improvement (Lee, 1987).

Maintenance can also embrace renovations, which consist of work done to restore a structure, service and equipment by a major overhaul to the original design and

specification, or to improve on the original design. This may include limited additions and extensions to the original building.

2.6 Other Maintenance-Related Concepts and Definitions as related to Housing 2.6.1 Prevention

It entails protecting housing by controlling its environment, thus preventing agent of decay and damage from becoming active. It involves clearing schedule, good house keeping and proper housing management.

2.6.2 Consolidation

Consolidation is the physical addition or applicati**on of** adhesive or supportive materials unto the actual fabric of housing in order to ensure its continued durability or structural integrity.

2.6.3 Rehabilitation

It involves the modernization of aged building with or without adaptive alteration for use. It means the introduction of modern services into the building without changing its original use.

2.6.4 Repair

Repair is to revive housing to the original state so that it works as it was first put up or built. It involves reactive responses to housing deterioration and it is essentially ad hoc in nature.

2.6.5 Renovation

It consists of work done to restore a structure, services and equipment by a major overhaul to the original design and specification or to improve on the original design. This may include substantial additions and extensions to the original structure and in the extreme re-building. Renovation constitutes the interface with improvement and refurbishment. Renovation to some extent is unavoidable, since in replacing a fitting, such as a bath, the replacement will be of a new design.

2.6.6 Refurbishment

Refurbishment means in architectural sense, as involving replacement of missing parts or introduction of new decorative elements into a structure. In addition, it involves working on a housing to make it bright, clean and fresh again.

2.6.7 Extension

With respect to housing, it involves addition of parts to make housing wider or larger in response to what is required of it.

2.7 Technology of Maintenance

The technology of maintenance is concerned with all the factors that influence and cause the need for maintenance work. The occurrence of defects in the fabric of a building can result from many unrelated design decisions- unsuitable material, incorrect assessment of loads, inadequate appreciation of conditions of use and inadequate assessment of exposure. Exposure is influenced by rainfall, direction of prevailing winds, microclimate, atmospheric pollution and aspect and height of building. The durability of the building material also influenced by frost action, crystallization of salts, sunlight, biological agents, abrasions and impact, chemical action and corrosion and incompatibility of modern building material.

Cracks in building normally result from failure or defective construction and are invariably unsightful and unacceptable to occupants. If severe, they may result in loss of stability. Furthermore, cracks frequently give rise to air infiltration, heat loss and reduced sound insulation all of which cause reduced efficiency in buildings. Cracking is generally caused by tensile stresses in excess of the tensile strength of the material, produced by externally applied loads or internal movements arising from temperature or moisture changes.

Other important concept of the maintenance can be illustrated by reference to roof construction. A good roof which is well maintained should last the life of a building and it is false economy to save money on roof during construction, because if it ever requires replacement, it will cause serious dislocation of production, occupancy or other activities within the building. A leaking roof apart from causing considerable inconvenience to users can lead to accelerated deterioration of other parts of the building such as ceiling, floors and walls and can cause serious damage to decorations and electrical installation. Traffic over a roof should be kept to a minimum and where it is essential, appropriate walkways and access ladders must be provided. To ensure that roofs are adequately maintained, they should ideally be inspected every three (3) years or alternatively one-third each year.

2.8 Economic and Social Significance of Maintenance

Frequent maintenance of the built environment brings such benefits as comfort and satisfaction to its inhabitants. Maintaining the physical structures of a property ensures that investments made does not only yield the highest possible returns over the life of the property but also fulfills the ultimate responsibility of providing the needed human satisfaction and comfort.

A house according to Dave (2002), as cited in (S. Afranie and E. Osei-Tutu, 1999) is regarded as an economic asset, which must be maintained to ensure that it appreciates in value and results in a return, either socially or economically, to the owner. In effect the primary aim of maintaining a building it to preserve it in its original state as practicable as possible so that it effectively serves that purpose. As a rule, the capital asset of a building is so valuable and is often appreciating so that in practice, maintenance should frequently be directed to prolong effective life. Therefore the purpose for maintaining a building are; retaining the value of investment, maintaining the building in a condition in which it continues to fulfill its function and presenting good appearance. No wonder many writers on the economic and social significance of maintenance contend that the built environment expresses in physical form, the complex social and economic factors, which give structure and life of the community. As a result, the condition and quality of buildings reflect public pride or indifference, the level of prosperity in the area, social values and behaviour and all the many influences both past and present, which combine to give a country its unique characteristics.

2.9 Aims of Maintenance

The primary aim of maintaining a building is to ensure that the building continue to serve the purpose for which it was put up. The purposes for which maintenances are undertaken include:

(I) 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 value(S. Afranie and E. Osei-Tutu, 1999)

(II) To ensure optimum use of buildings- good maintenance should allow buildings to be used to their full potential

(III) To create or maintain suitable appearance- can make a positive contribution to external environment and social conditions. Dilapidated buildings can contribute to social deprivation and badly maintained services and facilities, waste energy and resources and can affect the environment

(IV) To maximize the life of main components and materials- maintenance can reduce cost of subsequent maintenance by extending periods between repairs and replacements;

(V) To ensure that buildings do not detract from surroundings and also maintain a suitable appearance.

2.10 Factors Influencing Decision to Undertake Maintenance

Derek Miles and Paul Syagga, (1987), identify the following factors as influencing the decision to carry out maintenance on a building:

i. 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 him, 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 in these cases maintenance is taken for granted except when it threatens production or 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 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 result 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.

ii. Bad management- refers to the idleness and waste among maintenance personnel.

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

iv. Stapleton (1994), in S. Afranie and E. Osei-Tutu (1999), relates than the decision to carry out maintenance is affected by many factors, among which are:

(a) cost- investors would want to have the most economic method for carrying out maintenance work whether, corrective or preventive, thus they look at

- Actual cost of maintenance of the building to the cost of maintaining similar buildings;
- Consideration of money spent to achieve acceptable standard at present;
- Cost of maintaining same standard in future and economies of replacing facilities, and
- Amount of work available and priority of work to be executed.

(b) Availability of physical resources- the availability or 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 will deter 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;

(c) Urgency of work- this also affects decisions on maintenance in that investors consider whether delayed work in the short run will require more expensive work at a later stage. This usually takes into account

- Safety of building users; and
- Possible damage to structure and finishes used in the building.

(d) Interference with activities carried out in the building.

Seeley (1993) on the other hand according to S. Afranie and E. Osei-Tutu (1999), summarizes the principal criteria which could influence the decision to carry out maintenance briefly as, cost, age and condition of property, availability of adequate resources, urgency, future use and sociological considerations.

2.11 Maintenance Policy

BS 3811, Defines maintenance policies as a strategy within which decisions on maintenance are taken. Alternatively, it may be defined as the ground rules for the allocation of resources (men, materials and money) between the alternative types of maintenance actions that are available to management. In order to make a rational allocation of resources the benefits of those actions to the organization as a whole must be identified and related to the costs involved. Issues under consideration in a policy include; objectives, benefits and policies.

2.12 Physical Causes of Poor Maintenance in Residential Buildings

The physical causes of maintenance problem refer to all the natural/physical factors that negatively affect the durability of the building. The durability of a built facility is a measure, in an inverse sense, of the rate of deterioration of a material or component (S. Afranie and Osei Tutu, E 1999). According to S. Afranie and Osei Tutu, E 1999, the British Standard Institution (BSI) Code of Practice defines durability as the quality of maintaining a satisfactory appearance and performance of required functions. The code measures this parameter in terms of the minimum number of years of satisfactory life. The three major causes of deterioration and hence maintenance problems are, age or period of construction, environmental and location factor.

Newly constructed houses are observed to be in relatively better condition as compared to older houses. Environmental factors such as extreme moisture content (too high and too low), high and fluctuating temperature and salt laden winds among others have effects on the building (S. Afranie and Osei Tutu, E 1999). In areas of continuously high humidity, some materials retain more moisture sufficient to have deleterious effects while in drought zones, some materials may deteriorate or fail to develop their potential properties because of hydration. Fungal and insect attack of organic materials and the corrosion of metals are encouraged in very moist conditions.

The components of buildings, which are found to be more affected are the wooden members, the cement based parts and the roofs, especially the corrugated iron sheets (S. Afranie and Osei Tutu, E 1999).

The location of a building has a direct effect on the maintenance problem. The location refers to the exact loci of the building. Thus location is influenced by the terrain of the environment, soil, nature of social and seismic movement, salt laden winds and salty water effects as well as high temperatures and drastic temperature changes.

2.13 Organisation of Maintenance Department

The maintenance department in an organization is managed by a maintenance manager. The maintenance manager is responsible for the planning and control of maintenance operations. In a small firm, the functions may be undertaken by a member of staff in addition to his other duties, while in a larger firm there would be a separate group of people solely responsible for maintenance.

2.13.1 The Functions of the Maintenance Department

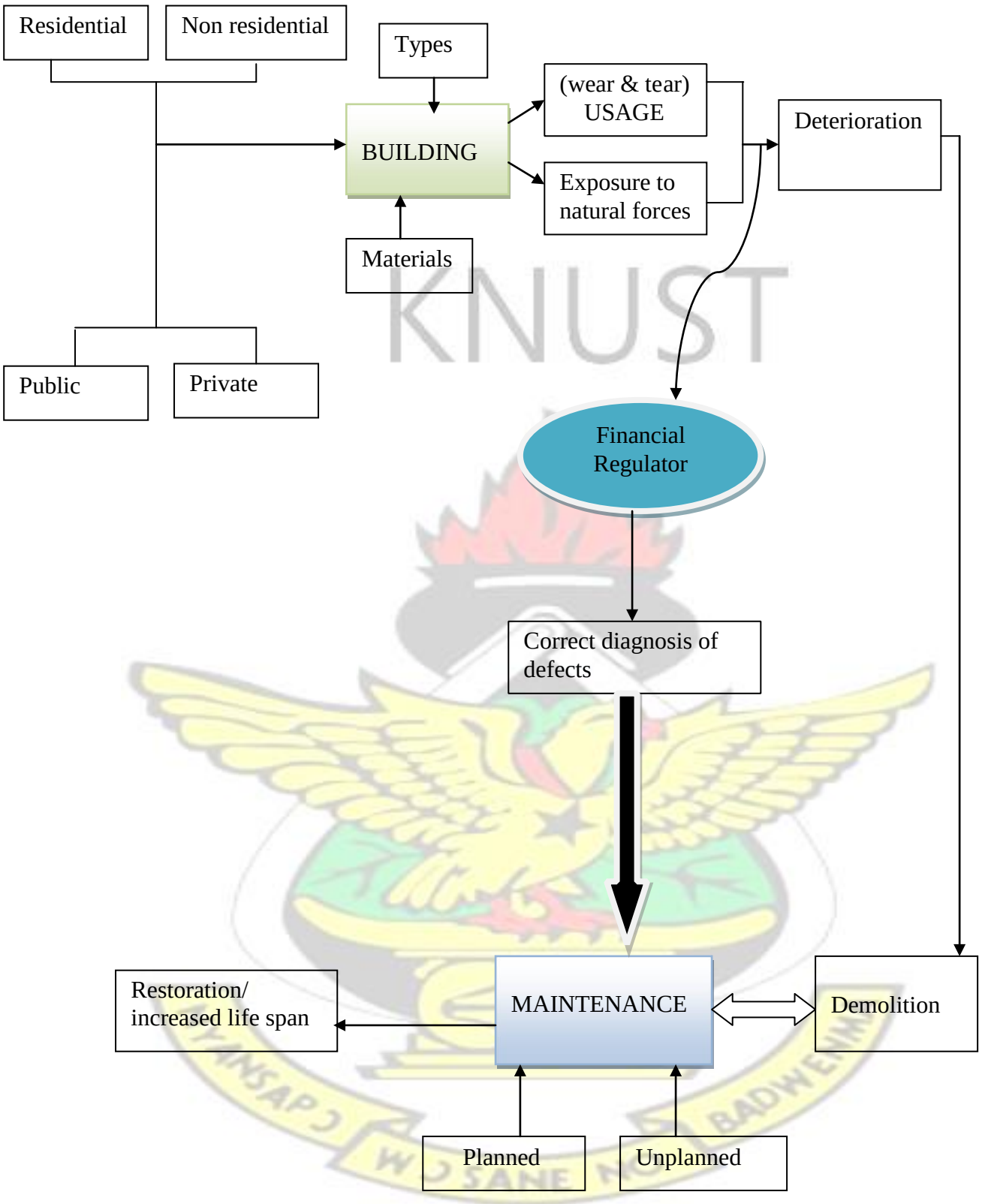
The maintenance department among other things performs the following basic functions.

1. Advisory function: this involves liaison with occupants and users and consultation with upper management on such matters as;
    - The standards to be maintained and the effect on user activities of deviations from these standards.
    - The relative merits of alternative maintenance policies and the extent to which it would be advantageous to employ operatives directly for executing the work.
    - Clarification of any constraints in relation to limits of expenditure, desirable cash flow patterns, acceptable delay times or restrictions on time and method of carrying out work
    - Estimates of maintenance expenditure both long and short term, including, where appropriate, the cost of initially bringing up to the required standard and the possibility of phasing any such backlog over a period of years.
    - Provision of cost and other data to assist upper management in deciding whether to repair or renew.

- Technical requirements for minor works involving alterations or small additions to the building; although not strictly maintenance, it is usual for the maintenance organization to assume full responsibility for this type of work.
- Advice on the maintenance implications of designs for proposed new buildings.

2. Organizational function: this may be in relation to the central administrative and supervisory system or to the execution system whether by direct labour or contract.
3. Control functions: the control functions are dependent on the timely receipt of accurate information relating to the state of the system. The control functions operate in the following areas:
    - Work input. Identifying the extent of work necessary to achieve the required standards within the constraints laid down. The processes involved would include planned inspections, appraisal of user requests and assignment of priorities.
    - Time of execution. Programming the workload so that the carrying out of the work is timed in accordance with the needs of the user and the available labour force
    - Quality. Supervision of work during execution and by subsequent control inspections to detect latent defects
    - Cost. Budgetary control system including estimating resource requirements in cost and performance terms for later comparison with actual cost and performance achieved.
    - Feedback. This is an inherent feature of all the control functions and involves keeping such records as are necessary for the proper control of the operations.
4. Miscellaneous functions: the maintenance organization may have responsibility for other matters such as: Safety and security, principally in relation to compliance with statutory fire precautions and the maintenance of fire fighting equipment, Refuse disposal, cleaning, grounds etc.

Figure 2.3 CONCEPTUAL FRAMEWORK FOR MAINTENANCE OF BUILDINGS



Source: Author's Construct 2010

Property owners all too frequently endeavour to keep maintenance expenditure to a minimum, ignoring or misunderstanding the adverse long-term effects of such a policy. Neglect of maintenance has accumulative results with rapidly increasing

deterioration of the fabric and finishes of a building accompanied by harmful effects on the contents and occupants (Seeley 1987).

Building maintenance depends on the materials used in the construction of the building and the type of building. Buildings however, can be categorized into public and private. Public buildings are buildings owned by the state whereas private buildings are owned by individuals other the state. In addition, buildings can be used for residential (dwelling) and non-residential (non-dwelling) purposes.

The usage of a building resulting in wear and tear and exposure to natural forces cause deterioration of building. Human activities responsible for the deterioration/decay of building are: failure to clean and carry out routine maintenance, ignorance of the causes of deterioration and decay, failure to promote awareness of maintenance needs by all who use the building and adopting a negative attitude of waiting until emergency measures are required,. Other factors that are responsible for the deterioration of building are presence of chemical, fire, faulty design, construction, materials and systems as well as vandalism. This deterioration can however be avoided or rectified through maintenance of the building. Maintenance (planned and unplanned) can make the necessary impact only if the financial regulator of the building through correct diagnosis of defects ensures that funds are made available for such a purpose. Failure to undertake maintenance of a building will ultimately result in reducing the life span of the building and consequently result in demolition. Maintenance of the building will however ensure that the building is restored to its initial status and also increase the life span of the building.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology of the study. It describes and justifies the methods and processes that will be used in order to collect data that will be used in answering the research questions. The chapter is presented under the following sections namely: definition of research methodology, research design, the concept of population and sampling, and the sources of data and methods of data collection.

3.2 Research Methodology

Kothari (2003) defines research as the pursuit of truth with help of study, observation, comparison and experiment, that is a systematic method of finding solutions to a research problem identified. Kothari (2003) further argues that the process of research is a systematic method that includes the following in logical sequence:

a) Enunciating or defining the research problem.
b) Formulating the hypothesis/research questions from the research problem.
c) Designing the appropriate research process.
d) Collecting facts or data to help answer the research questions
e) Analyzing the data
f) Reaching certain conclusions from the analyzed data hence answering research questions.

Research methodology on the other hand is inclusive of the research methods and encompasses the overall approach to the research process from definition to selection of the appropriate research method and analysis of data and drawing conclusions from the analysis hence would entail all the above steps from (a) to (f).

3.3 Research Design

The study adopted both quantitative and qualitative framework. However a case study design approach was adopted for this research to investigate the concept of building maintenance as applied in public institutions in Ghana with particular reference to the following public institutions in Kumasi Metropolis: Ghana Police Service, University of Education, and the Ghana Health Service nurses quarters.

3.3.1 Quantitative

Quantitative research is concerned with measuring of quantity or amount and involving statistical manipulation, or hypothesis testing. It deals with numbers and

their manipulation in order to gain insight in that which is being studied (Davis, 1997). Kothari 2003 defines quantitative research as that which involves generation of data in quantitative form, which is then subjected to rigorous quantitative analysis in a formal and rigid way. Data collecting techniques included questionnaires, and actual physical measurements of the phenomena such as weight, height, ages, and duration of projects.

3.3.2 Case Study Method

Case study research method can be defined as the in-depth study of one or a few events or cases in order to understand the phenomenon being investigated. Rather than study a large sample and study a limited number of variables, we are limited to one or two cases and an in depth study longitudinally is done (Flyvbjerg, 2006). According to Kumekpor (2002), a case study method can be conceived as a method of investigation which aims at studying the facts of a particular case from all aspects and from all angles. It is thus a critical and systematic examination into the circumstances and factors that resulted in a particular condition or situation. The purpose of a case study is to probe deeply and to analyse intensively the complex phenomena that constitute the life of the unit with a view to establishing generalizations about the wider population to that unit belongs.

According to Frankfort-Nachmias and Nachmias (1996 p. 146), a case study involves an observation of a single group or event at a single point in time, usually subsequent to some phenomenon that allegedly produced change. In reference to the research at hand, the researcher would study the public institutions mentioned above extensively in order to have an in depth understanding of their maintenance policies and practices and how it impacts on the lifespan of these buildings and the life of the occupants as well as its aesthetic value.

However, the case study approach does not allow for before-after or control groupexperimental group comparison (Cronbach, 1982). It is often difficult to generalize from a case study but insights gained may be useful for other equally important purposes. Findings may be particular to that group alone but the study may be replicated with other groups.

3.3 Variables of the Study

According to Kerlinger (1986 cited in Kumar 1999), 'A variable is a property that takes on different values'. Also, Black and Champion (1976) defined a variable as, 'rational units of analysis that can assume any one of a number of designated sets of values'. However in this study, the main variables to be measured include specific housing elements such as roofs, walls, and foundation that decay as a result of non maintenance, the age of the buildings, housing types and the design (facilities) of the building.

A set of indicators (See Table 3.1) have been developed to measure housing maintenance. They are used to assess the nature of maintenance of public institutions buildings.

Table 3.1: Indicators for Measuring Public Building Maintenance

Housing Elements and Facilities	Indicators of Measuring Maintenance of Buildings
Roofs	Leakage, rusty, partly ripped off, completely ripped off.
Windows and Doors (wooden members)	Partly broken down, completely broken down, no problem
Painting	No Painting, faded painting, dirty, well painted
Floor	Develop cracks, peel-off, partly broken down, no problem
Walls	partly broken down, develop cracks, peel – off, tilted
Foundation	Exposed, hanging, weak

Age of the building	Old (above 50 years) medium aged (20-50 years) and younger buildings (less than 20 years)
Housing type	Detached, semi-detached, single storey, multi-storey and terrace
Housing facilities(toilet, water, bathroom, kitchen, electricity	Good, fairly good and bad
Painting	no painting, faded painting, dirty, well painted

Source: Author's Construct, 2010

3.4 The Concept of Population, Sample Frame and Unit of Analysis

3.4.1 Population

A population can be defined as the complete set of subjects that can be studied: people, objects, animals, plants, organizations from which a sample may be obtained (Shao, 1999). A population is also defined as including all people or items with the characteristic one wish to understand (Wikipedia).

Frankfort-Nachmias and Nachmias, (1996), describe population as the entire group or set of cases that a researcher is interested in generalizing. For the purpose of this research, the population consists of the buildings of the selected public institution in the Kumasi metropolis.

3.4.2 Sample Frame/unit of analysis

A sample frame is a list that includes every member of the population from which a sample is to be taken. The sample frame includes all the households occupying the buildings of the public institutions under research and it was obtained from records of the institutions being studied.

The unit of analysis is the household or the personnel of these institutions occupying the buildings. It is from the unit of analysis that the necessary data required for this research was gathered for analysis.

The units of analysis constitute the most elementary part of the phenomenon under study (Frankfort-Nachmias and Nachmias 1996, p. 53). They are the basic units of

investigation. According to Kumekpor (2002), the units of analysis in any investigation refer to the actual empirical units, objects and occurrences which must be observed or measured in order to study a particular phenomenon. This is because they influence the research design, data collection and data analysis decisions. In an attempt to provide hints as to how this was done effectively, Patton (1987), for instance, points out that the key factor for making the decision about the appropriate unit of analysis rests on what unit the researcher wants to discuss and draw conclusions at the end of the research. In this regard, the unit of enquiry in this research was households occupying public buildings in the following institutions.

- Ghana Police Service;
- Ghana Health Service Nurse quarters; and
- University of Education Winneba, Kumasi Campus.

3.5 Sampling

Sampling is that part of statistical practice concerned with the selection of an unbiased or random subset of individual observation within a population of individuals intended to yield some knowledge about the population of concern, especially for the purpose of making predictions based on statistical inference (Wikipedia). Kumar (1999) explains that a sample is a sub-group of the population which is an ideal representative of the entire population.

Researchers usually cannot make direct observations of every individual in the population they are studying. Instead, they collect data from a subset of individuals (a sample) and use those observations to make inferences about the entire population (Zickmund 1991).

This research made use of both probability and non probability sampling techniques. A probability sampling scheme is one in which every unit in the population has a chance (greater than zero) of being selected in the sample, and this probability can be accurately determined, while non-probability sampling is any sampling method where some elements of the population have no chance of selection (these are sometimes referred to as 'out of coverage'/'under covered'), or where the probability of selection can't be accurately determined. It involves the selection of elements based on assumptions regarding the population of interest, which forms the criteria for selection. In non-probability sampling, there is no way of specifying the probability of each unit’s inclusion in the sample, and there is no assurance that every unit has

some chance of being included. Hence, because the selection of elements is nonrandom, non-probability sampling does not allow the estimation of sampling errors.

Probability sampling methods adopted for the study are the stratified and simple random sampling. Stratified sampling method is where the population embraces a number of distinct categories; the frame can be organized by these categories into separate "strata." Each stratum is then sampled as an independent sub-population, out of which individual elements can be randomly selected. Dividing the population into distinct independent strata enabled this researcher to draw inferences about specific subgroups that may be lost in a more generalized random sample.

Stratified sampling method was used to categorize the residential accommodation into the different managerial levels and the housing types within the organizations. The housing types identified in the institutions are: terrace/barracks, single storey and detached bungalow types for the Ghana Police Service while the nurse's quarters of the Ghana Health Service and the University College of Education- Kumasi have the detached bungalows and single storey types. This assisted the researcher to determine how maintenance is undertaken at the different levels and within the different housing types in the three public institutions and how it imparts on their residential accommodation. These are low level, middle level, and top level management. Simple random sampling technique was then be used to select the sample size for the study. In a simple random sample (SRS) of a given size, all such subsets of the frame are given an equal probability. Each element of the frame thus has an equal probability of selection: the frame is not subdivided or partitioned. This minimizes bias and simplifies analysis of results.

In the case of the Ghana Police Service, a two-stage cluster sampling method was used to select the households. Cluster sampling is a random sampling plan in which the entire population is subdivided into groups and a random sample of these clusters is selected (www.metagora.org/training- assessed on 8/4/2010). The building of the institution was put into three clusters: Kumasi Central, Suame and Manhyia, and households randomly selected from these clusters.

Purposive sampling method was used in selecting public institutions in the Kumasi Metropolis as well as the building types to be sampled. In purposive sampling, we sample with a purpose in mind. With purposive samples (occasionally referred to as judgment samples), researchers select units subjectively in an attempt to obtain a sample that appears to be representative of the population.

3.5.1 Sampling Size Determination

The number of households by housing types in the three institutions.

Table 3.2 Households according to house types Source:

Institutions	**House Types**			
	Single-Unit/Terrace	**Bungalows**	**Tenement**	**Total**
Police	324	48	18 (3 storey building by 6 flats	390
UEW-Kumasi Campus	8	31	14 (3 storey by 2 flats and 2 storey by 4 flats)	53
GHS- Nurses quarters	-	24	12	36
Total	**332**	**103**	**44**	**479**

Author's Field Survey, February 2010.

The total number of households which represents the sample frame is 499. The sample size was made up of 40% of the sample frame excluding the single-unit houses of the UEW-K which will be purposely added to the sample.

Table 3.3 Sample size for institutions

Institution	House Type			
	Bungalows	Tenement	Single-Unit	Total

GPS	19	7	130	156
GHS	10	4	-	14
UEW-K	12	6	8	26
Total	41	17	138	196

Source: Author's Construct, 2010

3.5.2 Criteria for Selecting the Study Areas

The researcher considered the following to purposely select the three public institutions for study. The Police Service was selected due to the type of its residential buildings and the system of administration. The services' residential accommodation has a combination of terrace/ single unit type of buildings, tenement and bungalows. It however has a centralized system of administration with total reliance on the state for funds for its operations. The bungalows are allocated to Senior Police Officers' (SPO) who are of the rank of Assistant Superintendent of Police and above. The tenement houses are occupied by the Inspectorate rank, while the single unit houses are occupied by the other ranks made of personnel from the rank of Constable to Sergeant.

The nurses' quarters on the other hand consist of both bungalows and tenement buildings. Its administrative system though centralized, has options of internally generating funds to support some of its activities.

Finally the University of Education- Kumasi Campus, operates a semi autonomous administrative system such that it has power to raise revenue internally for its operations and therefore as a public institution with such a system of management serves as a source of interest for the researcher to undertake a study into their maintenance activities as far as their buildings are concerned. Its building types are the bungalows, tenement and single unit houses. The bungalows and tenement houses are occupied by the lecturers, senior lecturers and senior administrative staffs while the junior administrative staff and artisans occupy the single unit houses.

3.6 Data Collection Method and Instruments

In this study both quantitative and qualitative methods was employed for data collection. This approach is similar to the view of Flyvbjerg (2004), that more often than not, a combination of qualitative and quantitative methods will do the task best.

Unique in comparison to other qualitative approaches, within case study research, investigators can collect and integrate quantitative survey data, which facilitates reaching a holistic understanding of the phenomenon being studied (Yin, 2003).

Data was collected from the population using the following data collecting techniques or instruments, questionnaire, interview and physical observation, of the buildings under study. Logical empiricists also take the position that social scientists can attain objective knowledge in the study of the social as well as the natural world. They contended that the social and the natural sciences can be investigated by the same scientific methodology (Frankfort-Nachmias and Nachmias, 1996).

Photographs of buildings defects relevant to the study were also taken.

3.6.1 Primary Data Collection

Data was collected from the population using the following data collecting techniques or instruments: questionnaire, interview guide and physical observation of the buildings. Furthermore, photographs of some of the buildings sampled were taken.

A series of questions that are easy and convenient to answer but can describe the intended practices or behaviours was formulated into a questionnaire. Shao (1999) defines a questionnaire as a formal set of questions or statements designed to gather information from respondents that accomplish research objectives.

The questionnaire may have either structured, semi structured or unstructured questions. For the purpose of this research, the questionnaire contained structured questions.

The structured questions are convenient easy and take less time to answers because options are available to the respondents from which they tick options that best describe their practices, opinions or attitudes. The disadvantage is that they restrict the respondent in choice. The available options from which they have to select may not be exhaustive to describe the situation of the respondent.

The questionnaire was disseminated to the respondents in the following ways: a) Delivered and dropped and picked up after respondents have responded

b) Administered face to face.

3.6.2 Questionnaire Design

Preliminary contacts with potential respondents based on information from the literature review served as a basis for questionnaires design for the different respondents. In the light of the above, questions were prepared for the following purposes and respondents.

1. Housing conditions and the state of maintenance of public buildings
2. Heads of households (personnel) occupying these buildings
3. Estate Managers of the institutions
4. Workshop and Maintenance Officers of the institutions
5. Stakeholders in the provision of public buildings such as SHC and PWD

The questionnaire for the maintenance and estate departments was to enable the researcher to assess the capacity of these departments to maintain buildings of their respective institutions and the type of maintenance activities that go on in these institutions. The questions covered the variables necessary to measure maintenance of buildings. This included the age of buildings, the components that decay and the design of the buildings and its effect on maintenance.

3.6.3 Piloting of Questionnaires

The questionnaire was field tested by the researcher to assess the relevance of the questions, the understanding of respondents, identify any ambiguities, as well as the general availability of the various categories of information needed. The field testing also provided hands on experience for the interviewer in the administration of the questionnaire. The researcher piloted the questionnaire on a group of households and Management of the three public institutions and their contributions was then incorporated in the final questionnaire by way of a review based on the information gathered by the interviewer/researcher.

The second instrument that was employed to collect data was interviews. According to Moser and Kalton (1971) an interview is a conversation between interviewer and the respondent with the purpose of eliciting certain information from the respondent. Cohen (1976) adds that interviewing is an activity requiring careful preparation, much patience, and considerable practice if the eventual reward is to be a worthwhile catch.

Interview requires more in depth answers and takes longer and more resources to carry out. It requires setting up appointments at the convenience of both the researcher and the respondents and it takes a longer period of time to get as much information as you could get from a questionnaire (Shao, 1999). Personal interview was conducted. The personal interview is a face-to-face, interpersonal role situation in which an interviewer asks respondents questions designed to elicit answers pertinent to the hypotheses (Frankfort-Nachmias and Nachmias, (1996). This took the form of schedule- structured interview. With this form of interview the number of questions and the wording of the questions are identical for all of the respondents.

Thirdly, the researcher undertook field observation of buildings in the selected institutions in terms of walls to determine the nature or state of the coated surfacecheck for cracks and fungi infestation. Other things looked out for were the floor screed, broken windows and doors, non functional electrical fittings, faulty sewerage and broken down drains, damaged ceiling and ripped off/ rusty/ leaking roofs. This was done through field observation.

3.6.4 Secondary Data Collection

Secondary sources of data relevant to the research was obtained from the World Wide Web (internet), records from the three public institutions relating to the their building types, its location within the metropolis, and the annual maintenance reports by the Estate and Maintenance Departments.

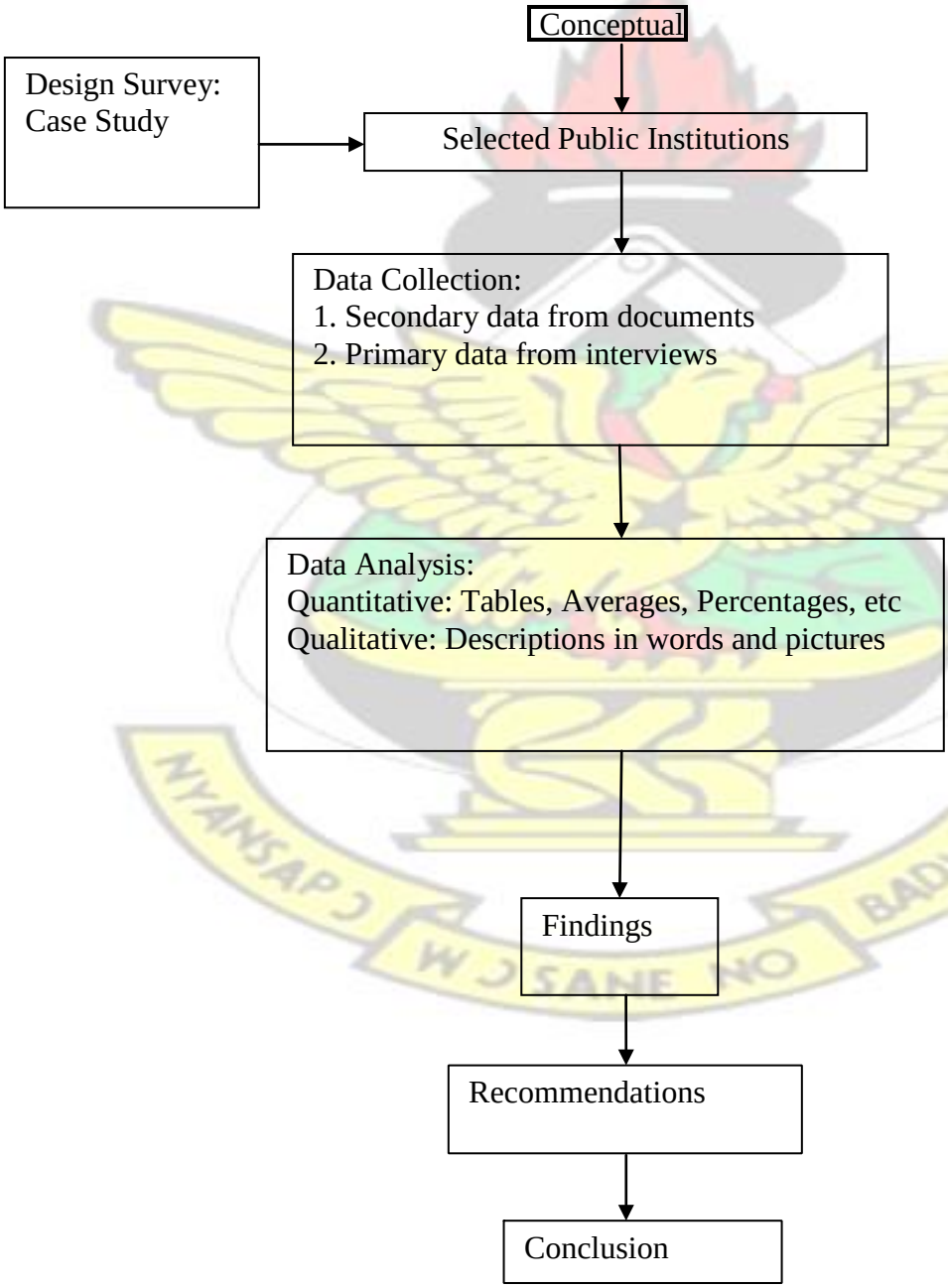
3.7 Data Analysis Design

Data analysis is a practice in which raw data is ordered and organized so that useful information can be extracted from it. Analysis of the data was done using both qualitative and quantitative analytical techniques. Tables, charts, percentages and textual write-ups of the data gathered among others were used in the case of the quantitative technique, while descriptions and pictures were used in the case of the qualitative analysis.

In addition cross case analysis was done. These methods were designed or employed to refine and distill the data so that readers can glean interesting information without reading to sort through all the data on their own.

Figure 3.1 below is a diagrammatic illustration of a data analysis and reporting mechanism adapted from Waugh (1995) which gives a summary of the key features of the analytical framework. Figure 3.1 therefore is a summary of the methodology and the analytical techniques adopted for the study. From the figure, the details of the stages of the research methodology adopted are shown.

Figure 3.1: Framework for Data Analysis and Reporting



Source: Adapted from Waugh (1995), Geography: An Integrated Approach (2nd Ed)

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents the results, analysis, discussions and findings of the data collected. Analysis of responses was done according to the research objectives. It examined the present state and condition of the residential buildings of the following public institutions: University of Education, Winneba- Kumasi campus, Ghana Health Service nurses quarters and the Ghana Police Service, the causes of maintenance problems in public institutions and the maintenance policy and practices of these institutions. This report also examines best practices in managing preventive maintenance for buildings owned public institutions. Simple percentages and charts were used for the analysis.

4.2 Types of Houses Occupied by Personnel (Households)

Personnel of the surveyed public institutions reside in three main house types, namely; bungalows (detached and semi-detached), tenement (block of flats), and one storey and two-storey single unit (terrace). Table 4.1 summarizes the type of houses being occupied by personnel of the three institutions in surveyed area.

Table 4.1 House Types of Surveyed Public Institutions

Institution	House type							
	Bungalows		Flats		Single unit		Total	
	No	%	No	%	No	%	No	%
GPS	18	13.2	6	4.4	112	82.4	136	100
UEW- K	12	46.2	6	23.1	8	30.7	26	100
GHS	10	71.5	4	28.6	0	0.0	14	100
Total	**40**	**22.7**	**16**	**9.1**	**120**	**68.2**	**176**	**100**

Source: Author's Field Survey: May, 2010

4.3 The Present State/Condition of the Buildings

4.3.1 The Availability of Domestic Facilities and Services in Public Buildings. Domestic facilities and services in the building namely toilet, kitchen, water, electricity and bath among others are basic and necessary requirement to make the building habitable and ensure the comfort and safety of occupants. They form an integral part of housing design and construction and are therefore required to be incorporated in the design of buildings before approval will be given by city authorities upon application. These facilities have been described as in good condition, fairly good condition and bad condition. Facilities described as being in good condition are those that are well maintained and operational in most of the times. Those that have served many years of useful life and are fairly maintained but have some problems with its functionality, and yet operational are described as being in a fairly good condition while facilities that are not well maintained and are either not operational or operational for limited periods of time due to maintenance problems are said to be in bad condition. The study therefore sought to assess the state of these facilities in residential buildings of the Ghana Police Service, the UEW- Kumasi campus and the GHS Nurses quarters.

4.3.2 Condition of Domestic Facilities and Services

All the institutions surveyed had the full complement of the following domestic facilities services: toilet, kitchen, water, electricity and bath. The single unit buildings (terrace) however, have their toilet, kitchen, water and bath separated from the main buildings. In addition each of these domestic facilities and services are shared by two households or housing unit. Pipe borne water is the main source of water supply to the households and the toilet facility used was water closet.

Table 4.2 below details out the condition of these domestic facilities and services in the various institutions, while Table 4.3, also details the results of the survey of the state of the domestic facilities by institution.

Table 4.2 State/ Condition of Domestic Facilities and Services by Institution

Institution	Water							
	Good		Fairly Good		Bad		Total	
	No	%	No	%	No	%	No	%
Ghana Police service	58	42.6	58	42.6	20	14.7	136	100
UEW- Kumasi Campus	0	0	2	7.7	24	92.3	26	100
Ghana Health Service	4	28.6	10	71.4	0	0	14	100
Total	**62**	**35.2**	**70**	**39.8**	**44**	**25.0**	**176**	**100**
Bathroom								
Ghana Police Service	62	45.6	42	30.9	32	23.5	136	100
UEW- Kumasi Campus	8	30.8	6	23.1	12	46.2	26	100
Ghana Health Service	4	28.6	8	57.1	2	14.3	14	100
Total	**74**	**42.1**	**56**	**31.8**	**46**	**26.1**	**176**	**100**
Toilet								
Ghana Police Service	62	45.6	54	39.7	20	14.7	136	100
UEW- Kumasi Campus	8	30.8	14	53.8	4	15.4	26	100
Ghana Health Service	10	71.4	2	14.3	2	14.3	14	100
Total	**80**	**45.5**	**70**	**39.8**	**26**	**14.8**	**176**	**100**
Kitchen								
Ghana Police Service	30	22.1	64	47.1	42	30.9	136	100
UEW- Kumasi Campus	4	25.4	14	53.8	8	30.8	26	100
Ghana Health Service	4	28.6	10	71.4	0	0	14	100
Total	**38**	**21.6**	**88**	**50.0**	**50**	**28.4**	**176**	**100**
Electricity								
Ghana Police Service	16	11.8	90	66.2	30	22.1	136	100
UEW- Kumasi Campus	2	7.7	22	84.6	2	7.7	26	100
Ghana Health Service	2	14.3	10	71.4	2	14.3	14	100
Total	**20**	**11.4**	**122**	**69.3**	**34**	**19.3**	**176**	**100**

Source: Author's Field Survey, May 2010.

Table 4.3 State/ Condition of Domestic Facilities and Services by House Type

Institution	Water							
	Good		Fairly Good		Bad		Total	
	No	%	No	%	No	%	No	%
Bungalows	6	15.0	24	60.0	10	25.0	40	100
Flats	2	12.5	2	12.5	12	75.0	16	100
Single-Unit	54	45.0	44	36.7	22	18.3	120	100
Total	**62**	**35.2**	**70**	**39.8**	**44**	**25.0**	**176**	**100**
	Bathroom							
Bungalows	16	40.0	18	45.0	6	15.0	40	100
Flats	10	62.5	4	25.0	2	12.5	16	100
Single-Unit	48	40.0	34	28.3	38	31.7	120	100
Total	**74**	**42.1**	**56**	**31.8**	**46**	**26.1**	**176**	**100**
	Toilet							
Bungalows	24	60.0	12	30.0	4	10.0	40	100
Flats	8	50.0	8	50.0	0	0.0	16	100
Single-Unit	48	40.0	50	41.7	22	18.3	120	100
Total	80	45.5	70	39.8	26	14.8	176	100
	Kitchen							
Bungalows	6	15.0	34	85.0	0	0.0	40	100
Flats	8	50.0	8	50.0	0	0.0	16	100
Single-Unit	24	20.0	46	38.3	50	41.7	120	100
Total	**38**	**21.6**	**88**	**50.0**	**50**	**28.4**	**176**	**100**
	Electricity							
Bungalows	12	30.0	26	65.0	2	5.0	40	100
Flats	4	25.0	12	75.0	0	0.0	16	100
Single-Unit	4	3.3	84	70.0	32	26.7	120	100
Total	**20**	**11.4**	**122**	**69.3**	**34**	**19.3**	**176**	**100**

Source: Author's Field Survey, May 2010.

The state of water, bathroom, toilet, kitchen, and electricity shown by table 4.2 depicts that 35.2 percent, 39.8 percent and 25.0 percent of the water facility among households of public institutions surveyed were in good, fairly good and bad condition respectively. This means that about 65 percent of the water facility of the public buildings surveyed requires some form of maintenance.

In terms of institutions, there is the need for the entire water facility of the UEW-K to be maintained since none was in good condition.

The situation is however better with the GPS which had about 43 percent of the water facility in good condition, with about 57 percent in fairly good and bad condition, and the GHS which had none of its surveyed buildings with its water facility in bad condition. But with only about 29 percent and 71 percent in good and fairly good respectively, the situation is gloomy and needs some maintenance attention.

The survey results of Table 4.3 indicate that about 85 percent, 87 percent and 55 percent of bungalows, flats and single unit buildings surveyed had their water facility in fairly good and bad condition respectively.

The condition of the facility has been associated with the following problems according to the various institutions. The UEW-K has its water facility broken down and as such water has not flowed through the taps for the past 6 months. In the case of the GPS and GHS, there is irregular flow of water and frequent breakdown of the taps especially with the single unit building of the GPS where pressure on the facility is high due to the number of users.

For a house to become a home for man there is the need for a bathroom to be incorporated in the main design. This facility should have a smooth floor and wall to prevent water from seeping through into the foundation. It was essential to take a look at the state of the bathroom of occupants of public buildings. From Table 4.2 about 42 percent, 32 percent and 26 percent of respondents surveyed indicated that the facility was in good, fairly good and bad condition respectively. Therefore about 58 percent of public buildings surveyed require some maintenance.

However a look at the facility according to institutions revealed that 45.6 percent, 30.9 percent and 23.5 percent of buildings surveyed in the GPS have their bathroom in good, fairly good and bad condition respectively. While in the case of the GHS this was represented by 28.6 percent, 57.1 percent and 14.3 percent respectively. The UEW-K on the other hand had 42.1 percent of its bathroom being in good condition, with 31.8 percent and 26.1 percent being in fairly good and bad condition respectively.

A look at the condition of the bathroom facility according to house type from table 4.3 indicated that 15.0 percent of bungalows, 12.5 percent of flats, and 31.7 percent of single unit houses have their facility in a bad condition. While 40.0 percent and 45.0 percent of the bungalows, 62.5 percent and 25.0 percent of the multi-storey flat and 40.0 percent and 28.3 percent of the single unit houses were fairly good and bad respectively. This indicates that about 60 percent, 38 percent and 60 percent of bungalows, flats and single unit houses surveyed respectively need to be maintained to put them in a good condition.

The major maintenance problems with the bathrooms are: presence of cracks on the floor and wall, peeling off of the plastered walls, slippery floors and too many users particularly in the case of single unit houses.

The study revealed that the toilet facility used in all building types is the water closet. From Table 4.2 about 45 percent of the toilet facility is in good condition, while 40 percent and 15 percent are in fairly good and bad condition respectively. The state of the toilet facility in the GPS shows that about 54 percent of households surveyed had their facility in fairly good and bad condition. The situation with GHS was much better, with 29 percent of respondents having their facility in bad condition. This is in sharp contrast with the situation in the UEW-K just about 31 percent of the facility surveyed was in good condition

The state of the condition of the toilet facility for the three institutions emanates from the problem of leakages from the sewerage system, thus emitting very bad odour and cracks in the water closet due to the age of this facility and large number of users particularly with the single unit buildings. According to the residents the water closet has been in existence for decades dating back to the 1960,s when the building was put up.

It can be observed from Table 4.3, that the condition of the toilet facility according to house type for the public institutions revealed that in the case of the bungalows
60.0 percent, 30.3 percent and 10.0 percent of the households surveyed had the facility in good, fairly good and bad respectively, while in the case of the multistorey flats all the facility was in good and fairly good condition, represented by 50.0 percent each.

However, the situation in the single unit houses showed a relatively greater number of respondents' i.e. about 54 percent describing it as being in bad condition.

The kitchen facility was analyzed by looking at the nature of ventilation, the size of the kitchen and the number of users as well as its location in the building. The bungalows and flats of the GPS, GHS and the UEW-K have their kitchens located within it, spacious and well ventilated and used by one occupant. The situation is different when it comes to the single unit houses of the GPS and the UEW-K, where the facility is located behind the building, poorly ventilated, small in size and shared by two households. The pressure on the kitchen facility for the single houses has resulted in deterioration of the floor, the wall, window, door and the electrical gadget such as sockets, switches and plugs. This has been compounded by lack of maintenance of this facility.

Table 4.2 depicts that, about 22 percent, 50 percent and 28 percent of kitchens in public buildings surveyed are in good, fairly good and bad condition respectively an indication that about 78 percent of them needs maintenance works. 22.1 percent, 47.1 percent and 30.8 percent of respondents from the GPS had their kitchen facility in good, fairly good and bad condition respectively. The situation in the GHS nurses quarters and UEW-K revealed that only about 29 percent and 15 percent respectively are in good condition. Considering house types, none of the bungalows and flats had their kitchen in bad condition, but about 42% of the kitchens in the single unit houses were in bad condition.

Electricity was available in all buildings surveyed. The electrical facilities in the buildings were also analyzed to establish the functionality of the entire wiring system of the building, the state of the fixtures (sockets, switches), fans/airconditions if available and provided by the institution. Respondents complained of frequent power cuts due to the wiring system which they intimated has not been changed since the building was put up. The fans and fluorescent fittings are faulty, rusty and non-functioning.

The electricity facility was described as being in good condition by about 12 percent of respondent, while about 69 percent and 19 percent responded that the facility was fairly good and bad respectively. However, 11.8 percent, 66.2 percent and 22.1 percent

of respondents from the GPS indicated that the electrical facility was good, fairly good and bad respectively. The situation for GHS nurses quarters was 14.3 percent, 71.4 percent and 14.3 percent respectively, with 7.7 percent of surveyed buildings in UEW-K describing the electricity as good, 84.6 percent as fairly good and 7.7 percent as bad.

The survey results in table 4.3 indicate that, about 70 percent, 75 percent and 89 percent of all bungalows, flats and single unit houses respectively surveyed had problems with their electricity facility and therefore needed urgent attention to protect the building and property of occupants.

4.3.3 Present State/Condition of Building Elements

This section examines the current general maintenance situation of the residential buildings of the three public institutions in the Kumasi Metropolis in relation to the building elements. A building is made of several elements with each performing specific functions. The effective functioning of these elements determines the condition of a building. All the elements have well defined and distinct functions irrespective of the design of the building, its specifications and construction. The maintenance condition of the buildings will be done by assessing the following elements: the foundation/substructure, the roof, the floor, the wall, painting, and wooden members (window and door).

4.3.3.1 Foundation

A foundation is the skeleton of buildings. It is the joint of any given structure. Primarily it is the foundation upon which the building's strength resides. A weak sub-structure/foundation cannot support any super structure no matter how well the building is constructed. Much attention is therefore given to the foundation. The foundation of a building represent between 20-30 percent of the cost of any built environment (Afrane & Osei Tutu, 1997).

Table 4.4 Condition of Foundation by Institution and House Type

Institution	Deep Cracks		Exposed/hanging		No Defect		Total	
	No	%	No	%	No	%	No	%
Ghana Police Service	32	23.5	42	30.9	62	45.0	136	100
UEW- Kumasi Campus	4	28.6	4	28.6	6	42.9	14	100
Ghana Health Service	6	23.1	8	30.8	12	46.2	26	100
Total	**42**	**23.9**	**54**	**30.7**	**80**	**45.5**	**176**	**100**
Housing Type								
Bungalow	10	25.0	4	10.0	26	65.0	40	100
Flats	2	12.5	4	25.0	10	62.8	16	100
Single-Unit	30	25.0	46	38.3	44	36.7	120	100
Total	**42**	**23.9**	**54**	**30.7**	**80**	**45.5**	**176**	**100**

Source: Author's Field Survey, May 2010.

Table 4.4 reveals that about 24 percent, 31 percent of all buildings surveyed had problems with their foundation. The survey however revealed that about 24 percent, 29 percent and 23 percent of buildings of the GPS, GHS and UEW-K respectively surveyed have developed deep cracks, while about 30.9 percent, 29 percent and 31 percent respectively have their foundation exposed or hanging. This indicates that the buildings need urgent attention.

From Table 4.4, a look at the house type revealed that single unit houses have the greatest defect in their foundation, with 25.0 percent and 38.3 percent of their foundation having developed cracks and being exposed respectively .It was observed that the problem of exposed foundation is as a result of intensive erosion resulting from heavy and torrential rainfall experienced in this part of the country. Again most of the surroundings of the building have no vegetation cover to reduce the rate of erosion.

4.3.3.2 Roofing Element

Roofing element constitute about 15-20 percent of the cost of any housing project (Afranie & Osei Tutu, 1997). The roof cover of any building forms an important component of that building. The roof of a building must be in place before it can be habitable. The predominant roofing material identified in the study area was the

asbestos roof and iron sheet. A leaking roof of a building has a multiplier effect of causing damage to the building structure itself as well as the property of occupants.

Table 4.5 Condition of Roofing Element by Institution and House Type

Institution	Leaking		Rusty		Partly Ripped Off		No defect		Total	
	No	%	No	%	No	%	No	%	No	%
GPS	24	17.6	24	17.6	0	0.0	88	64.7	136	100
GHS	6	42.9	2	14.3	0	0.0	6	42.9	14	100
UEW-K	4	15.4	14	53.9	0	0.0	8	30.8	26	100
Total	**34**	**19.3**	**40**	**22.7**	**0**	**0.0**	**102**	**58.0**	**176**	**100**
House Type										
Bungalows	8	20.0	12	30.0	0	0.0	20	50.0	40	100
Flats	4	25.0	6	37.5	0	0.0	6	37.5	16	100
Single-Unit	22	18.3	22	18.3	0	0.0	76	63.3	120	100
Total	**34**	**19.3**	**40**	**22.7**	**0**	**0.0**	**102**	**58.0**	**176**	**100**

Source: Author's Field Survey, May 2010.

From the data in table 4.5, approximately 42 percent of all buildings surveyed had problems with their roofs. It was recorded that, about 19 percent and 23 percent of all surveyed houses had their roofs either leaking or rusted respectively. The problem of roof leakage was more pronounced in buildings of GHS where about 43 percent of buildings surveyed had leaking roofs. About 54 percent of houses of UEW-K had rusty roof because about 90 percent of buildings of this institution was roofed with iron sheet.

A look at the house type indicated that roofing problem was more pronounced in the flats, with about 25 percent and 38 percent of roofs of all bungalows surveyed leaking and rusty respectively. In the case of bungalows about 50 percent of respondents had problems with their roof, while about 37 percent of all single unit houses surveyed had problems with their roof.

4.3.3.3 Flooring Element

Table 4.6 Condition of Flooring Element

Institution	Develop Cracks		Peel-Off		No Defect		Total	
	No	%	No	%	No	%	No	%
GPS	32	23.5	38	28.0	66	48.5	136	100

GHS	6	42.8	4	28.6	4	28.6	14	100
UEW-K	8	30.8	8	30.8	10	38.5	26	100
Total	**46**	**26.1**	**50**	**28.4**	**80**	**45.5**	**176**	**100**
House Type								
Bungalow	14	35.0	12	30.0	14	35.0	40	100
Flats	0	0.0	6	37.5	10	62.5	16	100
Single-Unit	32	26.7	32	26.7	56	46.6	120	100
Total	**46**	**26.1**	**50**	**28.4**	**80**	**45.5**	**176**	**100**

Source: Author's Field Survey, May 2010.

The floor of any building is an area that experiences a lot of activity due to the movement of occupants and as such undergoes both imposed and natural stress; hence the rate of wear is enhanced and more pronounced. Majority of the buildings surveyed had problems with their floor. Only 45.5 percent of the houses surveyed had their floors in good condition. The situation from the data in Table 4.6, reveal that approximately 63 percent of all flats surveyed had their floors in good condition. The situation was however bad in the case of bungalows where only 35 percent of surveyed bungalows had their floors in good condition. In addition to the floors developing cracks and peeling off, there were sections of some floor exhibiting indentation and others dusty due the peeling off with respect to the concrete floor.

4.3.3.4 Wall Elements

Wall element is for enclosing of space. It is one of the most substitutable elements of the building and it is basic to all buildings. Table 4.7 depicts the condition of the walling elements of buildings surveyed.

Table 4.7 Maintenance Conditions of Wall by Institution and House Type

Institution	**Nature of Walling Problem**									
	Develop cracks		**Peel Off**		**Tilted**		**No Defect**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
GPS	66	48.5	30	22.1	16	11.8	24	17.6	136	100
GHS	2	14.3	0	0.0	4	28.6	8	57.1	14	100
UEW-K	6	23.1	8	30.7	6	23.1	6	23.1	26	100
Total	**74**	**42.0**	**38**	**21.6**	**26**	**14.8**	**38**	**21.6**	**176**	**100**
House Type										
Bungalows	12	30.0	0	0.0	8	20.0	20	50	20	100
Flats	6	37.5	0	0.0	6	37.5	4	25.0	16	100

Single-Unit	56	46.7	38	31.7	12	10.0	14	11.7	120	100
Total	**74**	**42.0**	**38**	**21.6**	**26**	**14.8**	**38**	**21.6**	**176**	**100**

Source: Author's Field Survey, May 2010.

The survey indicated that the commonest problem with the wall is the development of cracks. From Table 4.7, 42 percent, 21.6 percent, and 14.8 percent of the walls of all public buildings surveyed have either developed cracks, peeled off or are tilted respectively. According to the institutional survey, GPS had the development of cracks of the wall as the most pronounced problem accounting for 48.5 percent of the walling problem. However, the GHS topped the institutions in terms of tilted walls accounting for 28.6 percent of walls surveyed.

The survey according to house type from Table 4.7 depicts that single unit houses have about 47 percent of their walls developing cracks. Whereas all bungalows surveyed had 50 percent of their walls with problems that in single-unit house had as high as 88 percent of their walls requiring some form of maintenance. The situation is similar to that of the flats where 75 percent of their walls were defective and needed maintenance. This indicates that there is low maintenance awareness and maintenance practice among occupants in these two building types.

4.3.3.5 Painting

Painting on a building adds up to the beauty of any built environment and protects the buildings as well against the vagaries of the weather. It also serves as a qualitative measure of the building. Painting as a finishing material is an aesthetic variable as far as the building fabric is concerned. Table 4.8 shows the data in terms of painting by institution and house type.

Table 4.8 Condition of Building with respect to Painting

Institution	**Nature of Walling Problem**									
	No Painting		**Faded Paint**		**Dirty**		**Well Painted**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
GPS	24	17.6	50	36.8	50	36.8	12	8.8	136	100
GHS	0	0.0	8	57.1	2	14.3	4	28.6	14	100
UEW-K	0	0.0	12	46.2	12	46.2	2	7.7	26	100
Total	**24**	**13.6**	**70**	**39.8**	**64**	**36.4**	**18**	**10.2**	**176**	**100**
House Type										

Bungalows	0	0.0	18	45.0	16	40.0	6	15.0	20	100
Flats	0	0.0	6	37.5	6	37.5	4	25.0	16	100
Single-Unit	24	20.0	46	38.3	42	35.0	8	6.7	120	100
Total	**24**	**13.6**	**70**	**39.8**	**64**	**36.4**	**18**	**10.2**	**176**	**100**

Source: Author's Field Survey, May 2010.

From Table 4.8, approximately 10 percent of all buildings surveyed were well painted. However about 90 percent had various forms of painting-related problems as follows: no painting (13.6 percent), faded paint (39.8 percent), and dirty (36.4 percent). this is an indication that buildings of these public institution need urgent attention in terms of painting. The survey results by institutions indicated that all the buildings of the GHS and UEW-K have ever been painted, but 17.6 percent of that of GPS hadn't seen any paint since it was put up. Relatively the GHS had the highest well painted number of buildings (28.6 percent), while the UEW-K had the highest number of dirty buildings (46.2 percent). On the other hand, 36.8 percent, 57.1 percent and 46.2 percent of buildings of GPS, GHS and UEW-K respectively surveyed had faded paint.

From Table 4.8, approximately only 7 percent of single unit houses are well painted, with another 24 percent never painted since it was built. The survey also indicated that 85 percent and 75 percent of all bungalows and flat surveyed respectively have painting-related problems. There is therefore the need to ensure that buildings are regularly painted due to the aesthetic and protective value of painting.

4.3.3.6 Maintenance Condition of Windows and Door (Wooden Members)

Windows and doors are purposely put place to regulate the amount of air and sunlight penetration into a building. It also ensures that properties of occupants are safe and secure. Table 4.9 tabulates data on the general maintenance condition of windows and doors with respect to institution and house type.

Table 4.9 Condition of Windows and Doors by Institution and House Type

Institution	Partly Broken down		Completely broken down		No Defect		Total	
	No	%	No	%	No	%	No	%
GPS	56	41.2	32	23.5	48	35.3	136	100
GHS	0	0.0	2	14.3	12	85.7	14	100
UEW-K	12	48.2	3	23.1	8	30.8	26	100
Total	**68**	**38.6**	**40**	**22.8**	**68**	**38.6**	**176**	**100**
House Type								

Bungalows	10	25.0%	12	30.0%	18	45.0%	40	100
Flats	6	37.5%	0	0.0%	10	62.5%	16	100
Single-Unit	52	43.3%	28	23.3%	40	33.3%	120	100
Total	**68**	**38.6**	**40**	**22.8**	**34**	**38.6**	**176**	**100**

Source: Author's Field Survey, May 2010.

From Table 4.9, approximately 61 percent of buildings surveyed had defective wooden members. The survey also indicated that GHS had the least defective wooden members (14.3 percent). That of the GPS and UEW-K was 64.7 percent and 71.3 percent respectively. This implies that about 23 percent of all buildings surveyed need to have their windows and doors replaced, because they are completely broken down.

Assessing the situation by house type indicates that approximately 67 percent and 65 percent of all singe-unit and bungalows surveyed respectively have defective wooden members. The partly broken wooden members had some doors with their hinges defective as well as part of the door especially the bathroom doors rotten due to lack of coating or painting to prevent the doors from absorbing water. The major problem with the windows was broken louver blades which impacts negatively on day and night room temperatures and indoor air quality.

4.3.3.7 General Maintenance Condition of Buildings by Institution and House Type

Having assessed the maintenance condition of some facilities in the buildings as well as individual elements, a general assessment of the buildings surveyed was carried out in order to establish an overall picture of the maintenance conditions of houses of public institution in the Kumasi metropolis. The buildings were classified into good, fair and bad. Houses were classified as being in good condition if:

Components are structurally sound with no defects (no cracks, peel-off, tilted, broken down, leakages etc.) and require only general maintenance and minor repair; little or no deferred maintenance exists. Few building systems fail, and they allow uninterrupted daily use of the facilities .e.g. water, toilet, bathroom, electricity, kitchen etc

Those in fair condition had the following characteristics:

Components show signs of slight deterioration and require some corrective maintenance and major repairs; some deferred maintenance exists. Building systems fail occasionally, causing some interruptions in daily use of the facilities.

Those in bad condition had the following characteristics

Components show signs of severe deterioration and require corrective maintenance and emergency repairs; deferred maintenance is extensive. Building systems fail frequently, causing ongoing interruptions in daily use of facilities.

The survey results of the general maintenance condition of buildings by institutions and house types are presented in Table 4.10.

Table 4.10 General Maintenance Condition of Buildings

Institution	Good		Fair		Bad		Total	
	No	%	No	%	No	%	No	%
GPS	22	16.2	58	42.6	56	41.2	136	100
GHS	2	14.2	10	71.4	2	14.3	14	100
UEW-K	6	23.1	12	46.2	8	30.8	26	100
Total	**30**	**17.0**	**80**	**45.5**	**66**	**37.5**	**176**	**100**
House Type								
Bungalows	6	15.0	32	80.0	2	5.0	40	100
Flats	6	37.5	4	25.0	6	37.5	16	100
Single-Unit	18	15.0	44	36.7	58	48.3	120	100
Total	**30**	**17.0**	**80**	**45.5**	**66**	**37.5**	**176**	**100**

Source: Author's Field Survey, May 2010.

The survey indicated that, only 17 percent of all buildings of public institutions surveyed are in good condition and well maintained, 45.5 percent are in fair condition while 37.5 percent are in a bad state due to poor maintenance. This situation demands that those buildings in fair condition need to be maintained before they deteriorate into worse situation with time. Institutional wise, GHS had a good maintenance practice compared to the GPS and UEW-K since only about 14 percent of its building was in

bad condition. The GPS was worse in terms of maintenance with about 41 percent of its buildings in bad condition. The institution with the most well maintained building was the UEW-K (21.3 percent).

An assessment of the maintenance conditions of the various house types revealed that flats are well maintained (37.5 percent) compared to bungalows (15 percent) and single-unit houses (15 percent). Maintenance was very poor among single-unit houses with 48.3 percent of them in poor condition. While 37.5 percent of flats are in a bad state, only 5 percent of bungalows are in bad condition. However, in terms of maintenance needs 85 percent of all bungalows and single-unit buildings needs some form of maintenance to bring them into a good condition.

In sum, the assessment of maintenance conditions of residential buildings of public institutions surveyed has revealed that the houses are not well maintained. The most poorly maintained elements of the building are the foundation, flooring, wall, painting and wooden members where only 45.5 percent, 45.5 percent, 22.6 percent, 10.2 percent and 38.6 percent respectively were well maintained and in good condition. Major defects identified on the buildings include the following: cracked and exposed foundation, rusty and leaking roof, cracked, peel-off and dusty floors, faded and dirty painting of buildings, broken down windows and doors, torn mosquito net, broken louver blades, damaged door locks, missing keys, missing hinges, as well as loose screws and bolts on doors.

4.4 Causes of Maintenance Problems in Public Buildings

Government since independence have put up buildings for use by public institutions. Some of these properties even date back to the colonial administration. Public institutions are therefore expected to have the natural tendency to preserve, protect and maintain these properties. This is however not the case as revealed by this study. Respondents listed five factors as having combined to create the maintenance problems in public institutions:

1. The age of the buildings,
2. Lack of maintenance culture,
3. Inadequate funds and high maintenance cost,
4. Pressure on building facilities by number of users and

5. Poor construction work and maintenance work done by maintenance personnel of the institution.

4.4.1 Age of the buildings

From the survey, only 22.2 percent of bungalows of the GPS are below 20 years. All the other house types of tenement and single-units are over 50 years, indicating that approximately 97 percent of all GPS buildings are over 50 years. The UEW-K has 25 percent and 100 percent of bungalows and tenement respectively surveyed below 20years, while all its single-unit buildings are above 50 years. While the ages of all buildings of the GHS nurses quarters surveyed are between 6 years and 55 years.

Houses deteriorate with age, since the lifespan of most buildings are constructed to last at least sixty (60) years, but may exceed this period if the building is well maintained over time. Above 60 years most houses exhibit serious maintenance problems which will demand at least major renovation, rehabilitation, replacement or repair. The present state of the public buildings in fair and bad state surveyed has been attributed to the age of the buildings since they are over 50 years.

4.4.2 Lack of Maintenance Culture

Respondents pointed out that the institutions after having acquired these property, authorities or management do not show much eagerness towards the maintenance of them. According to them, Estate and Maintenance Managers do not undertake regular inspection of the building to ascertain its condition neither do they undertake routine and periodic maintenance on the buildings. Respondents from the GHS and UEW-K indicated that even though they pay rent as a company policy for the building they occupy, external maintenance work which are to be carried out by the institution is either not done or takes a long time for reported complains to be attended to thus creating a lot of inconvenience and safety problems for occupants. In the case of the GPS, external maintenance must be carried out even though personnel of ranks below Assistant Superintendent of Police do not pay rent. Expressing their views on lack of maintenance culture by the institutions, 3.4 percent of the respondents from UEW-K had this to say; “all that they do about our buildings is to bring in labourers to weed around the compound at regular intervals to the neglect of the building ‘proper’ ”.

In situations when maintenance request are put in by occupants according to the policy of the institutions, 48.9 percent of respondents responded that their request had not received any attention over 2 years after submitting them. However, 20.5 percent, 15.9 percent and 14.8 percent responded that maintenance request takes between 1-3months, 6-12months and over 12months to receive attention. Ironically, maintenance request are prompt in the case of occupants of bungalows and tenement house types as against those of the single-unit occupants. In short, negligence on the part of public officers in maintaining buildings all point to the fact that maintenance culture is very poor.

4.4.3 Inadequate Funds and High Maintenance Cost

Personnel occupying public buildings have contributed to the deterioration of the buildings citing lack or inadequate funds and high maintenance cost resulting from high cost of building materials as the main reason. Discussions with respondents in single-unit houses where poor maintenance has resulted in deterioration of facilities and elements of the buildings revealed that poor condition of service in terms of low salaries is the major cause of their inability to play their role in the maintenance of the building. There was however people living in poorly maintained building with respect to bungalows and tenement whose income defies this logic.

In addition to low remuneration, the survey also revealed that occupants' inability to maintain their buildings is being attributed to high cost of maintenance in respect of cost of materials such as cement, wood, paint, nails etc and labour. As a result of this, respondents felt reluctant to sacrifice or increase spending towards the proper maintenance of their building which at the end of the day creates a lot of problems for the occupants in terms of their comfort and safety. Moreover, what is less considered is that maintenance problems become more expensive when not attended to in time.

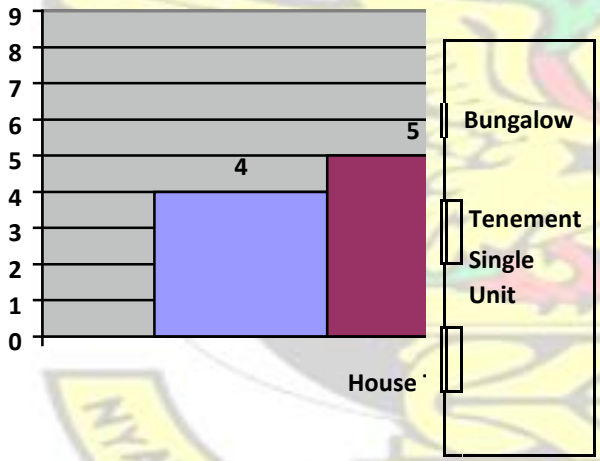
In spite of the above, respondents maintained that they contribute substantially to the external maintenance of the building else the maintenance situation would have been different. 39.8 percent of the respondents indicated that they spend less than GH¢ 100.00 annually on maintenance of their building. Those who spend GH¢101.00 – 200.00 and GH¢ 201.00 – 300.00 are 11.4 percent and 15.9 percent respectively. According to 23.9 percent of the respondents they cannot cost the amount they spend on maintenance of their building, while 9.1 percent revealed that they do not spend on

the external maintenance of the building since it is the responsibility of the institution which allocated them the building to do that.

4.4.4 Pressure on building facilities by number of users

The number of people occupying or living in a house is also seen to have a bearing on the maintenance conditions. Generally, the higher the number of people in a house, the more there is pressure on the use of facilities which are in common use such as water, bathrooms, toilet, and kitchen facilities. From the survey, it came out maintenance seems to suffer especially with single unit houses where the above facilities are shared between two housing units. In some cases the large number of occupants living in this house type breeds apathy and competition which all go to affect maintenance practice. Table 4.10 shows the average number of occupants in a building by house type

Figure 4.1 The Average Number of People by House Type



Source: Author's Field Survey, May 2010.

Table 4.11 The Average number of People by House Type

House Type	Average No of people per House	Housing Condition							
		Good		Fair		Bad		Total	
Bungalow	4	6	15.0	32	80.0	2	5.0	40	100
Tenement	5	6	37.5	4	25.0	6	37.5	16	100

Single-Unit	8	18	15.0	44	36.7	58	48.3	120	100
Total		30	17.0	80	45.5	66	37.5	176	100

Source: Author's Field Survey, May 2010

According to the data, only 15.0 percent of single-unit houses are in good condition against 37.5 percent and 15.0 percent for tenement and bungalows where the number of persons per building is low. Again whereas bungalows had only 5.0 percent of houses in poor condition, single unit houses had 48.3 percent. This gives credence to the effect of population pressure on maintenance.

4.4.5 Poor Construction and Maintenance Work done by Maintenance Personnel of the Institution.

Complaints of structural defects and breakdown of building facilities in tenement house built less than 10 years ago as revealed by occupants according to the study, bring to the fore the problem of poor construction work done in some public institutions. This leaves the institutions with a vast maintenance problem. Poor construction work is seen to emanate from the use of poor quality materials and poor supervision. Observations during the survey confirm this with regard to poor quality doors, locks and electrical fittings, poor work done on floors and the wall which has resulted in cracks and peel-off. Poor work on the roof and the drains resulting in leakage were also observed. The implication for this situation is that maintenance should not be thought of only after construction but also during construction.

This means that maintenance work is required to rectify failures caused by incorrect design, poor construction, incorrect installation or the use of faulty or inferior material or bad workmanship. Therefore the cost of and means to maintain the building must inform architectural designs, the materials used and all construction activities.

Some respondents also complained of poor maintenance work done by the maintenance department due to lack of supervision. This according to them compounds the problem or results in the reoccurrence of the problem in no time. This sometimes compels them to call in private artisans at additional cost to the occupant to rectify the maintenance problem.

4.5 Maintenance Policy and Practices of Public Institutions

Ghana at present has no National Maintenance Policy to regulate or control preventive maintenance of buildings of public institutions. However, the survey revealed that the Estate and Workshop departments of the institutions in consultation with the Building Management Committee (BMC) have developed maintenance policy to ensure that there is regular maintenance of buildings allocated to personnel. The maintenance policy of the institutions does not however take care of preventive maintenance which is a regularly scheduled inspection, testing, and repair of building components intended to prolong a building's life and restore components' efficiency.

The institutions adopt a centralized approach in handling preventive maintenance. This responsibility for building maintenance rests largely with one office i.e. the Estate and Maintenance office that oversees maintenance for most or all buildings owned by the institution.

The institutions are responsible for the external maintenance of the buildings including: painting, replacement of wooden members and net, roof, electricity, sewerage, and plumbing. Occupants on the other hand are responsible for the internal maintenance of the building such as:

I. Replacement of all burnt-out bulbs, lost keys or locks and broken louver blades.
II. Keeping service or institutional properties and the surrounding thereof in good sanitary condition, by weeding around and disposing off refuse regularly to avoid any nuisance.
III. Fumigation of the internal portions of dwelling units to get rid of ants, mosquitoes, cockroaches, flies etc.
IV. Occupants not causing or permitting anything to be done to their dwelling units which will alter the external walls or allow any renovation to be done to any part of the premises without the written consent of the institution.

4.5.1 Mode of Access to the Building and its Maintenance

The buildings are allocated to the personnel by the Estate Officer in consultation with the accommodation committee. The Estate department is to ensure that an inventory of the building is taken and signed by both the officer and the would-be occupant. Similarly this procedure must be followed before occupant vacates the building. The

study revealed on the contrary that occupants take occupancy of the building without signing any inventory form. This has arisen largely because of the urgency with which personnel move in to take over the building on retirement or transfer of previous occupant without recourse to the laid down rules. In the case of the GPS respondents claimed they take over the accommodation of their relievers after service vehicle have brought them in without necessarily consulting the Estate Department. This development makes it difficult for the institutions to surcharge occupants who refuse to undertake internal maintenance of their building for the period of their occupancy.

All defects arising out of wear and tear are to be reported to the Estate Department which is responsible for making good such defects. The study revealed that the Estate Department does not plan building inspection but rely on report of maintenance needs by occupants to act. This process the survey observed has not been an effective way of drawing a maintenance program for the buildings since approximately 79% of respondent claimed that the bureaucratic reporting process prevents them from reporting maintenance needs of their building unless in emergency situations such ripping off of roof, emptying of septic tanks and major electrical faults.

4.5.2 Funding of Maintenance Activities of Public Institutions

Because maintenance includes daily maintenance, minor repairs, and major system replacement requiring huge capital outlay, public institutions rely on central government funds to cover maintenance expenses. This is captured in General Maintenance and Repair Fund and included in their annual budget submitted to the government. But in the situation of UEW-K, the fund is supplemented with part of internally generated fund since money released into the fund by central government is woefully inadequate to meet maintenance needs of the building. This, from the survey, results in deferred maintenance on public buildings.

The survey revealed that personnel occupying public buildings are charged rent based on government rent policy which currently is 10 percent of gross salary. The situation is however different in the case of the GPS where only senior officers from the rank of ASP to Commissioner do pay rent on their bungalows. The rent paid on public buildings is not paid into the institutions account but rather to the Consolidated Accounts of the government.

4.5.3 Staffing Preventive Maintenance Programs

To perform preventive maintenance, public institutions rely both on their own inhouse public employees and on private maintenance services hired on a temporary, contract basis. For maintenance and repair that require special equipment or expertise, such as ultrasonic noise testing to identify arcing in electrical equipment, public institutions often turn to private firms instead of retaining those tools or skills on staff. They also contract for services when they find it inefficient to employ fulltime personnel for infrequent tasks or when they need additional help for special projects or maintenance backlogs.

Maintenance Staffing of GPS

Personnel	Qualification	No. of Personnel
Estate Officer	B.Sc (Estate Management)	1
Workshop Officer	B.Sc (Admin) HR	1
Mason	NVTI Grade II	8
Carpenters	NVTI Grade II	7
Painters	NVTI Grade II	6
Electricians	NVTI Grade II	3
Plumbers	NVTI Grade II	4
Total		30

Source: Author's Field Survey, May 2010.

Maintenance Staffing of UEW-K

Personnel	Qualification	No. of Personnel
Estate Manager	M.Sc (Const. Mgt)	1
Maintenance Officer	B. Tech	1
Carpenters	Foreman/Grade I	2
Plumbers	Foreman/Grade II	2
Electricians	Grade I/Grade II	2
Painter	Grade II	1
Masons	Grade I/Grade II	2
Total		11

Source: Author's Field Survey, May 2010.

Maintenance Staffing of GHS

Personnel	Qualification	No. of Personnel
Estate Manager	M.Sc (Const. Mgt)	1
Carpenters	Master Apprentice	1
Plumbers	On-the-job training	2
Electricians	On-the-job training	2
Total		6

Source: Author's Field Survey, May 2010.

Interview with Estate Officers indicated that staff capability is one of the major problems inhibiting effective maintenance of public buildings. In addition to inadequate staffing, lack of training to enhance the skills of the artisans was also cited. The department emphasizes training for employees because it believes that professionally managed operations and running building systems efficiently require high levels of training to maintain workers' expertise.

4.6 Views of Key Actors on the Causes of Maintenance Problem of Public Institutions

Views of the key actors in housing i.e. State Housing Company, Public Works Department and Estate Officers were sought on the causes of the maintenance problem. 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, inadequacy of funds and high cost of maintenance and capacity of maintenance personnel.

Interviews and discussions with the above stakeholders point to the fact that government in a bid to see to the welfare of workers and enhance their efficiency provide accommodation for public institutions to avoid the situation where private landlords continuously charge exorbitant rents to the detriment of public workers whose salaries are nothing to write home about. However once these buildings are built, government desire to acquire or build more houses overshadows its role of maintaining these already existing ones thus, leading most of them, into a state of deterioration and in some instances disrepair, calling for outright demolition. Again because new construction often receives more attention than ongoing building maintenance, the government may find it difficult to draw adequate attention to maintenance needs. This they indicated is evident in the absence of a government

policy on maintenance of public buildings in the country at the moment and that managers of public institutions have contributed to the situation by not advocating for preventive maintenance as a high priority.

Secondly, apathy and ignorance of maintenance responsibility on the part of occupants has also played a major part in the current maintenance problems of public buildings. Occupants refuse to undertake internal maintenance as directed by the maintenance policy of the institutions holding the view that once the buildings are owned by the state, its deterioration is none of their business. Some respondents exhibited their ignorance of maintenance responsibility by the neglect of desilting choked gutters, cleaning dirty floors and clearing bushy surrounding. In this entire situation the study observed that the lack of enforcement of the policy has resulted in the present situation public buildings are in.

In addition, stakeholders also attributed poor maintenance to lack and inadequacy of funds for maintenance purposes as well as high maintenance cost. According to the actors government funding of activities of public institutions have been dwindling over the years thus making it difficult for managers of public institutions to set aside adequate funds for maintenance of their building. This has led to the situation of deferred preventive maintenance that can generate higher costs over the long term. “The high cost of maintenance attributable to high cost of materials such as cement, paint, wood, nails etc is also not helping matters”, one stakeholder added.

Finally, the capacity of the maintenance unit in terms of its personnel who are entrusted with the responsibility of carrying out maintenance works on public buildings is low in terms of expertise and number. This has led to most public institutions relying on private maintenance companies for their maintenance works which goes to increase the cost of maintenance due to the profit motive of these firms. This situation according to the PWD has arisen because it is no longer responsible for carrying out maintenance works and putting up of new buildings in most public institutions including those for the study. In the view of the PWD government will be making a lot of savings if it is given that responsibility with its level of expertise and non profit motive. Quality of work is also assured, they added.

In conclusion, stakeholders argued that government should take a second look at its rent policy to reflect current economic realities. They argued that the current rates which were set some thirty years ago cannot sustain the maintenance of the building. The management of the rent should also be left in the hands of managers of public institutions in addition to creating a maintenance budget. Presently rents are paid into the consolidated accounts but institutions are to undertake maintenance from their annual budgets which put pressure on them. There is also the need to improve the conditions of service of public officers in a bid to enhance the maintenance culture in public institutions so as to enhance the image of public buildings in the country.

CHAPTER FIVE

KEY FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

This chapter highlights and discusses the key findings from the study. The various issues analysed in the foregoing chapters have provided critical insights into the

nature, causes and effects of the maintenance problems of public residential buildings. This insight has informed the recommendations of the study on how the maintenance problems could be effectively addressed. For easy appreciation the key findings have been itemized under appropriate sub-headings.

5.2 Summary of Key Findings of the Study

5.2.1 Availability and Condition of Facilities in Public Buildings.

The study established that:

All residential facilities of public institutions surveyed have all the necessary facilities necessary to make a house, a home for man. Bungalows and tenement houses have these facilities within the building and used by individual household, while in the case of single unit houses these facilities are detached from the main building and are shared by two households.

The majority of houses surveyed are old buildings (84.1 percent), with only 9.1 percent and 6.8 percent being recent and medium aged buildings respectively. Buildings of the GPS were much older (97.1 percent), with only 2.9 percent being younger buildings. In the case of GHS, 85.7 percent and 14.3 percent of its buildings are younger and medium-aged respectively, with the UEW-K having 38.5 percent and 61.5 percent of its buildings being younger and older respectively.

Generally, condition of facilities (toilet, bathroom, kitchen, water and electricity) in public buildings was fairly good regarding its usability. Toilet facility in good and fair condition was 85.2 percent, with electricity (80.7 percent), water (75 percent), bathroom (73.9 percent) and kitchen (71.6 percent) in the same condition. Among the institutions, GPS had its kitchen facility in worst condition 30.8 percent, followed by bathroom (23.5 percent) and electricity (22.1 percent). The UEW-K has water facility as its major problem with 92.3 percent in bad condition, followed by bathroom (46.2 percent) and kitchen (30.8 percent). Facilities in GHS were relatively in better condition with 85.7 percent of all its facilities surveyed in good and fair condition.

In terms of house types, toilet facility for tenement houses was in the best of condition with all toilets being in good and fair condition. Water facility was poor in tenement (75 percent) and bungalows (25 percent). Single unit houses have the worst of

condition in terms of available facilities. Most affected facilities are kitchen, bathroom and electricity. This has been attributed to the pressure on the facilities due to the number of users as well as the limited attention given to maintenance by personnel with the explanation that their income is too meager for them to undertake any meaningful maintenance and therefore look up to the institutions to do that.

5.2.2 Condition of Building Elements

General

Among all the building elements of the houses surveyed, painting, wall, windows and doors, the roof, the foundation and the floor had the most maintenance problems whilst the roof had the least of problems. About 90 percent of painting, 78 percent of walls, 61 percent of windows and doors, 55 percent of foundation and floor and 42 percent of all roofs had problems.

The most prevalent maintenance problems are cracks in walls, faded painting, partly broken windows and doors, exposed foundation and leaking roofs affecting 42 percent, 39.8 percent, 38.6 percent, 30.7 percent and 19.3 percent of residential buildings of the three institutions surveyed.

Foundation

The institutions with the worst foundation problem were the GPS and UEW-K with approximately 40 percent of their foundation exposed and hanging. 28.6 percent of GHS buildings had a similar problem.

Single Unit houses had the most foundation problem with 38.3 percent of foundations exposed and hanging.

Roof

Leaking roof was most pronounced in the GHS with 42.9 percent of its building with roofs leaking. However, 17.6 percent and 15.4 percent of roofs of GPS and UEW-K had the same problem.

In the building types, tenement houses suffer the most with 25 percent of buildings in tenement having leaking roofs. Leaking roof problem for bungalows and single unit houses was 20 percent and 18.3 percent. Leaking roof has resulted in damage to building materials or furnishings. It is a prime source of microbial contamination that affects indoor air, posing health risks.

Floor

About 54.5 percent of the buildings have problems with their floors. They main problems associated with the floors are development of cracks resulting in some situation indentation of the floor and peel offs. The problem of cracks is most pronounced in bungalows (35 percent), whilst 37.5 percent of tenement houses had their floor peeled off.

Cracks in the floor affected 42.8 percent of all GHS buildings surveyed, with peel off affecting 30.8 percent of UEW-K buildings.

Wall

Cracking is the major problem affecting walls with 42 percent of buildings of public institutions having developed cracks. Peel offs and partly broken down walls are the other problems affecting 21.6 percent and 14.8 percent of all buildings surveyed.

GPS had the most of wall problem with 48.5 percent of buildings developing cracks. Tenement houses have the worst wall problems with about 88 percent having problems with the wall (46.7 percent cracks, 31.7 percent peel offs and 10 percent partly broken down).

Painting

Painting protects walls as well as serving aesthetic purpose, but as high as 89.8 percent of all buildings surveyed had problem with painting. The problem of painting is more pronounced in buildings of UEW-K and GPS where 92.3 percent and 91.2 percent of all their buildings surveyed being dirty, faded, and no painting.

The problem of painting is most prominent in single unit houses and least in tenement houses affecting 75 percent, 85 percent and 93.3 percent of all tenement, bungalows and single unit buildings respectively.

Windows and Doors

The major problems with the wooden members of the buildings surveyed are that they are either partly or completely broken down as a result of the wooden members being rotten due to penetration of water resulting from lack of coating and poorly treated wood. The problem of wooden members is most prominent in buildings of UEW-K and least in GHS. It has accounted for 69.2 percent, 44.7 percent and 14.3 percent of buildings of UEW-K, GPS and GHS surveyed respectively.

In the house types, the problem is most prominent in single unit houses affecting 72.7 percent of all surveyed single unit houses. However bungalows have the most completely broken down windows and doors.

5.2.3 General Building Conditions

On the whole, 83 percent of all residential buildings of public institutions surveyed have maintenance problems. Maintenance problem is more prominent in GPS and UEW-K with 41.2 percent and 30.8 percent of their buildings in a bad condition, with 14.3 percent of those of GHS in the same situation.

Building maintenance problems are more pronounced in single unit houses than tenement houses and bungalows with 48.4 percent, 37.5 percent and 5 percent respectively in bad condition. However, tenement houses had the highest buildings with good condition, with 37.5 percent of all tenement houses surveyed in good condition requiring the least or no maintenance.

5.2.4 Causes of Maintenance Problems in Public Buildings

I. From the study, the major causes of poorly maintained public buildings include the following:

II. The age of buildings of public institutions. Houses deteriorate with age, with buildings between the ages of fifty and sixty and above exhibiting serious maintenance problems and thus requiring replacement of some building elements or at least rehabilitation. Houses surveyed were classified into younger buildings (less than 20 years old), medium aged buildings (20-50 years old) and older buildings (above 50 years old). About 84.1% of all

buildings surveyed were older buildings above 50 years. All these houses were in fair and bad condition and required maintenance.

III. There is generally lack of maintenance culture on the part of both the institutions and the occupants, thus resulting in deferred maintenance of buildings by public institutions. This situation is also evident in the lack of preventive maintenance plan by public institutions for their buildings. Occupants also exhibit apathy towards maintaining their buildings holding the view that it is a government property and that whatever the state is no business of theirs.

IV. There is also the problem of over-centralisation of maintenance decisions. Maintenance decisions and building management are taken at the management level at the headquarters and the regional office of the institutions surveyed. The channels through which decisions are brought to the local level are in most cases, too long resulting in the delay of release of funds for maintenance. These bureaucratic processes also affect the reporting of maintenance problems by personnel, since some occupants have failed to report maintenance problems citing this bureaucratic process as a hindrance.

V. Another obstacle to maintenance of public buildings is funding. Inadequate funds and delays in the release of funds have contributed significantly to the present state of public buildings. This has been worsened by the high cost of building materials, new constructions which often receives more attention than ongoing building maintenance projects and high cost of maintenance resulting from works done by private firms due the low capacity of maintenance staff to undertake such tasks.

VI. There is also pressure on building facilities by number of users. There is inverse relation between population density and the quality of housing conditions. Houses with fewer people had better conditions as against those with large number of occupants.

VII. There is lack of effective national maintenance policy, laws and regulations to compel both managers of public institutions and occupants to undertake maintenance failure of which sanctions can be applied.

5.3 Recommendations

The following are recommendations as a way of dealing with maintenance problems of public institutions housing in Ghana:

I. There is the need for public institutions to embrace preventive maintenance practice as a high priority rather than adhoc maintenance. To gain optimum benefits from preventive maintenance, building managers should incorporate preventive maintenance tasks into a work-order system and keep systematic maintenance records, either by computer or manually. Managers should evaluate the preventive maintenance program to improve it over time.

II. Public institutions should ensure that their maintenance department is adequately staffed with the requisite manpower and that employees have appropriate training to competently and safely undertake and complete the maintenance tasks expected of them.

III. Estate and maintenance managers should oversee periodic inspections of buildings' conditions and create an inventory of buildings' components and equipment. They should plan building inspection, since proper planning of inspection is a sure way to reduce cost of maintenance since doing so can provide insight into future maintenance needs and avoid unnecessary costs.

IV. There should be a state regulation to affect state maintenance of specific building systems. A state building and maintenance code should govern building construction and remodeling. It should also affect accessibility, electricity, energy, fire protection, plumbing and other mechanical components such as elevators. In addition, a National Maintenance Policy should be formulated as part of the National Housing Policy to compel people to undertake maintenance on the buildings they occupy to avoid the situation where huge sums of taxpayers' money go down the drain through deterioration of public buildings due to lack of maintenance.

V. There is the need for institution of a maintenance awards scheme for public institutions at the National, Regional and District levels to award institutions that have effectively managed maintenance of their buildings. This will demand that taskforce from the Ministry of Water Resources Works and Housing periodically inspects the condition of building components of public buildings.

VI. Mangers of public institutions should ensure that high quality and durable building materials are used to prolong its life span and minimize the rate of deterioration. Current building designs should also incorporate materials with least maintenance problems, for instance tiling of high rise buildings will solve the problem of painting due to the height of the building. Aesthetic value of new buildings should also be taken into consideration to serve as tourist attraction.

VII. The PWD should be given the mandate to develop a systematic programme of maintaining public buildings since they have the necessary human resource capacity. This will reduce the total cost of maintenance in relation to employing private contractors. The effectiveness of this recommendation will depend on the level of supervision because of the history behind the attitude of employees of such institutions.

VIII. Estate and Maintenance managers should develop a multiple-level education strategy to address the differing information needs of their various levels of employees in terms of maintenance of building. This should include safety and health implications about lack of maintenance e.g. food poisoning resulting from falling paint particles or scraps and indoor air quality.

IX. Occupants of government buildings should also shed off their apathy in terms of ownership and maintenance of such property and rather exhibit high sense of patriotism. This can be done through public education and sensitization and strict application of sanctions such surcharging occupants with cost of damage caused as well as eviction from the premises.

X. There is the need for government to set up a maintenance budget from which all maintenance activities will be drawn. There is the need to set up a National Maintenance Fund similar to that of the Road Fund to mobilize adequate funds to meet maintenance needs of public institutions. In addition, there is the need for the review of the current rents paid by tenant of public buildings to reflect current economic trends and to generate enough funds to undertake maintenance works on these buildings. Improving the conditions of service of public employees will also ensure that tenants are able to do their own maintenance on the buildings.

XI. Finally there is the need for government to put up more public residential buildings in view of the present national deficit in housing which stand at one million(http/www.ghanaweb.com). This housing deficit has resulted in competition for rental housing. Landlords however prefer to rent out their premises to private individuals instead of public officials due to the high rent charged. There is however, the need for regular maintenance of public building put up to protect the huge investment put into it. Building maintenance which is a shared responsibility must be the prime focus for both the occupant and the government (Managers of public institutions).

5.4 Conclusion

The study has established that housing maintenance is a real problem among public institutions in Ghana, with about 83 percent of all residential buildings of public institutions surveyed having maintenance problems. Maintenance problem is more prominent in GPS and UEW-K with 41.2 percent and 30.8 percent of their buildings in a bad condition, with 14.3 percent of those of GHS in the same situation.

Building maintenance problems are more pronounced in single unit houses than tenement houses and bungalows with 48.4 percent, 37.5 percent and 5 percent respectively in bad condition. This has come about as a result of two main factors: Pressure on the single unit buildings due to large number of occupants and preference to the maintenance of bungalows and flats except in emergency situations because the bungalows and the flats are occupied by senior and middle level management respectively while that of the single units are occupied by the lower level personnel.

In addition maintenance culture is relatively higher among occupants of bungalows and tenement buildings than single unit occupant due the differential in income level.

The most widespread maintenance problem according to the study are cracks in walls, faded painting, partly broken windows and doors, exposed foundation and leaking roofs affecting 42 percent, 39.8 percent, 38.6 percent, 30.7 percent and 19.3 percent of residential buildings of the three institutions surveyed.

The maintenance problems the study observed have been influenced by the age of the buildings, lack or absence of a national maintenance policy, inadequate funds and high cost of maintenance, low capacity of maintenance staff, apathy and lack of patriotism on the part of occupants, pressure on buildings due to the number of users among others.

The study concludes by enumerating a number of recommendations aimed at addressing the problem of poor maintenance of public buildings in the country. It is hoped that these recommendations if implemented will contribute in no small way in reducing the maintenance problem plaguing the public sector in the country at the moment.

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APPENDIX 1

PHOTOGRAPHS OF MAINTENANCE PROBLEMS OF PUBLIC BUILDINGS

Floor- peeled-off

Crack on Wall

Cracks on Floor

Painting: Dirty Wall

Concrete Roof Peel-off

Roof: Leakage

Wall: Partly Broken Down

Foundation: Exposed/Hanging

Electricity: Exposed Cables

APPENDIX II: QUESTIONNAIRES FOR PUBLIC INSTITUTIONS

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ARCHITECTURE AND PLANNING
FACULTY OF PLANNING AND LAND ECONOMY
DEPARTMENT OF PLANNING

The series of questions in this questionnaire are designed to obtain organizational response on maintenance of public buildings.

Please, answer the questions that follow by ticking the appropriate option (if provided) or writing unrestrictedly for open-ended questions. Please answer all questions freely but objectively.

The information is for academic purposes only and will be treated with the strictest confidentiality.

Thank You

Prince Jude Cobbinah
(M.Sc Dev't Policy and Planning, KNUST)

Maintenance of Building

To be answered by occupants/personnel occupying public buildings:

Name of Institution…….

Building Type of Occupant (Bungalow/Tenement/Single Unit)

1. How long have you stayed in the building? ……
2. How many people occupy this building? ……..
3. Did you take inventory of the state and facilities in the building before taking occupancy? Yes [ ] No [ ] Please assign reason(s) for your response

   ……
   ……
   ……
4. Do you pay any rent for occupying the building? Yes [ ] No [ ].
5. If yes how much do you pay?
6. If no please attempt an explanation for non-payment of rent

   …….....
7. Does your institution undertake regular inspection of the building? Yes [ ] No [ ] Please give reason for your answer

   …….....
8. Does the maintenance/estate department come in to do maintenance work on the building without request? [ ] Yes [ ] No
9. If yes, when is it done? [ ] Quarterly [ ] Annually [ ] Biannually [ ] other (please specify)

   …….....
10. Who is responsible for the maintenance of the building? Self [ ] Institution [ ] PWD [ ] other please specify

……..

11. How long does it take for maintenance request to be responded to? [ ] less than a month [[ ] 1-3 months [ ] 6-12 months [ ] More than 12 months [ ] other please specify
12. In your opinion is the building well maintained? [ ] Yes [ ] No. please give reason(s) for your answer

……

……

13. Please indicate in your opinion the reasons/factors responsible for the present state of your building

……

……

……

14. How does the current state of your building affect your stay/life in the building?

.....

.....

.....

15. What role do you play in the maintenance of your building?

.....

.....

.....

16. How much do you spend annually if any on maintenance of your building?

.....

.....

General Maintenance of Building Elements

Please tick appropriately how you consider the state of the following elements of your building.

17. Condition of the foundation [ ] cracks developed [ ] exposed/ hanging [ ] weak [ ] no problem

18. Roof [ ] leakage [ ] rusty [ ] partly ripped off [ ] completely ripped off [ ] No problem
19. Floor screed [ ] cracks [ ] peeled-off defect [ ] no defect
20. Wall [ ] partly broken down [ ] develop cracks [ ] peel – off [ ] tilted
21. Painting [ ] no painting [ ] faded painting [ ] dirty [ ] well painted/no problem
22. Windows and Doors [ ] no problem [ ] partly broken down [ ] completely broken down
23. Electrical installations [ ] no problem [ ] non functioning [ ] faulty
24. Plumbing/water [ ] no problem [ ] leaking [ ] broken down
25. What type of toilet facility do you use? Water closet [ ] KVIP [ ] Pan Latrine [ ] other please specify
26. Toilet /Sewerage [ ] no problem [ ] leaking [ ] broken down [ ] non functioning
27. Kitchen [ ] well ventilated [ ] poorly ventilated [ ] No ventilation. Please describe the condition of the kitchen in reference to No. 1- 9 above.
28. Conditions of the facilities

Please how do you consider the conditions of these facilities in the building? Tick appropriately.

Facility	Good	Fairly Good	Bad
Water			
Bath			
Toilet			
kitchen			
Electricity			

Major Cause of Non Maintenance of public building

29. How will you rank the following as the major cause of non maintenance of public building if it is so? Please rank from 1st to 7th, with first being the major reason and seventh being the least reason.

Causes of maintenance problem	**Rank**
Lack of maintenance culture	

Inadequate funds	
Bureaucratic reporting process	
Pressure on facility/building due to number of occupants	
Poor work done on building	
Non response to maintenance request	

30. How will classify the general condition of your building? [ ] good [ ] fairly good [ ] bad [ ] very bad

APPENDIX III: INTERVIEW SCHEDULE FOR ESTATE/WORKSHOP PERSONNEL

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ARCHITECTURE AND PLANNING
FACULTY OF PLANNING AND LAND ECONOMY
DEPARTMENT OF PLANNING

The series of questions in this questionnaire are designed to obtain organizational responses on maintenance of public buildings.

Please, answer the questions that follow by ticking the appropriate option (if provided) or writing unrestrictedly for open-ended questions. Please answer all questions freely but objectively.

The information is for academic purposes only and will be treated with the strictest confidentiality.

Thank You

Prince Jude Cobbinah

(M.Sc Dev't Policy and Planning-KNUST)

MAINTENANCE OF BUILDINGS OF PUBLIC INSTITUTIONS Name of Institution**……..**

1. What is your position, job description/qualification, please?

……

……

2. What are the ages of your buildings?

……

……

3. How will classify your buildings according to the period of existence as to whether they are old (above 50 years), medium aged (20-50years) or young building (below 20years)?

……

……

4. Are occupants charged for their occupancy of the building?

……

5. If yes, then how much rent is charged?

……

……

6. With reference to the above, who determines the rent payable?

.....

.....

7. Does your institution have a maintenance policy?

……

8. If yes, who developed the policy?

……...

9. What type of maintenance arrangement do you have in place? Periodic ☐

Routine ☐ None Preventive ☐

Other please specify

……

……

10. Who is responsible for the allocation of buildings?

.....

.....

11. Do you inspect the building to determine its maintenance needs? If yes how often and if no please assign reasons.

.....

.....

.....

12. Who is ultimately responsible for the maintenance of the residential building?

    Personnel ☐ institution ☐ PWD ☐

    Other please specify

    ……

    ……

13. What is the responsibility/role of the occupants towards the maintenance of the building?

    .....

    .....

    .....

14. How is request for maintenance by occupants on their building handled by your department?

    .....

    .....

    .....

15. Does the estate/maintenance dep't undertake regular inspection of the building?

    YES ☐ NO ☐

    Please give reasons for your answer

    ……

    ……

16. Does the institution take inventory of the state of the building on occupancy of new tenant/personnel?

    .....

    ……

17. How does the institution treat any incidence of negligence in maintenance of the building when a tenant is moving out?

    .....

    .....

    .....

18. How is maintenance funded?

    IGF ☐ Rent payment ☐ Surcharging ☐ Government budgetary allocation. ☐

    Others please specify

……

……

19. What necessitates the carrying out of maintenance on the buildings?

    Upon inspection ☐ upon request ☐ upon occupancy of new ☐ personnel.

    Other (Specify)

    ……

    ……

20. How long does it take to respond to maintenance request/needs of personnel?

    ……

    ……

21. Do technicians and managers receive training to conduct the condition assessments of the buildings?

    Yes ☐ No ☐

22. Does the institution have a written long-range plan for building maintenance and repairs that extends out a minimum of three to five years? Yes ☐ No ☐

23. Does the institution have a written long-range plan for building maintenance that contains an inventory of all buildings' components and systems, their condition and estimates of their expected remaining useful life?

    Yes ☐ No ☐

24. How well are you equipped in terms of personnel and equipment for the maintenance task confronting the institution?

Personnel/Artisans e.g. masons etc	Qualification	Number of Artisans

25. Is there a plan to reduce deferred maintenance that includes a list of major deferred maintenance projects ranked by level of severity and urgency? Yes No ☐
26. What factors in your opinion are impeding the effective maintenance of buildings in the institution?

    .....
27. Have building conditions in public institutions improved or stayed at acceptable levels from year to year? Yes ☐ No ☐
28. Does the government have an annual maintenance plan for the buildings as well as estimates for unscheduled repairs and maintenance works orders?

    Yes ☐ No ☐
29. How will you consider the current state of the buildings of the organization in terms of the following elements and facilities?

Element/Facility	Current State
Roof	
Foundation	
Wall	
Windows/Doors	
Painting	
Toilet	
Bathroom	
Kitchen	
Pipe/water	
Drains/gutter	
Electricity	

APPENDIX 4: INTERVIEW SCHEDULE FOR STATE HOUSING COMPANY (SHC)/ PUBLIC WORKS DEPARTMENT (PWD)

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ARCHITECTURE AND PLANNING
FACULTY OF PLANNING AND LAND ECONOMY
DEPARTMENT OF PLANNING

The series of questions in this interview schedule are designed to obtain organizational responses on maintenance of public buildings.

Please, answer the questions that follow by ticking the appropriate option (if provided) or writing unrestrictedly for open-ended questions. Please answer all questions freely but objectively.

The information is for academic purposes only and will be treated with the strictest confidentiality.

Thank You

Prince Jude Cobbinah

(M.Sc Dev't Policy and Planning-KNUST)

1. Name of your institution…….
2. Position of the interviewee……
3. What is the role of SHC/PWD in the provision of residential buildings or infrastructure for public institutions in Ghana?
4. What building types do you put up for public institutions?
5. What minimum facilities are required to be provided for these residential building to make it habitable?
6. What is the lifespan of these buildings put up?
7. How can the lifespan of the facility be extended or prolonged?
8. Please do you have a maintenance policy in place for the buildings put up for the institutions?
9. Which components of a building need regular attention and maintenance and why? Relate your response to the following elements and facilities: The roof, walls, windows/doors, courtyard, toilet, plumbing/water, kitchen, bathroom and electrical fitting.
10. What role does your institution play in fixing government rent?

11. How would you describe the current state of public building?
12. What reasons can be adduced for the deterioration of public buildings?
13. In what way(s) can the deterioration of public buildings be prevented?
14. Does the government have a maintenance manual used when performing preventive maintenance, managing emergency situations etc?
15. Do you have an annual maintenance plan for public buildings as well as estimates for unscheduled repair and maintenance work orders?
16. Does your institution keep acceptable levels of materials and spare parts to support timely repairs of public buildings?
17. Do you follow a quality assurance program that includes use of maintenance standards, monitoring, inspecting and evaluating completed works and developing corrective action plans?