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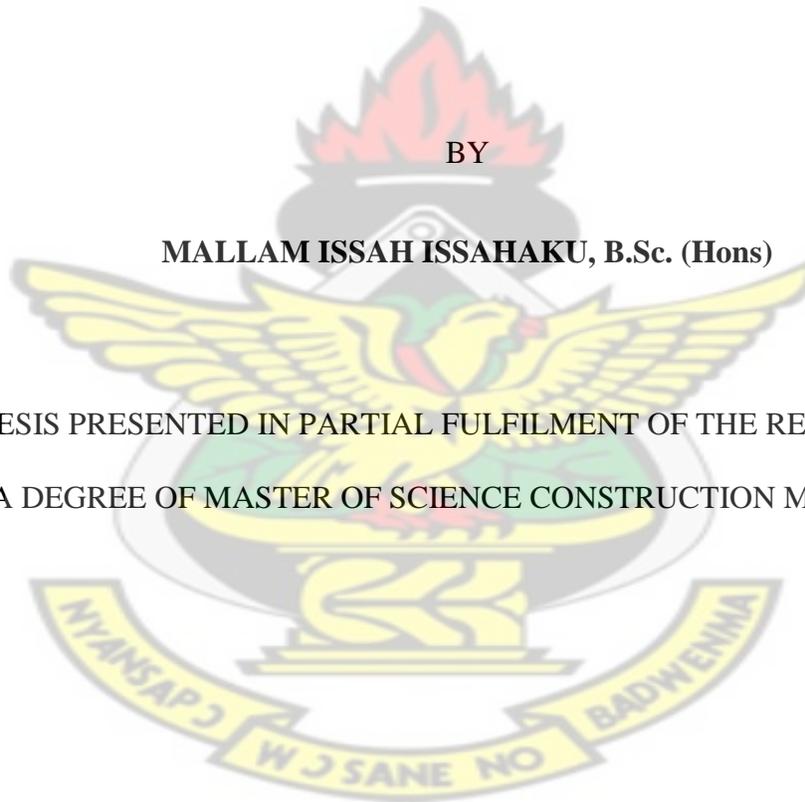
**DEPARTMENT OF BUILDING TECHNOLOGY**

**EVALUATION OF MAINTENANCE MANAGEMENT PRACTICES IN GHANA  
HIGHWAY AUTHORITY'S BUNGALOWS IN GREATER ACCRA REGION**

**BY**

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**A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR A DEGREE OF MASTER OF SCIENCE CONSTRUCTION MANAGEMENT**



**November, 2013**

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## DECLARATION

I hereby declare that this work is the result of my own original research and this thesis has neither in whole nor in part been prescribed by another degree elsewhere. References to other people's work have been duly cited.

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## ABSTRACT

Maintenance management practices continue to be a growing phenomenon in developing and developed countries. As the rate of usage of buildings also continue to grow, it has become necessary that maintenance management practices associated with building are critically evaluated and examined. Current practice indicated that most government buildings in Ghana are left unattended to without any maintenance practices. This study therefore, focuses on the evaluation of maintenance management practices in Ghana Highway Authority's bungalows in Greater Accra Region. It assessed the operational state of Ghana Highway Authority's bungalows, the factors affecting maintenance management of the bungalows and the maintenance management strategy used in maintaining bungalows. In achieving these objectives, opinions of maintenance officers and tenants were solicited. These officers were randomly selected and questionnaires administered to them. The data collected were analyzed using descriptive and one-sample t-test. The analysis revealed the operational state of bungalows in Accra as very bad. It was observed that there is no significant difference in the perception of the maintenance staff and users as to the operational state. However, there is significant difference in the operational state of the old and the new generation bungalows as the study revealed that the components and services of the buildings of the new generation bungalows are in better operational state than those of the old generation bungalows. Maintenance officers ranked attitude of users and misuse of facilities as the most significant factors affecting maintenance management of bungalows while users of the buildings ranked lack of discernable maintenance culture in the country as the most significant factor responsible for poor maintenance management practices of bungalows. The perception of the maintenance staff and users of bungalows as regards factors responsible for poor maintenance management of the bungalows are significantly different. The study recommended that, top management are to provide adequate funding for the running of maintenance operations and such funds should be properly monitored to ensure that it is judiciously utilized.

**Keywords:** Bungalows, Evaluation, Ghana Highway, Maintenance, Practices

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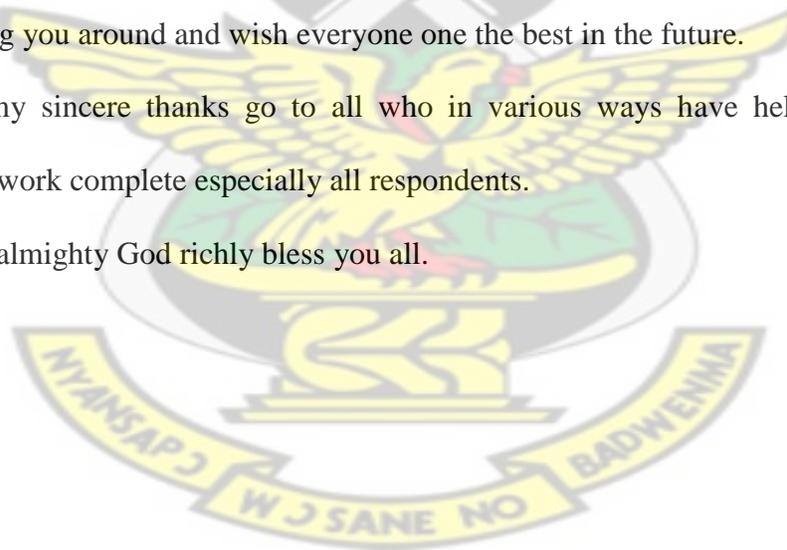
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May the almighty God richly bless you all.



## **DEDICATION**

This thesis is dedicated to my wife, **JAMILA IDDRISU KORAY** and child, **NUMBU**

**NADIEEM ISSAH**



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## CHAPTER ONE

### GENERAL INTRODUCTION

#### 1.1 BACKGROUND OF THE STUDY

One of the critical problems confronting the housing industry in Ghana is the poor maintenance practice (Afranie and Osei Tutu, 1999). Building maintenance is generally considered an unproductive operation by majority of individuals, organisations, institutions and governments. However, it remains one of the most neglected areas in terms of technology in both developed and developing countries (Bennel-Yinteman, 2008). It must be said that deterioration in buildings and other fixed equipment is inescapable; for this reason periodic attention is required to keep them in good state so that they can continue to perform their required functions and also sustain the level of utility and value derived from them.

In addition, varying intervals depending on the nature of the property and includes such works as repainting, replacement of slates and tiles, cleaning of drains and rain water disposal systems, more importantly, deterioration of buildings hampers their ability to effectively perform their required functions and accordingly it is important to ensure proper maintenance to circumvent or curb deterioration (Aha *et al* n.d). According to BS381 cited in Seeley (1985) stated that it is work undertaken in order to keep or restore every facility, that is every part of a building. British standard further explains that where there are statutory requirements for maintenance, the acceptable standard must be no less than that necessary to meet them.

However, an effective maintenance management practices might be characterized as the product of prudence, of the sentiment that ‘a stitch in time saves nine’ (Olajide, Adenuga, 2012). Good maintenance management systems are essential for economically viable and operationally safe buildings (Rapp and George, 1998). Historically, in both public and the private sectors, the maintenance is seen as an avoidable task which is perceived as adding little to the quality of the working environment, and expending scarce resources which would be better utilized. The financial consequences of neglecting maintenance is often not only seen in terms of reduced asset life and premature replacement but also in increased operating cost and waste of related and natural and financial resources (Banful, 2004). This is why property managers should give maintenance a high priority in their day to day activities (Lai *et al.*, 2009).

It is highly desirable but hardly feasible to produce buildings that are maintenance-free; therefore, occupants must be advised to adopt a productive maintenance practice approach towards their allotted properties as poor maintenance results in rapid increase in deterioration of the fabrics and finishes of these public sector buildings / bungalows. Hence, a study to evaluate the maintenance management practices of public sector buildings cannot be understated.

## **1.2 PROBLEM STATEMENT**

Poor building maintenance is widely regarded as the result of people’s apathetic attitude which may be referred to as a poor “maintenance culture” (Ghana News Agency, 2001). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) 1997 cited in Obeng-Odoom and Amedzro (2011), the problem of maintenance management practices plagues Africa as a whole the “African Poor

Maintenance Culture”. Perhaps this is why, in a BBC discussion titled “Is Africa’s architecture dying?” many of those who commented on the topic felt that the problem with Africa was not its architecture but its poor maintenance practice (BBC 2006 cited in Obeng-Odoom and Amedzro 2011). Similarly, the Ghana Highways Authority needs to adequately maintain its bungalows to prevent them from descending into a state of disrepair. Studies also show that, most researches are done to determine the factors responsible for the poor maintenance management practices public, private housing estates and offices in Ghana but with little attention to the evaluation of the maintenance management practices adopted in the implementation of maintenance programmes for Ghana Highway Authority’s bungalows. There is therefore a need to establish and evaluate the strategies for the maintenance management practice of Ghana Highway Authority’s bungalows.

### **1.3 RESEARCH QUESTIONS**

In order to evaluate the maintenance management practices of the Ghana Highway Authority’s bungalows in the Greater Accra Region, the following research questions were formulated;

- i. What are the current maintenance practices of Ghana Highways Authority owned bungalows?
- ii. What are the factors affecting maintenance management practices of Ghana Highway Authority’s bungalows in Accra?

#### **1.4 AIM AND OBJECTIVES**

The aim of the study is to evaluate the maintenance management practice of the Ghana Highway Authority's bungalows with a view to recommending most efficient maintenance management strategy. The research objectives also include:

- i. To examine the operational state (physical-functional condition) of Ghana Highway Authority bungalows in Accra as carried out by the maintenance department; and
- ii. To identify factors affecting maintenance management practices of Ghana Highway Authority's bungalows in Accra.

#### **1.5 SIGNIFICANCE OF THE STUDY**

This research work is important because not only would it be contributing to the body of knowledge and theory, but will also contribute to good maintenance management practice in the public institutions in Ghana, particularly the Ghana Highways Authority. It will also endeavor to investigate the factors that contributed to the current state of non-maintenance of some public bungalows, some of which have been abandoned due to its state of deterioration and proceed to recommend appropriate remedial actions to be taken. In addition the study will assist the management of the Ghana Highways Authority to become aware of the current state of their staff bungalows in the Greater Accra Region and its effect on the safety and health of its occupiers, and also to put in place adequate measures to prevent new bungalows put up to suffer decay which eventually leads to increased cost in restoring them to their original state.

## **1.6 SCOPE OF STUDY**

The study seeks to explore the maintenance management practices of the Ghana Highways Authority and its application. In addition, the researcher will consider in detail how these bungalows are managed and maintained by the organisation. The focus of research is limited to the Ghana Highway Authority's residential bungalows located in the Greater Accra Region.

## **1.7 RESEARCH METHODOLOGY**

Achieving the objectives of this research required conforming to logical and scientific processes and empirical investigations from the viewpoint of stakeholders. Information for this study was gathered as follows: firstly, use of books, technical journals and professional magazines and secondly, through questionnaires to consultants. Responses to the questionnaire were collected, collated and analyzed.

### **1.7.1 The Research Design**

Research design enables the researcher to ensure that the evidence obtained answer the objectives under investigation in a research, as unambiguously as possible (De Vaus, 2001). The data was analysed using quantitative analysis. Quantitative method, however, uses standardised instruments, so that the varying perspectives and experiences of people can fit a limited number of predetermined response categories, to which numbers, relative importance index etc. are assigned and measured statistically. Fellows *et al.* (2008) described several types of research, e.g. instrumental, descriptive, exploratory, explanatory, and interpretive. Descriptive research aims at identifying and recording a

phenomenon, process, or system and may be conducted using surveys (Fellows *et al.*, 2008).

### **1.7.2 Data Sources**

It has been mentioned earlier that multiple sources of information was collected to address the research goals. The researcher deliberately decided to use multiple sources of data because of the added benefits (such as the validity of the data gathered) associated with multiple sources was enough motivation (Owusu, *et al.*, 2007). The approach for collecting data in this study was divided into two main parts. The first discussed the desk survey and the second discussed the field survey. Applying desk review and fieldwork, this research adopted a quantitative approach of inquiry.

### **1.7.3 Desk Survey**

The desk survey (literature review) forms an essential aspect of the research since it sets the pace for the development of field survey instruments using questionnaires, and interview (Fadhley, 1991 and Owusu, 2008). Secondary sources of information was identified and collected in books, articles, technical journals and from databases. The secondary source of information for this research was collected from two sources; mainly internal and external sources.

### **1.7.4 Internal Secondary Sources**

These are published within companies or organizations, such as annual reports, information booklets, brochures, magazines, financial information memoranda, financial reports, plant and equipment registers. This type of internal secondary source of information for the research was collected from the selected consultancy firms.

### **1.7.5 External Secondary Sources**

Wahab (1996) described external secondary sources of data gathering as primary literature sources. Accordingly, they are the most accurate sources of information as it contains the original research. Alternative sources of external secondary sources of information include textbooks, technical journals, newspapers, magazines and internet sources.

### **1.7.6 Field Survey: Primary Data Source**

The field survey will be involved with the collection of empirical data. A single source approach of data gathering will be adopted for the purpose of this research (using questionnaires).

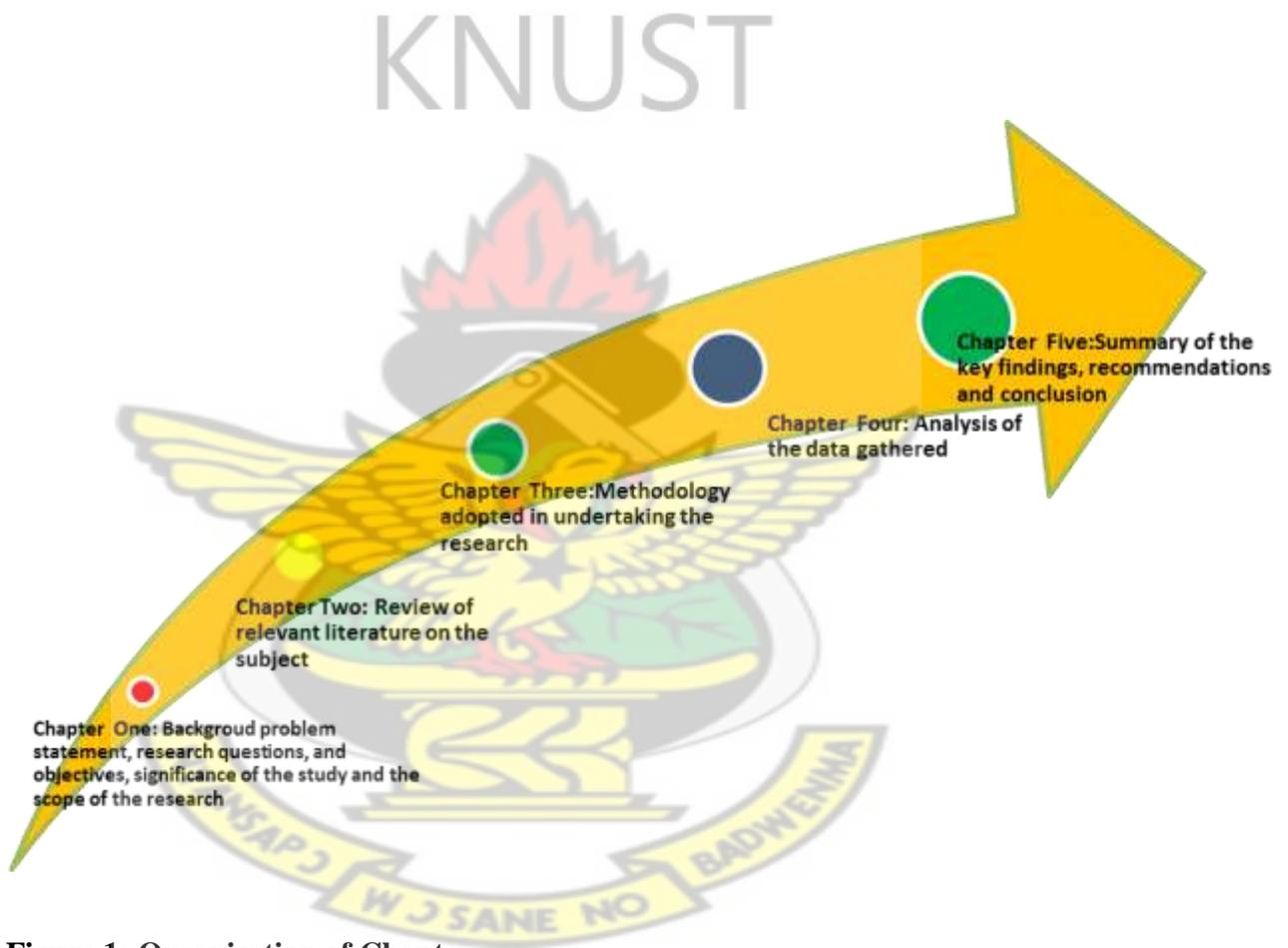
### **1.7.7 Population, Sampling Techniques and Sample Size**

The population for this study comprises the sixty-(60) tenants and thirty – (30) staff Ghana Highway Authority’s bungalows within Accra was obtained from the Estate department at the head office and staff of the estate department. The main reason for using this category of directly or indirectly has bearing on the work. Census sampling technique was adopted for collections since the number of bungalows is relatively small.

## **1.8 ORGANISATION OF THE STUDY**

This research work has been organized under five chapters. **Chapter one**, covers the general introductory and background of the study. It also includes the problem statement, research questions, and objectives, significance of the study and the scope of the research. The **second chapter** deals with the review of relevant literature on the

subject. That is to say the 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 (*see figure 1 below*).



**Figure 1: Organisation of Chapters**

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 INTRODUCTION

This chapter reviews in-depth, literature on issues relating to the concept of building and the importance that is attached to the maintenance of buildings. It covers secondary materials related to the conceptual issues as well as definitions and concept maintenance of buildings

#### 2.2 OVERVIEW OF MAINTENANCE MANAGEMENT

Building maintenance plays an important role among other activities in building operation. Building defect and damages are part of the building maintenance ‘bread and butter’ as their input indicated in the building inspection is very much justified, particularly as to determine the building performance. The quality and efficiency of maintenance management operation of building depends, to some extent, on the building condition information available and the expectation from the owners or the organization (Zulkarnain *et al.*, 2011). However, buildings exist largely for the benefit of their occupants and for what goes on in the building. For instance an office building exists to facilitate administrative functions and on the other hand, a residential flat exist for people to live in, including perhaps some social interactions between residents. The building elements (floor, roofs, walls etc.) exist largely to divide the building’s uses one from another and to keep at bay external elements of rain, wind, reptiles etc. Building maintenance therefore needs to be carried out to allow those functions of the building to

continue to be carried out, preferably in the way and to the standard of the originally envisaged, designed and built, and at least satisfactorily.

Maintenance management can be defined in as a medium provider and operator that oversee the components related to building condition and services installation so as to ensure it can perform at the optimum level (Ibid). It encompasses many operations and functions and can be described as “the effective and efficient utilization of resources to ensure that the process and its facilities are kept operable to a standard required by the users”. In the words of Seeley (1987), building maintenance has until recently been a neglected field of technology, being regarded as a ‘Cinderella’ activity. It possesses little glamour and is unlikely to attract very much attention and is frequently regarded as unproductive, although many of the managerial and technical problems are more demanding of ingenuity and skill than those of new works. Miles and Syagga, (1987) mentioned that a casual stroll around a city, town or village in almost any developing country today suggests that many important national assets, such as school buildings, roads, residential houses and apartments, hospitals and civic buildings are run-down beyond the point of economic repairs

### **2.3 DEFINITION OF BUILDING**

Building is a relatively permanent enclosed construction composed of stone, brick, wood, or other proper substance connected together, over a plot of land, having a roof and usually windows and often more than one level, used for any of a wide variety of activities, as living, entertaining, or manufacturing (Wikipedia). In the world all over, people spend 90% of their lives in buildings. This therefore makes them a very important and valuable asset to be neglected. According to Seeley, (1987) all elements

of buildings deteriorate at a greater or lesser rate depending on materials and methods of construction, environmental conditions and the use of the building. Dictionary.com (2013) also defined building as a relatively permanent enclosed construction over a plot of land, having a roof and usually windows and often more than one level, used for any of a wide variety of activities, as living, entertaining, or manufacturing. Business Dictionary, (2013) similarly stated that a building is a permanent or temporary structure enclosed within exterior walls and a roof, and including all attached apparatus, equipment, and fixtures that cannot be removed without cutting into ceiling, floors, or walls.

## **2.4 BUILDING TYPES IN GHANA (Public and Residential Buildings)**

### **2.4.1 Public Buildings**

Van Baren (2013) defined Public buildings as any type of building that is accessible to the public and is funded from public sources. Typically, public buildings are funded through tax money by the government, state or local governments. All types of governmental offices are considered public buildings. Public buildings generally serve the purpose of providing service to the public. Many of these services are provided free to residents. This list includes public schools, libraries, courthouses, state bungalows and post offices. In other words, public building is a building, whether for single or multitenant occupancy, and its grounds, approaches, and appurtenances, which is generally suitable for use as office or storage space or both by one or more Government agencies or mixed-ownership Government corporations.

## 2.4.2 Residential Buildings

- Detached Houses: This refers to single-family homes that sit on their own lot without sharing any walls with another home or building. It is self-contained and may be made of two (2) to (5) bedrooms with a living room, bathrooms and toilets, store rooms and garages.
- Semi Detached Houses: This consists of pairs of houses built side by side as units sharing a party wall and usually in such a way that each house's layout is a mirror image of its twin. Unlike the Detached houses, the Semi Detached, shares walls on both sides with another home.
- Apartments: This refers to a self-contained living space which may consist of one room or a set of rooms designed as a residence and generally located in a building occupied by more than one households. In the city of Accra, most of these apartments are found in the Airport Residential Areas.

## 2.5 THE CONCEPT OF BUILDING MAINTENANCE

RICS (2009) states that building maintenance has for many years been regarded as the 'Cinderella' of the building industry, with little attention paid to innovation and 'free thinking' in the delivery of its service. However, it should be pointed out that building maintenance is not only key to sustaining the built environment, but its value in terms of employment and expenditure in the economy is also significant. Maintenance, according to the British Standard (BS 3811) is defined as 'a 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'. 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.

The committee on Building Maintenance defined ‘acceptable Standard’ as quoted in the first edition of BS 3811, as “one which sustains the utility and value of the facility” and this is found to include some degree of improvement over the life of a building as acceptable comfort and amenity standards rise. Similarly, the committee of the Department of Environment (1972) defined building maintenance as ‘Work done in order to keep, restore or improve every facility, i.e. every part of building, its services and surrounds, to a currently accepted standard and to sustain the utility and value of the facility. In the same vein, the engineering definition of maintenance by the Business Dictionary, (2013) terms it as an actions necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life. Furthermore, the University of Calgary (2013), identified maintenance as work required preserving or restoring building systems and components to their original condition or to such condition that they can be effectively used for their intended purpose.

### 2.5.1 Identifying the maintenance needs

RICS (2009) in identifying the needs of maintenance indicated that it involves collecting and assimilating information from:

- Regular condition surveys of the building stock;
- Pre-acquisition surveys prior to any building purchase;
- The existing planned maintenance programme (or profile);
- Faults and repairs notified by the building users;
- Feedback from works of servicing, repairs and improvements in progress;
- Relevant legal requirements either from statute law or from lease and rent and repair covenants and any changes/updating of legislation;
- Existing building and service records; and
- Older buildings, which may be affected by legislation that came into effect after they were constructed. Legislation necessitates asbestos surveys and management plans, DDA assessment and fire risk assessment amongst other requirements.

Keeping track of all the required information in maintenance management requires careful handling to avoid errors, omissions or excessive bureaucracy. Similarly, Zulkarnain *et al.*, (2011) in considering maintenance needs emphasized that it is highly desirable but hardly feasible to produce buildings that are maintenance-free, although much can be done at the design stage to reduce the amount of subsequent maintenance work. All elements of buildings deteriorate at a greater or lesser rate depending on material and methods of construction, environmental conditions and the use of the building. A prime aim of maintenance is to preserve a building in its initial stage, as far

as practicable, so that it effectively serves its purpose. The main purposes of maintaining buildings are:-

- Retaining value of investment.
- Maintaining the building in a condition in which it continues to fulfill its function.
- Presenting a good appearance.

## 2.6 DIVISION OF MAINTENANCE

Various authors have classified maintenance into divisions. In BS 3811 cited in Seeley (1987) maintenance has been subdivided into 'planned' and 'unplanned' maintenance; the former being further divided into 'preventive' and 'corrective' maintenance. Likewise Zulkarnain *et al.*, (2011) also established that maintenance has been categorized as "predictable" and "avoidable". Predictable maintenance is regularly periodic work that may be necessary to retain the performance characteristic of a product, as well as that required replacing or repair the product after it has achieved a useful life span. Avoidable maintenance is the work required to rectify failures caused by poor design, incorrect installation or the use of faulty materials. The function of maintenance can be divided into three (3) groups;

- Cleaning and servicing,
- Rectification and repair and
- Replacement.

Timely expenditure on the first two can postpone the need to replace materials or components, a very expensive business. Cleaning and servicing should be carried out regularly and may be combined with a system of reporting faults when become apparent,

thereby avoiding the need for more expensive repairs or even replacement at a later stage. The categorization of maintenance according to BS 3811 cited in Seeley (1987) is as follows;

- ***Unplanned Maintenance:***

Maintenance carried out to no predetermined plan. It refers to works necessitated by unforeseen breakdowns or damages, for example repairing of a ripped off roof after a torrent rainfall.

- ***Preventive Maintenance:***

Maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intends to reduce the probability of failure in a building.

- ***Corrective Maintenance:***

Maintenance carried out after a failure has occurred and is intended to restore the facility to a state in which it can best perform its required functions.

- ***Emergency Maintenance:***

This is maintenance which is necessary to be affected immediately to avoid serious consequences.

- ***Conditioned-Base Maintenance:***

The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.

- ***Scheduled Maintenance:***

The preventive maintenance carried out to a predetermined interval of time, number of operations, seasons, etc.

- **Running Maintenance:**

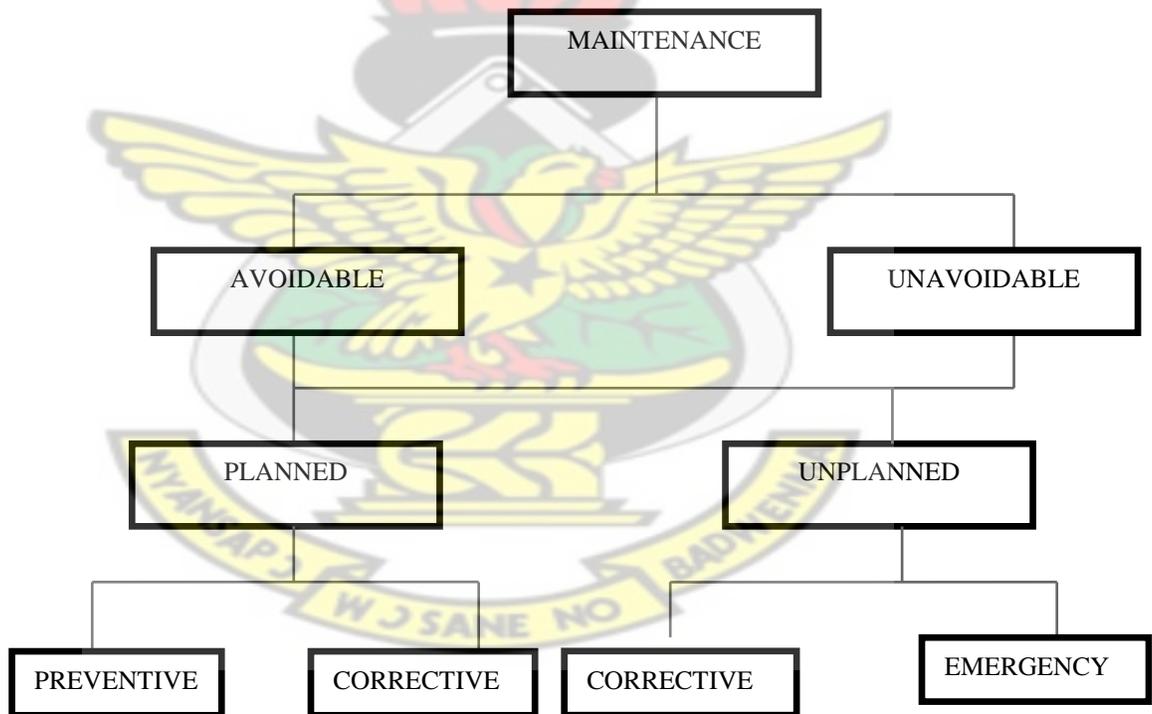
This is Maintenance which can be carried out whilst an item is being used such as the day-to-day cleaning of the building.

- **Shutdown Maintenance**

This refers to maintenance which can only be carried out after the building is evacuated or out of service.

- **Deferred Maintenance:**

These are maintenance works which have been identified as necessary but put off due to lack of funds.



**Figure 2**

**Source: Seeley (1987): Types of Maintenance**

On their part, Queensland Gov. (2012) developed the illustrated table below on the classification and sub-categories of maintenance. This table illustrates the elements that should be incorporated in a balanced maintenance works program.

**Table 2.1 Queensland Gov. (2012): Balanced Maintenance Works Program**

Category	Sub-Category	Definition
Planned Maintenance	Preventative Service Maintenance	Prevents asset failure by systematic inspection and monitoring to detect and avoid deterioration or failure. It also entails testing to confirm correct operation.
	Condition-Based Maintenance	Programmed maintenance work, based on condition assessment or other priorities, that returns an asset to an acceptable standard.
	Statutory Maintenance	Compulsory maintenance to meet requirements mandated in Acts, Regulations and other statutory instruments. This includes standards and codes referred to in an Act, Regulation or statutory instrument.
Unplanned Maintenance	Corrective and Breakdown Maintenance	Restores an asset to operational condition following an unforeseen failure.
	Incident Maintenance	Brings an asset back to an operational or safe condition following damage caused by natural disasters, storms, fire, forced entry or vandals.

Another approach to maintenance classification has been adopted by Speight (1982). It divides maintenance into three broad categories:

1. **Routine or day-to-day maintenance:** This is largely of the preventive type, such as daily sweeping, scrubbing, etc.

- II. ***Periodic maintenance*** carried out at specific times such as painting every Christmas or fumigating a school every academic year.
- III. ***Major repair or Restoration:*** such as re-roofing or rebuilding defective walls and often incorporating an element of improvement.

### **2.6.1 Planned Maintenance:**

Maintenance organized and carried out with fore thought, control and the use of records to a predetermined plan. The plan should be comprehensive and systematic encompassing both short and medium term considerations. The program should be based on sound knowledge of the building with particular regards to: The life of the building, the standard to be achieved, the financial implications and the responsibility for maintenance (Aha et al n.d). Furtherance to this, Zulkarnain *et al.*, (2011) also identified planned maintenance as a maintenance that is organized and carried out with forethought, control and the use of records to a predetermined plan. Queensland Gov. (2012) similarly in defining planned maintenance referred to it as planned work executed at predetermined intervals to meet statutory, health and safety, technical or operational reliability considerations, and to preserve the asset and prolong its economic life. Planned maintenance consists of preventative, statutory, and condition-based maintenance.

University of Calgary (2013) explained further that to prevent emergencies and equipment breakdown, Facilities Management conducts ongoing maintenance on building systems and components. Preventive measures include inspections, testing, lubrications, and cleaning, filter and belt changes. Work is performed according to the manufacturer's recommended maintenance procedures and typically does not require a

customer request. If a customer wants to have Operations & Maintenance on any special equipment outside the scope of the department's basic responsibilities, such services are chargeable. Planned Maintenance responsibilities include those mandated by government regulations, insurance requirements and building codes. Many of these, such as fire alarm testing, are designed to ensure the safety of building occupants. RICS, (2009) in other words explained planned maintenance as the process of periodically undertaking routine tasks necessary to maintain plant (lifts, boilers, etc.) in a safe and efficient operating condition.

### **2.6.2 Preventive/Predictive**

In their study, the Queensland Gov. (2012) stated that preventative maintenance may be applied to building structures, building fabric, services and site improvements but is predominantly used for maintenance of building services. When preparing their maintenance strategy, departments should be aware of the benefits of preventative maintenance practices which minimize the likelihood of building asset failures, health and safety issues and disruptions to service delivery. Preventive maintenance by RICS (2009) is generally identified by a condition assessment and is planned to take place to suit the pattern of deterioration of a building and the availability of funds for the purpose. University of Calgary (2013) similarly revealed that a planned and controlled program of periodic inspection, adjustment, lubrication and replacement of components as well as performance testing and analysis, sometimes referred to as a preventive maintenance program.

## **2.7 SIGNIFICANCE OF BUILDING MAINTENANCE**

In Seeley (1985) the committee on Building maintenance asserted that building maintenance was of great significance to the economy not only because of the scale of expenditure involved but also because it was important to ensure that the nation's (Great Britain) stock of buildings born as a tractor of production and of accommodation, was used as effectively as possible. The committee saw no early prospect of restoring, let alone keeping, a majority of buildings to an acceptable standard. It emphasized that more rather than less maintenance work is necessary if the value and amenity of the nation's buildings stock is to be kept at present levels.

## **2.8 NATURE OF MAINTENANCE**

Harper cited in Seeley (1985) believes that maintenance comprises three separate components namely; Servicing, Rectification and Replacement

### **Servicing**

This is essentially a cleaning operation undertaken at regular interval of varying frequency and is sometimes termed day-to-day maintenance.

### **Rectification**

This work usually occurs fairly early in the life of the building and arises from shortcomings in design, inherent faults in or unsuitability of components, damage of good in transit installation and incorrect assembly. Rectification represents a fruitful point at which to reduce the cost of maintenance, because it is avoidable.

### **Replacement**

Replacement problems involve items that degenerate with use or with the passage of time and those that fail after a certain amount of use or time. Items that deteriorate are

likely to be large and costly (e.g., machine tools, trucks, ships, and home appliances). Non deteriorating items tend to be small and relatively inexpensive (e.g., light bulbs, vacuum tubes, ink cartridges). The longer a deteriorating item is operated the more maintenance it requires to maintain efficiency. Furthermore, the longer such an item is kept the less is its resale value and the more likely it is to be made obsolete by new equipment. If the item is replaced frequently, however, investment costs increase. Thus the problem is to determine when to replace such items and how much maintenance (particularly preventive) to perform so that the sum of the operating, maintenance, and investment costs is minimized. (Encyclopedia Britannica, 2013)

## **2.9 MAINTENANCE MANAGEMENT**

The function in this area is mainly of a technical nature and concerned with the planning and control of construction resources to ensure that necessary repairs and renewals are carried out with maximum efficiency and economy. The major decisions relate to the following as spelt out in BS 3811 cited in Seeley (1985);

- Determining Standard
- Planning Inspections
- Identifying and Specifying the work necessary
- Estimating the cost of the work
- Planning the work
- Organizing the execution of the work

### **2.9.1 Determining Standards**

For this, it is necessary to have information on the overall objectives of the organization and of statutory and other external requirements so that compatible standards can be

fixed. The expression of these standards in qualitative and quantitative terms demands knowledge of the effects of varying degree of disrepair on user activities and levels of visual acceptance.

### **2.9.2 Planning Inspections**

Fixing the periodicity of inspections requires knowledge of the rates of deterioration of the building elements so that defects are revealed before they reach critical stage. The minimum period will be determined by the inspection cost which should clearly not exceed the cost consequence of failure.

### **2.9.3 Identifying and Specifying the Work Necessary**

This is achieved by compiling the information received on the condition of the building from inspectors and other sources with the standards laid down. It demands knowledge of the causes of defects and of the remedial measures which would be appropriate for the circumstance.

### **2.9.4 Estimating the Cost of the Work**

As far as possible the estimates should be based on historic cost data obtained from within the organization for previous similar jobs, but in the absence of such data, cost from external sources and experienced budget have to be used.

### **2.9.5 Planning the Work**

This is mainly in respect of fixing appropriate start and finish times for the individual jobs. It also requires information on the effect of the timing of the work on user activities, its agency, the availability of resources and the labour time required for each operation.

### **2.9.6 Organizing the executive of work**

The major decision here is whether to employ labour directly for the purpose or to engage an outside contractor; for this, information will be required on the relative merits of these alternatives from the point of view of both cost and convenience.

### **2.10 CHALLENGES OF MAINTENANCE MANAGEMENT PRACTICES**

Three considerations for developing maintenance policy are building maintenance objectives, benefits and policies (Armstrong, 1987). The main purpose is to obtain benefits with integration of adequate maintenance policies. It concerns with proper procedures for planning building maintenance activities. Alner and Fellows (1990) summarise that safety is the primary concern for the planning of maintenance strategy to ensure building and associated services are in safe condition, fit for use and comply with the law and all statutory requirements. Maintenance work is carried out to maintain the value of the physical assets of the building stocks and quality. Thus, these factors are considered important for development of maintenance policy. However, apart from the value consideration, Burns (1997) argues that there should be ground rules for the allocation of maintenance resources available to management. Maintenance policies are beneficial to the organisation as a whole, it must relate to the cost involved for getting maintenance funding. Maintenance strategy is adopted in order to extend the life cycle of buildings and its fittings services. Maintenance personnel choose different maintenance strategies depending on allocation maintenance resources. The maintenance policy is the integration of different strategic approaches, which include corrective, preventive and condition-based maintenance (Horner et al, 1997). Ollila and Malmipuro (1999) identify that the main types of categories of maintenance consisted of reactive,

preventive, predictive and proactive maintenance. However, Coetzee (1999) argues that the maintenance strategies should be based on the detailed design of the maintenance cycle for different types of organisations. Chan *et al.* (2001) split this into five types of maintenance strategy, including time-based, performance-based, breakdown-based, renovation-based and integration-based. Furthermore, Tse (2002) is of the opinion that most of the maintenance practices are failure-driven, time-based, condition-based, reliability-centered and predictive. The basic maintenance strategies include preventive, corrective and condition-based maintenance. According to Chan *et al.* (2001), the time-based, performance-based, breakdown-based, renovation-based and integration-based are also developed from the three basic maintenance strategies. Planned Preventive Maintenance (PPM) has been described as the most effective maintenance strategy against the frequency of breakdown (Seeley, 1976).

However, PPM is considered an ineffective solution because it makes too early and unnecessary replacement (Spedding, 1987). The argument of this maintenance strategy is becoming the focus of economic downturn, resulting in cutting operation cost to organisations. Moreover, the study about the effectiveness of PPM with empirical data to support its efficiency is limited (Horner *et al.*, 1997). Wood (1999) introduces just-in-time theory developed from the production industry applying to building maintenance. From the strategic perspective, there is little understanding about the relationships of PPM with the core business objectives (Loosemore and Hsin, 2001). On the contrary, it is recommended for the better use of the PPM in order to optimise maintenance resources (Shen and Lo, 1999). Tse (2002) argues that maintenance practices in Hong Kong concentrate on time-based and failure-driven strategies, but without adopting a

comprehensive maintenance approach, and that maintenance is still in a primitive stage. From the technological perspective, most of the studies focus on the study of technology application to condition-based maintenance and performance-based maintenance with centered reliability maintenance, and forward maintenance and predictive maintenance are all based on the condition surveys (Pitt, 1997).

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## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 INTRODUCTION**

In order to help in achieving the research aims and objectives, this chapter examines research methods with the outlook of finding the best methodology to answer the research questions raised. The drive of any research methodology and research design as recognised globally is to provide direction in the planning and implementation of the study in a manner most likely to attain the intended goal. Collis & Hussey (2003) argued that research methodology is the overall approach to the design process from the hypothetical foundations to the collection of data and analysis adapted for a study. Methodology is then a way by which we gain knowledge about the world, trying to discover how we can go about the task of finding out what we believe to be true (Christou *et al.*, 2008). Hence, this chapter first deliberates the philosophy that underpins the approach taken for the study, discussing the researcher's positivist stance to research and the consequent choice of a quantitative approach. The next section discusses the approach to data collection and then the data collection instrument. The chapter then provides an overview of the research population and sampling technique and the unit of analysis

#### **3.2 PHILOSOPHICAL POINT OF THE RESEARCH**

From literature point of view, the philosophical queries of existence, knowledge, and value, have significant influences in the research design (Koetting, 1996; Christou, *et al.*, 2008). Thus, such philosophical matters of ontology, epistemology, axiology and

methodology assumptions needs to be addressed explicitly since they shape the choice of research instruments (Christou, et al., 2008). Epistemology is the branch of philosophy concerned with how individuals determine what is right; positivism and interpretivism (Streubert & Carpenter, 1999). This research follows the positivists approach to knowledge. For the positivists, through the accumulation of verified facts, scientific knowledge is established (Bryman, 1992; *c.f* Osei-Hwedie, 2010). The research was of the opinion that the identification and analysis of maintenance management practices must be carried out in an unbiased way (free of researcher effects) which can be replicated.

At the ontological level, the position adopted for this research is objectivism. Ontology refers to enquiring the existence of a 'real' world that is sovereign of our knowledge; it is a theory of living being (Marsh & Stoker, 2002). This is because the strategies for evaluating maintenance practices exist as external facts that are beyond the reach and influence of the researcher. Thus, in answering the research question; what are the current management practices of maintenance they practice? The objectivism ontological position was followed.

### **3.3 RESEARCH STRATEGY**

This section explains the direction the researcher takes conducting the research. Naoum (1998) defines research strategy as the enquiry of research objectives. Accordingly, Baiden (2006) asserted that, the three main types of research strategies are quantitative, qualitative, and triangulation. However, the choice to adapt any particular strategy depends on the purpose of the study, the type, as well as availability of information for the research (Naoum, 1998; *c.f* Baiden, 2006). Hence, this research adapts a quantitative

strategy, as the main data collection techniques used in this research was questionnaires. This method will allowed the researcher to ask all respondent the same question with predetermined responses, which allowed objective data to be collected throughout the study therefore being in cycle with the positivist tradition with survey as the main data collection approach.

### **3.4 RESEARCH DESIGN**

A research design is a collection of guides or rules or data collection (Adams & Schvaneveldt, 1985; Ogoe, 1993). This pacts with the structure for data collection and analysis; the structure that influences the technique for collection and analysis of data and provides the connection between empirical data as well as its conclusions in a logical sequence to the initial research question of the study (Yin, 2003; Bryman, 2004; Baiden 2006). The research adopts a questionnaire survey in the quest to evaluate management practices of maintenance management in Ghana Highway Authority Bungalows. The need for generalization in the findings across the public buildings influenced the choice of questionnaire survey. Questionnaire survey enhances consistency of observations and improves replication due to its inherent standardized measurement and sampling techniques (Oppenheim, 2003).

### **3.5 APPROACHES TO DATA COLLECTION**

Data gathering is crucial in research, as the data contributes to a better understanding of a theoretical background (Bernard, 2002). It is therefore imperative that in selecting the way in which the data will be obtained and from whom the data will be acquired be done with sound judgment, especially since no amount of analysis can make up for improperly collected data (Bernard et al., 1986; Tongco, 2007).According to Naoum

(1998) there are two approaches to data collection namely, fieldwork (primary data collection) and desk study (secondary data collection). Patton (2002) noted that using more than one data collection instrument strengthens and gives credibility to the study. The researcher will adopt the used of multiple sources of data because of the added benefits (such as the validity of the data gathered) associated with multiple sources (Owusu, et al., 2007). Hence, this approach for collecting data in this study will be divided into two main parts desk survey and field survey.

### **3.5.1 Desk Survey**

The desk survey (literature review) forms an essential aspect of the research since it sets the pace for the development of field survey instruments using questionnaires, and interview (Fadhley, 1991 and Owusu, 2008). Secondary sources of information were identified and collected in books, articles, technical journals and from databases. The secondary source of information for this research was collected from two sources; mainly internal and external sources.

#### **3.5.1.1 Internal Secondary Sources**

These are published within companies or organizations, such as annual reports, information booklets, brochures, magazines, financial information memoranda and financial reports,

#### **3.5.1.2 External Secondary Sources**

Wahab (1996) described external secondary sources of data gathering as primary literature sources. Accordingly, they are the most accurate sources of information as it contains the original research. Alternative sources of external secondary sources of

information include textbooks, technical journals, newspapers, magazines and internet sources.

### **3.5.2 Field Survey: Primary Data Source**

The field survey is involved with the collection of empirical data. Fieldwork can be associated with three practical approaches; the survey approach, the case study approach and the problem-solving approach (action research) (Naoum, 2007). A survey is used to collect original data for describing a population too large to observe directly (Mouton 2001). A survey obtains information from a sample of people by means of self-report, that is, the people respond to a series of questions posed by the investigator (Polit *et al.*, 1993). The researcher used surveys because according to Robson (2002), surveys are used for relatively large number of respondents within a limited time frame. Robson (2002) added that there are two types of surveys available: the descriptive survey and the analytical survey (Robson, 2002).

### **3.5.3 Descriptive survey**

Burns et al. (2001) in explaining descriptive survey intimated that it is a study that observes and describes the presence, frequency or absence of characteristics of a phenomenon as it naturally occurs, in order to gain additional information. The primary purpose of a descriptive survey research is to describe the situation, preferences, practices, opinions, concerns or interests of the phenomenon of interests of the phenomenon of interests (Polit et al., 2006). Naoum (2007) added that the descriptive survey aims to answer such questions as: How many? Who? What is happening? Where? and When? It deals with counting the number of respondents with certain opinions/attitudes towards a specific object. The counting can be later analysed to

compare or illustrate reality and trends. Descriptive studies provide valuable base line information. The method is also flexible and can be used to collect information from a large group of respondents (Mouton, 2001).

The descriptive survey was selected because it provides an accurate portrayal or account of the characteristics, for example behaviour, opinions, abilities, and knowledge of a particular individual, situation, or group (Naoum, 2007). This design was chosen to meet the objectives of the study, namely to examine the current practices of maintenance management by Ghana Highway Authority, and to identify the maintenance methods and techniques employed by the tenants and maintenance staff.

### **3.6 DATA COLLECTION INSTRUMENT**

#### **3.6.1 Questionnaire Development**

It was essential to establish the information to gather for relevant questions to be solicited (Oppenheim, 1996). Contemplations of appeal to respondents ease of reading and supplying the required data guided the format of the questionnaires. This enhanced proper usage of time during the data collection. The questionnaire designed includes; close-ended questions, open-ended questions and scaled response questions. The likert response scale employed, measures the strength or intensity of respondent's opinion. Some of the advantages of the self-administered questionnaires used include, it been an efficient way to collect statistically quantifiable information and an efficient method as many respondents can be reached within a short space of time (Twumasi, 1993). The questionnaires structured to align with the main objectives of this study. Notwithstanding, the questions have also been structured in such a manner that the answers received would help achieve the research aim. Therefore, the questions focus on

fulfilling the requirements of this study. Measures also deployed to keep the questions in the questionnaire in simple language, null and void of technical terms in order to minimize potential errors from respondents.

### **3.6.2 Questionnaire Format**

The optimum length of questionnaire ranges from one side of A4 paper to eight pages of A4 paper (Naoum, 1998; Oppenheim 2000; Saunders et. al., 2000; Polgar & Thomas, 2005; Fellows & Liu, 2003). This research however designed a questionnaire covering three pages as provided in the Appendix.1

### **3.6.3 Questionnaire Design and Distribution**

As described earlier, the format of the questionnaires aligned to meet the objectives of this research has two main parts. Part one emphasis on the background of the respondents while part two focused on the good and bad practice of maintenance, condition of building and strategies to be adopted for effective maintenance management practices . The questionnaires were distributed and retrieved in person. This ensured that the intended recipients, in order to help improve the response rate, completed the questionnaires.

## **3.7 SCOPE OF THE STUDY**

Geographically, the study would be carried out exclusively in Accra, Ghana. However, contextually, the management practice of maintenance was evaluated. The maintenance management tools and techniques employed by estate department are explored, and finally the strategies for effective practice of maintenance are explored.

### **3. 8. RESEARCH POPULATION AND SAMPLING TECHNIQUE**

#### **3.8.1 Research population**

A research population can be defined as the totality of a well-defined collection of individuals or objects that have a common, binding characteristics or traits (Polit and Hungler, 1993). Burns *et al.*, 1993 added that a population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study. The research covers a population of ninety-(90) tenants and estate department staff; that is sixty-(60) tenants and thirty (30) estate department staff responsible for maintenance. The main reason for using this category of people is that their activities directly or indirectly have a bearing on maintenance management practices of Ghana Highway Authority.

#### **3.8.2 Sampling Technique and Sample size determination**

The term “sample” means a part of a whole (population) drawn to reflect the remaining (Naoum, 1998). Thus, sampling refers to the process of selecting a quota of the population to characterise the entire population. A sample, then, consists of a subject of the units that constitute the population (Polit & Hungler, 1999). However, research studies use simply a small fraction of the population, referred to as a sample. This is because using a sample is more practical and less costly than collecting data from the entire population. Polit & Hungler (1999) asserted that, the major risk of using a selected sample is that it might not adequately reflect the behaviours, traits, or beliefs of the population. The sampling technique for this endeavour based on its purpose, design, and practical implication of the research topic is purposive sampling. Simply put, the

researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard, 2002; Lewis & Sheppard, 2006; Tongco, 2007). In the context of this research, the targeted groups were the tenants and staff of the estate department. More so, purposive sampling was utilized in attaining the sample size because of the difficulties encountered in assessing the population size of the class. Purposive sampling refers to strategies in which the researcher exercises his or her judgment about who will provide the best perspective on the phenomenon of interest, and then intentionally invites those specific perspectives into the study.

### **3.9 DATA ANALYTICAL TOOL**

The choice of an analytical tool is dependent on a comprehensive review of available analytical and statistical tool. The decision for statistical consideration was to choose between parametric or non-parametric statistical test. The choice between the two tests depends largely upon the level of measurements achieved in the study and the type of variables. The principal statistical tool utilized was the non-parametric statistical testing using descriptive statistics and one-sample t-test.

### **3.10 SUMMARY**

This chapter addressed the methodology for the research and the reason for the adoption of the methodology used for this research. The research approach used and the method of data collection was discussed i.e. the use of survey questionnaires. The chapter concluded with the research process and covered issues such as; the study area, sources of data, questionnaire developments, questionnaire response formats, content and design

of the questionnaires, distribution of questionnaire, targeted respondents, the scope of questionnaire survey, sample size determination, and data analytical tools.

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## **CHAPTER FOUR**

### **DISCUSSION AND ANALYSES**

This chapter of the study discusses and analyses the data collected to answer the various objectives the study set to achieve. This chapter elaborates on the background information of respondents interviewed, operational state of the buildings, the factors responsible for poor maintenance management of the buildings, and the major factors for good maintenance practices on the buildings of tenants. This analysis represents 43 tenants representing a 72 percent rate of respondents and 20 staffs representing a 67 percent rate of respondents respectively. The variables in this section of the study were tested with the aid of one tailed t-test at a significance level of 1% (test value of 2.25). Test value of 2.25 (confidence level of 99%) is the most preferred significance level with a minimal level of statistical error (Maddala, 2001).

The data analysis is in four parts;namely:

- Background of Information;
- Operational State of Bungalows;
- Factors Responsible for Poor Maintenance Management;and
- Factors for Good Maintenance Practices.

#### **4.1 BACKGROUND INFORMATION OF RESPONDENTS**

The presentation of the results from the survey on the background information of respondent was analysed using descriptive analysis. The goal was to present both the background information of tenants and staffs who took part in the study. Knowing the background information will help generate confidence in the reliability of data collected.

#### 4.1.1 Background Information of Tenants

This section of the study discusses the background information of the tenants of the bungalows of the Ghana Highway Authority. Some of the major factors considered included tenant type, type of building, years of staying in the building, age of building, and others. These questions were to assess the nature and state of the buildings occupied by tenants of the bungalows of the Ghana Highway Authority. The results of the section are presented in Table 4.1.

**Table 4.1: Background Information of Tenants**

<b>Background Information</b>	<b>Frequency (=43)</b>	<b>Percent</b>
<b>Tenant type</b>		
Senior staff	17	39.6
Junior staff	26	60.5
<b>Type of building</b>		
2-Bedroom House	19	44.2
2-Bedroom House	11	25.6
4-Bedroom House	13	30.2
<b>Years of staying in the building</b>		
1-5 years	13	30.2
6-10 years	15	34.9
11-15 years	8	18.6
16-20 years	6	14.0
20-25 years	1	2.3
<b>Age of building</b>		
Below 10 years	4	9.3
Between 10-15 years	12	27.9
Above 15 years	27	62.8
<b>Took inventory of state of building before occupancy</b>		
Yes	26	60.5
No	17	39.5
<b>Undertaking of regular inspection of the building</b>		
Yes	28	65.1
No	15	34.9
<b>If yes, how often is it done</b>		
Quarterly	4	14.3
Annually	23	82.1
Biannually	1	3.6

<b>Persons responsible for building maintenance</b>		
Self	8	18.6
Ghana Highways Authority	35	81.4
<b>Period taken for maintenance request to be responded to</b>		
Less than a month	15	34.9
1-5 months	18	41.9
6-12 months	3	7.0
More than 12 months	7	16.3
<b>Perception of maintenance concerning building condition</b>		
Very Good	6	14.0
Good	8	18.6
Poor	26	60.6
Very Poor	3	7.0

Source: Field Survey, 2013

From Table 4.1, out of the total tenant respondent interviewed (n=43), the majority were junior staffs. The dominant type of buildings of the interviewed tenants was 2-bedroom houses as indicated by 44.2% of the interviewed tenants. Also, 30.2% of the interviewed tenant respondents held 4-bedroom type of building. The majority (65.1%) of the tenants have stayed in these buildings between 1 and 10 years. Furthermore, the age of most of the buildings as indicated by the majority (62.8%) of the interviewed tenant respondents was above 15 years. The majority (65.1%) of the respondents took inventory of the state of the buildings before occupancy. Regular inspection is also taking of the state of the building as indicated by the majority (65.1%) of the respondents. The inspection on the state of the buildings is often done annually. Ghana Highways Authority is the organisation responsible for the maintenance of the buildings as indicated by 81.4% of the interviewed tenants. It often takes a month to about 5 months for maintenance request to be responded to by the Ghana Highway Authority. The majority (60.6%) of the interviewed tenants believed that the maintenance conducted by the Authority is poor.

#### 4.1.1 Background Information of Staffs

This section of the study discusses the background information of the staffs of the Ghana Highway Authority. Some of the major factors considered included years of experience as maintenance officers, status of staffs in the maintenance departments, department of maintenance staffs in the buildings or bungalows, presence of maintenance policies and others. The results of the section are presented in Table 4.2.

**Table 4.2: Background Information of Staffs**

<b>Background Information</b>	<b>Frequency (n=20)</b>	<b>Percent (%)</b>
<b>Years of experience as a maintenance staff</b>		
Less than 5 years	11	55.0
5-10 years	9	45.0
<b>Status of staff in the maintenance department</b>		
Senior	11	55.0
Intermediate	9	45.0
<b>Department of maintenance staff in the building</b>		
Maintenance		
Project	10	50.0
Facilities	10	50.0
Premises and property	0	0.0
<b>Presence of maintenance policy in the institution</b>		
Yes	17	85.0
No	3	15.0
<b>Type of maintenance arrangement</b>		
Periodic	9	45.0
Routine	7	35.0
Preventive	4	20.0
<b>What necessitated maintenance on the building</b>		
Upon inspection	8	40.0
Upon request	9	45.0
Upon occupancy of new tenant	3	15.0
<b>Period taken to respond to maintenance request of occupant</b>		
Less than a month	6	30.0
1-5 months	13	65.0
6-12 months	1	5.0

Source: Field Survey, 2013

From Table 4.2, out of the total staff respondents interviewed, the majority (55.0%) have had less than 5 years' experience as maintenance staffs. The majority (55.0%) of the interviewed staffs were also senior staff officers in the maintenance department of the Ghana Highway Authority. Most of the interviewed staffs are with the maintenance and project departments of the Ghana Highway Authority. The greater percentage (85.0%) of the interviewed staffs of the Ghana Highway Authority believed the institution has maintenance policy. The maintenance arrangement of the Ghana Highway Authority is either periodic or routinely. Fixing the periodicity of inspections requires knowledge of the rates of deterioration of the building elements so that defects are revealed before they reach critical stage (Seeley, 1985). The maintenance of the buildings is often necessitated by knowledge of state of the buildings after inspection and also upon request by tenants. This finding is consistent with literature that identified the main types of categories of maintenance as reactive, preventive, predictive and proactive maintenance (Ollila & Malmipuro, 1999). It often takes 1 to 5 months for the Ghana Highway Authority to respond to maintenance request from occupants or tenants as indicated by 65.0% of the interviewed respondents.

#### **4.3 OPERATIONAL STATE OF BUNGALOWS**

The operational state of the buildings or bungalows of the Ghana Highway Authority was assessed in this section of the study with the aid of Likert Scaling questioning type. The tenants and staffs of the Ghana Highway Authority were presented with questionnaires containing questions assessing the operational state of the bungalows or buildings. The tenants and staffs were required to choose from 'very bad' to 'very good'

in assessment of the operational state of the buildings. The results are presented in Table 4.3.

**Table 4.3: Operational State of the Buildings**

PARAMETERS	Mean Responses	
	Tenant	Staff
Structural elements (beams, columns, upper floor slabs and stairs)	3.00	1.95
Walls (external and internal walls)	3.12	2.55
Finishes (wall finishes, floor finishes and ceilings)	2.98	2.85
Windows	3.16	2.75
Doors (external and internal doors)	3.02	2.60
Roofs	3.09	2.40
Services (sanitary appliances, building service equipment, disposal installation, water, ventilation, electrical, gas, lifts, protection installation, drainages, external services)	3.07	2.50
Fittings and furniture	3.05	2.65
Sanitation of the environment	3.05	2.90

Rank: [very bad-1, Bad-2, Average-3, Good-4, Very Good-5]

Source: Field Survey, 2013

From Table 4.3, out of the total tenant respondents interviewed (n=43), the average response of 3.00 indicates that they believed that the structural elements of the buildings that includes beams, columns, upper floor slabs and stairs are in an average state. However, the mean response of the staffs of 1.95 indicates that the staffs believed the structural element of the buildings is bad. The tenants also believed that the state of both the internal and external walls of the buildings is average as indicated by the means response of 3.12. The opinion of the staffs was also similar to the tenants with regards to

the walls of the buildings. The finishes of the buildings (wall finishes, floor finishes and ceilings) is also recognized by both the tenants and staffs interviewed as average in state as shown by the mean response of approximately 3.00. Furthermore, whereas the tenant respondents believed that the roofs of the buildings are in average state, the staffs believed the roofs are in bad state. The windows and doors of the buildings are believed to be in an average state by both tenants and staffs interviewed for the study. The services (sanitary appliances, building service equipment, disposal installation, water, ventilation, electrical, gas, lifts, protection installation, drainages, and external services), fittings and furniture's, and sanitation of the environment of the buildings are all believed to be in an average state. Therefore, both the tenants and the staffs generally believed that the operational state of the buildings is in an average state. The ineffectiveness of the building maintenance by the Ghana Highway Authority is supported by literature that indicates that building maintenance has until recently been a neglected field of technology, being regarded as a 'Cinderella' activity (Seeley, 1987). It possesses little glamour and is unlikely to attract very much attention and is frequently regarded as unproductive.

#### **4.4 FACTORS RESPONSIBLE FOR POOR MAINTENANCE MANAGEMENT**

This section of the study assesses the factors responsible for poor maintenance management of the bungalows of the Ghana Highway Authority. The tenants and staffs were given 13 factors to choose between least and highest concerning the state of the bungalows. The significance of the variables used was tested with the aid of t-test statistical tool at a critical value of 2.25. The variables were also ranked with the aid of the mean responses of the interviewed respondents. The result is presented in Table 4.4.

**Table 4.4: Factors for Poor Maintenance Management**

<b>Factors</b>	<b>Tenant</b>			<b>Staff</b>		
	<b>Mean</b>	<b>t-test</b>	<b>Rank</b>	<b>Mean</b>	<b>t-test</b>	<b>Rank</b>
Attitude of users and misuse of facilities	3.44	4.43*	5	2.20	-0.14	12
Persistent breakdown through indiscipline and ignorance factors of building users	3.63	6.31*	2	3.00	2.87*	4
Insufficient fund for maintenance job	3.79	8.52*	1	3.00	2.98*	3
Natural deterioration due to age and environment	3.42	6.28*	3	2.35	0.67	11
Inefficient inventory system	2.86	3.43*	11	2.55	2.22**	9
Inadequate training and development of personnel	2.91	4.13*	7	2.75	2.46**	5
Procurement of spare parts becomes difficult due to unavailable fund	3.09	5.09*	4	2.75	4.07*	1
Inflation of the cost of maintenance by the operatives	2.84	4.29*	6	2.70	2.75**	6
Lack of skilled manpower to maintain work in buildings designed and constructed by expatriates	2.84	3.88*	9	3.80	3.54**	2
Frequent shortage of materials and spare parts due to absence of efficient inventory system	2.86	3.86*	10	1.70	-2.67**	13
Lack of skilled personnel in maintenance department	2.81	3.86*	10	2.70	2.51**	7
No effective maintenance due to de-emphasize in training, retraining and continue education	2.88	3.95*	8	2.50	1.35	10
Lack of discernable maintenance culture in the country	3.44	6.40*	2	2.65	2.40**	8

Rank: [Least-1, Lower-2, High-3, Higher-4, Highest-5]

\*,\*\* &\*\*\* implies significance at 1%, 5% & 10% respectively

Source: Field Survey, 2013

From Table 4.4, considering the t-test statistics conducted at critical value of 2.25, all the poor management factors considered in seeking responses from the tenants were significant at 1%. out of the total tenants interviewed tenant respondents, the mean

response of 3.79, 3.63 and 3.44 indicates that the tenants believed that the major factors for the poor maintenance management are insufficient fund for maintenance job, persistent breakdown through indiscipline and ignorance of building users, attitude of users and misuse of facilities and lack of discernable maintenance culture in the country ranked 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> respectively. Other significant factors considered to promote poor maintenance management also includes natural deterioration due to age and environment, procurement of spare parts becomes difficult due to unavailable fund, and procurement of spare parts becomes difficult due to unavailable fund ranked 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> respectively. However, the least ranked factors for poor maintenance management included inflation of the cost of maintenance by the operatives, lack of skilled manpower to maintain work in buildings designed and constructed by expatriates, frequent shortage of materials and spare parts due to absence of efficient inventory system and lack of skilled personnel in maintenance department ranked.

Contrary to the responses of the tenants, the staffs of the Ghana Highway Authority ranked as major factors for poor maintenance management the persistent breakdown through indiscipline and ignorance factors of building users, insufficient fund for maintenance job, Lack of skilled manpower to maintain work in buildings designed and constructed by expatriates, Inadequate training and development of personnel and Procurement of spare parts becomes difficult due to unavailable fund. The staff however believed the least factors for the poor maintenance management of the buildings included frequent shortage of materials and spare parts due to absence of efficient inventory system, natural deterioration due to age and environment, and no effective maintenance due to de-emphasize in training, retraining and continue education. The

significance level of the factors considered for the assessment of the factors for the poor maintenance management by the staffs are shown in Table 4.4.

#### 4.5 FACTORS FOR GOOD MAINTENANCE PRACTICES

This section of the study assesses the factors responsible for good management practices on the bungalows of the Ghana Highway Authority. The tenants and staffs were given 6 factors to choose between least and highest concerning the state of the bungalows. The significance of the variables used was tested with the aid of t-test statistical tool at a critical value of 2.25. The variables were also ranked with the aid of the mean responses of the interviewed respondents. The result is presented in Table 4.5.

**Table 4.5: Factors for Good Maintenance Practices on the Buildings**

Factors	Tenant			Staff		
	Mean	t-test	Rank	Mean	t-test	Rank
Adequate/appropriate maintenance of facility plant and equipment for maintenance operations	3.40	4.18*	6	2.00	-.74	6
Involvement of maintenance experts at the design stage	3.60	6.27*	5	2.40	0.51	4
Long term arrangement for the supply of essential parts for replacement	3.53	6.32*	4	2.35	0.38	5
Maintenance programme by the maintenance department	3.56	7.14*	2	2.45	0.85	3
Innovate supports services	3.53	6.79*	3	2.70	1.87***	2
Planned maintenance programmes	3.77	8.08*	1	2.70	2.18**	1

Rank: [Least-1, Lower-2, High-3, Higher-4, Highest-5]

\*,\*\* &\*\*\* implies significance at 1%, 5% & 10% respectively

Source: Field Survey, 2013

From Table 4.5, from the t-test statistics conducted, all the factors considered for the assessment of the factors for good maintenance practices through an interview with the tenants of the buildings maintained by Ghana Highway Authority were significant at 1%. From the t-test, the mean responses of 3.77, 3.60, and 3.56 indicates that the major three factors for good maintenance practices on the buildings of the tenants interviewed were planned maintenance programmes, involvement of maintenance experts at the design stage, and maintenance programme by the maintenance department ranked 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> respectively. However, the least ranked factors for the good maintenance practices on the buildings by the Ghana Highways Authority were appropriate maintenance of facility plant and equipment for maintenance operations, long term arrangement for the supply of essential parts for replacement, and innovative support services.

However, considering the mean responses of the interviewed staffs of the Ghana Highway Authority, the major two factors for good maintenance practices were innovative support services and planned maintenance programmes that were significant at 10% and 5% respectively. From the t-test, all the other factors apart from the mentioned two major factors for the good maintenance practices were insignificant.

## **SUMMARY**

In general, the results of the surveys as discussed are found to reflect the true situation in Ghana Highway Authority (GHA) Bungalows in Accra. It shows that tenants and staff of the estate department responded to the questionnaires base on their experience over the years. It began with a brief discussion of the survey participants and the descriptive statistics of the results obtained from the field thereof. The chapter concluded with mean

score index (in the form of one sample t-test) analysis of both poor and good practices of maintenance factors identified. The finding clearly shows the importance of the need maintenance management practices in the GHA.

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## CHAPTER FIVE

### SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 INTRODUCTION

The aim of the study is to evaluate the maintenance management practice of the Ghana Highway Authority's bungalows with a view to recommending most efficient maintenance management strategy. In this chapter, the research questions and the objectives are revisited to bring into light the extent to which the aim of the study has been achieved throughout the various phases of the study. This chapter also presents recommendations of the researcher based on the findings of the study and states the difficulties that were encountered throughout of the study. Lastly, recommendations are made for further studies.

#### 5.2 SUMMARY OF FINDINGS

##### 5.2.1 Operational State

- The study showed that the operational state (physical-functional condition) of bungalows in Accra was within very bad and average, with the mean average rating from 1.95-3.00m which clearly indicate that most building of the GHA are deteriorating.
- The analysis however, revealed that there is significant difference in the operational state of the old generation bungalows when compared to the operational state of new generation bungalows.

- The study revealed that the components and services of the buildings of the new generation bungalows are in better operational state than those of the old generation bungalows.
- In addition, the study further indicate that Structural elements (beams, columns, upper floor slabs and stairs) was rate very bad with mean average of 1.95 by the staff and Finishes (wall finishes, floor finishes and ceilings) was rated 2.98 by tenants.

### **5.2.2 Poor Maintenance Management**

As for the factors responsible for poor maintenance management of bungalows in ,a number of factors were identified with the degree of the significance of each of these factors established based on the responses obtained from the field survey as presented in the previous chapter of this research work. However, the two groups of respondents, the maintenance staff and the tenants have relative agreement on the degree of significance for all of the postulated factors except for the significance of lack of discernable maintenance culture in the country, which was ranked by the users as the most significant factor responsible for poor maintenance management of bungalows whereas the maintenance staff ranked it as the least significant factor. Consequently, the research showed that the association between the perception of maintenance staff and users of bungalows on the factors responsible for poor maintenance management is very strong. Hence, the maintenance staff ranked: Lack of skilled manpower to maintain work in buildings designed and constructed by expatriates, insufficient fund for maintenance job and Persistent breakdown through indiscipline and ignorance factors of building users as first, second and third respectively, while the tenants also ranked: Insufficient fund for

maintenance job; Persistent breakdown through indiscipline and ignorance factors of building users; Attitude of users and misuse of facilities as first, second and third respectively.

### **5.2.3 Good Maintenance Practices**

The information gathered in the course of this research work revealed that the maintenance department of the GHA adopts wide managerial duration of control as the organizational structure. This disclosure depicts that the maintenance management of bungalows has not given a chance to the use of the narrow span of control (alterative type of organizational structure) which may result in better coordination, supervision and monitoring of maintenance organization in bungalows and consequently a better overall performance of the department. Furthermore, it was gathered that the maintenance departments of bungalows deploy some form of preventive maintenance strategy, although the comprehensiveness and viability of such strategy. Finally, this research revealed that the level of funding of the maintenance department of GHA is merely sufficient and therefore requires a thorough review by the top management to ensure that these buildings do not deteriorate prematurely resulting from poor or inadequate funding.

### **5.3 RECOMMENDATIONS**

The findings of this research are expected to contribute to more effective practices of maintenance in government bungalows. To achieve this objective, this study proposes a set of recommendations to the staff of estate department and tenants.

- Strategies should be formulated by those saddled with the responsibility of maintenance management of bungalows in line with systems and components of

bungalows, to ensure that the bungalow remain operational in functional and safe manner.

- A viable preventive maintenance schedules (covering all major components and systems of bungalows) should prepared and the implementation of such schedule should be absolute. This will foster pro-activeness in the maintenance management of systems and installations of the buildings and facilities.
- Furthermore, provision for better funding of the maintenance department should be made in subsequent years when systems and components of bungalows begin to age and deteriorate at an increased rate. Such funds should however be monitored to ensure that they are judiciously utilized by the maintenance department.
- Finally, maintenance management staff of GHA should ensure proper planning and executing maintenance programmes, as well as overcome the prevailing maintenance problems of bungalows.

#### **5.4 LIMITATIONS OF THE RESEARCH**

There were problems encountered in the course of conducting the study at the fieldwork phase, which posed serious constraints to the execution of the study. Meeting with staff involved following some protocol, which was in the first place time unbearable. There is also possibility of sampling and measurement errors and the effects of these errors on the data collected.

## 5.5 CONCLUSION

The interest in maintenance practices is growing. With an increasingly and rapidly changing nature of buildings, the onus falls on both management and tenant to improve their attitude toward maintenance thereby ensuring efficient use of resources. There recommendations proffered in this research would assist all those who are involved in maintenance practices in Ghana Highway Authority and other government institution which is face with similar problem.



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APPENDIX 1: QUESTIONNAIRES



**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**COLLEGE OF ARCHITECTURE AND PLANNING**

**FACULTY OF ARCHITECTURE AND BUILDING TECHNOLOGY**

**DEPARTMENT OF BUILDING TECHNOLOGY**

**KNUST**

**EVALUATION OF MAINTENANCE MANAGEMENT PRACTICES IN GHANA  
HIGHWAY AUTHORITY'S BUNGALOWS IN GREATER ACCRA REGION**

**MALLAM ISSAH ISSAHAKU, B.Sc. (Hons)**



## Preamble

My name is Mallam Issah Issahaku an MSc. student from Department of Building Technology at Kwame Nkrumah University of Science and Technology, Kumasi.

This research questionnaire has been designed to solicit views from stakeholders (staff and tenants) on maintenance an activity of the Ghana Highway Authority Bungalow's .It is aimed at:

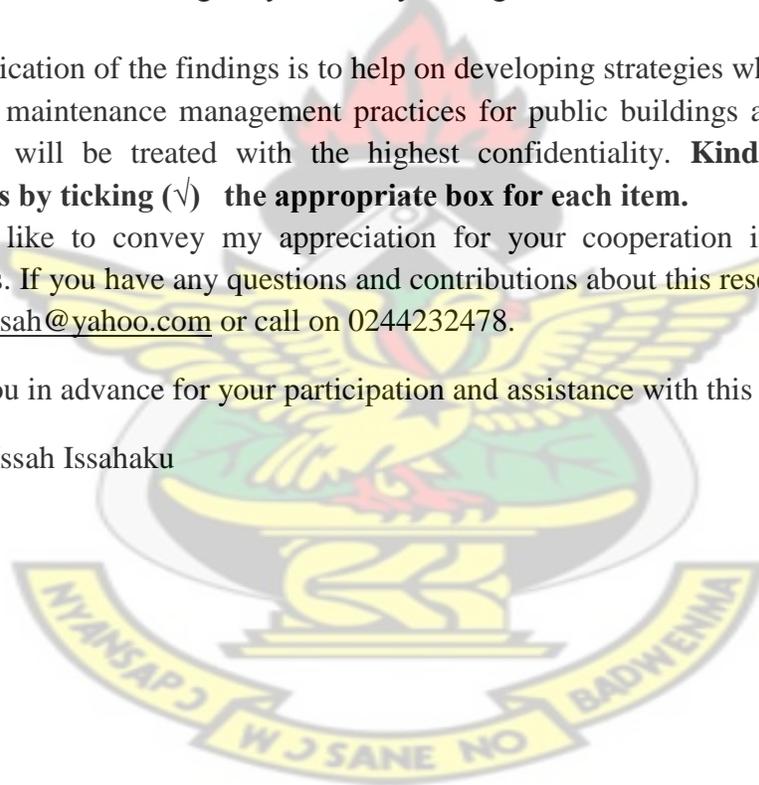
- Evaluating the operational state (physical-functional condition) of in Ghana Highway Authority's bungalows in Accra as carried out by the maintenance department; and
- Determining the maintenance management strategy used in maintaining Ghana Highway Authority's bungalows in Accra

The implication of the findings is to help on developing strategies which will be used for effective maintenance management practices for public buildings and any information provided will be treated with the highest confidentiality. **Kindly respond to the questions by ticking (√) the appropriate box for each item.**

I would like to convey my appreciation for your cooperation in completing these questions. If you have any questions and contributions about this research, please mail at [mallamissah@yahoo.com](mailto:mallamissah@yahoo.com) or call on 0244232478.

Thank you in advance for your participation and assistance with this study.

Mallam Issah Issahaku



**SECTION A: BACKGROUND INFORMATION**

1. How many years of experience do you have as a maintenance staff?
  - a) Less than 5 years [ ]
  - b) 5-10years [ ]
  - c) Others (please specify).....
  
2. Kindly indicate your status in the maintenance department:
  - a) Senior [ ]
  - b) Intermediate [ ]
  - c) Junior [ ]
  - Others (please specify).....

What department of maintenance staff in the building you are involved with.

- a) Maintenance [ ]
- b) Projects [ ]
- c) Facilities [ ]
- d) Premises and property [ ]
- e) Others (please specify).....

Does your institution have a maintenance policy?

- a) YES [ ]
- b) NO [ ]

What type of maintenance arrangement do you have in place?

- a) Periodic [ ]
- b) Routine [ ]
- c) Preventive [ ]
- Other (please specify).....

What necessitates the carrying out of maintenance on the buildings?

- a) Upon inspection [ ]
- b) Upon request [ ]
- c) Upon occupancy of new tenant [ ]
- Other (please specify).....

How long does it take to respond to maintenance request/needs of occupants?

- a) Less than a month [ ]
- b) 1-3 months [ ]

- c) 6-12 months [ ]
- d) More than 12 months [ ]
- Other (please specify).....

**SECTION B: OPERAATIONAL STATE**

In your experience, please indicate the operational state of the following elements by ticking the appropriate boxes.

**(1) Very Bad (2) Bad (3) Average (4) Good (5) Very Good.**

Elements	Levels				
	1	2	3	4	5
1. Structural elements (beams, columns, upper floor slabs and stairs)					
2. Walls (external and internal walls)					
3. Finishes (wall finishes, floor finishes and ceilings)					
4. Windows					
5. Doors (external and internal doors)					
6. Roofs					
7. Services(sanitary appliances, building service equipment, disposal installation, water, ventilation, electrical, gas, lifts, protection installation, drainages, external services)					
8. Fittings and furniture					
9. Sanitation of the environment					
<b>If other (please specify)</b>					

## SECTION C: POOR MAINTENANCE MANAGEMENT

In your experience, please indicate the factor responsible for poor maintenance management of buildings by ticking the appropriate boxes.

**1= Least, 2= Lower, 3= High, 4= Higher, 5= Highest**

Factors	levels				
	1	2	3	4	5
1. Attitude of users and misuse of facilities					
2. Persistent breakdown through indiscipline and ignorance factors of building users					
3. Insufficient fund for maintenance job					
4. Natural deterioration due to age and environment					
5. Inefficient inventory system					
6. Inadequate training and development of personnel					
7. Procurement of spare parts becomes difficult due to unavailable fund					
8. Inflation of the cost of maintenance by the operatives					
9. Lack of skilled manpower to maintain work in buildings designed and constructed by expatriates					
10. Frequent shortage of materials and spare parts due to absence of efficient inventory system					
11. Lack of skilled personnel in maintenance department					
12. No effective maintenance due to de-emphasize in training, retraining and continue education					
13. Lack of discernable maintenance culture in the country					
<b>If other (please specify)</b>					

**SECTION D: GOOD MAINTENANCE PRACTICES**

In your experience, which of the following factor account for good maintenance practices, please indicate the attitude level responsible for poor maintenance management of buildings.

**1= Least, 2= Lower, 3= High, 4= Higher, 5= Highest**

Factors	levels				
	1	2	3	4	5
1. Adequate/appropriate maintenance of facility plant and equipment for maintenance operations					
2. Involvement of maintenance experts at the design stage					
3. Long term arrangement for the supply of essential parts for replacement					
4. Maintenance programme by the maintenance department					
5. Innovate supports services					
6. Planned maintenance programmes					
<b>If other (please specify)</b>					

Please suggest some strategies that should be adopted for effective maintenance management practices.

.....

.....

.....

.....

**Thank you**

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

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**EVALUATION OF MAINTENANCE MANAGEMENT PRACTICES IN GHANA  
HIGHWAY AUTHORITY'S BUNGALOWS IN GREATER ACCRA REGION**

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## Preamble

My name is Mallam Issah Issahaku an MSc. student from Department of Building Technology at Kwame Nkrumah University of Science and Technology, Kumasi.

This research questionnaire has been designed to solicit views from stakeholders (staff and tenants) on maintenance an activity of the Ghana Highway Authority Bungalow's .It is aimed at:

- Evaluating the operational state (physical-functional condition) of in Ghana Highway Authority's bungalows in Accra as carried out by the maintenance department; and
- Determining the maintenance management strategy used in maintaining Ghana Highway Authority's bungalows in Accra

The implication of the findings is to help on developing strategies which will be used for effective maintenance management practices for public buildings and any information provided will be treated with the highest confidentiality. **Kindly respond to the questions by ticking (√) the appropriate box for each item.**

I would like to convey my appreciation for your cooperation in completing these questions. If you have any questions and contributions about this research, please mail at [mallamissah@yahoo.com](mailto:mallamissah@yahoo.com) or call on 0244232478.

Thank you in advance for your participation and assistance with this study.

Mallam Issah Issahaku





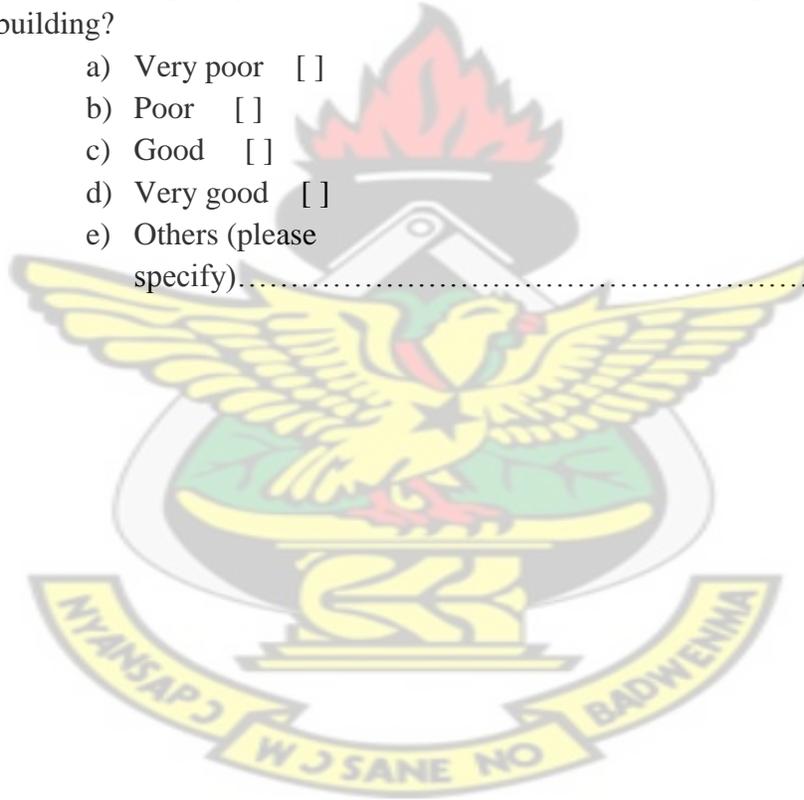
- a) Self [ ]
- b) Ghana Highways Authority [ ]
- c) Other please specify.....

9. How long does it take for maintenance request to be responded to?

- a) Less than a month [ ]
- b) 1-3 months [ ]
- c) 6-12 months [ ]
- d) More than 12 months [ ]
- e) Other please specify.....

10. What is your perception of the maintenance staff concerning the condition of the building?

- a) Very poor [ ]
- b) Poor [ ]
- c) Good [ ]
- d) Very good [ ]
- e) Others (please specify).....



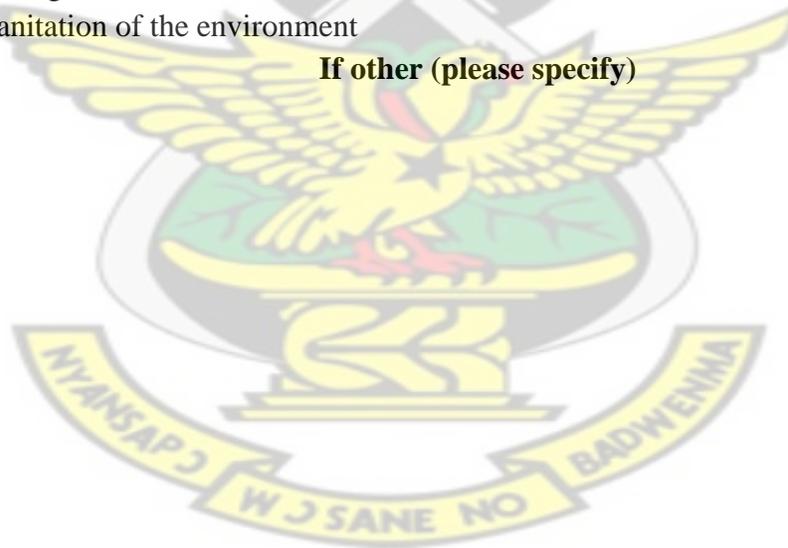
## SECTION B: OPERATIONAL STATE

In your experience, please indicate the operational state of the following elements by ticking the appropriate boxes.

**(2) Very Bad (2) Bad (3) Average (4) Good (5) Very Good.**

Elements	Levels				
	1	2	3	4	5
10. Structural elements (beams, columns, upper floor slabs and stairs)					
11. Walls (external and internal walls)					
12. Finishes (wall finishes, floor finishes and ceilings)					
13. Windows					
14. Doors (external and internal doors)					
15. Roofs					
16. Services (sanitary appliances, building service equipment, disposal installation, water, ventilation, electrical, gas, lifts, protection installation, drainages, external services)					
17. Fittings and furniture					
18. Sanitation of the environment					

**If other (please specify)**



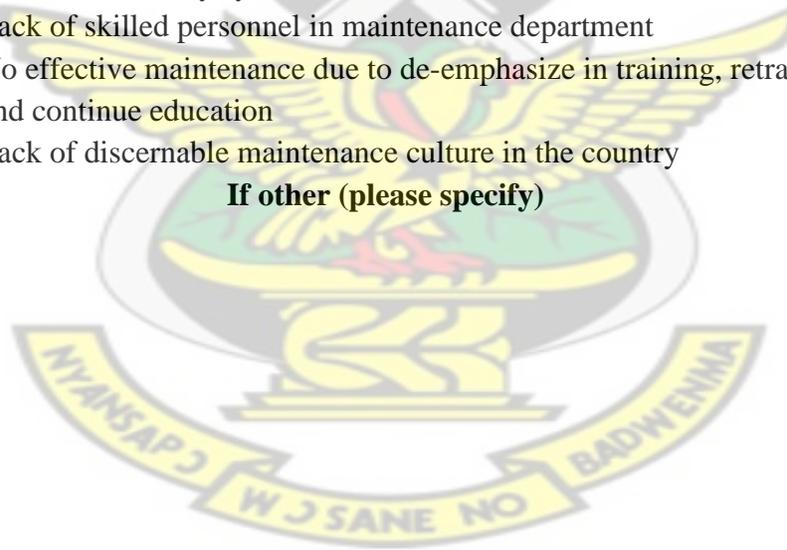
### SECTION C: POOR MAINTENANCE MANAGEMENT

In your experience, please indicate the factor responsible for poor maintenance management of buildings by ticking the appropriate boxes.

**1= Least, 2= Lower, 3= High, 4= Higher, 5= Highest**

<b>Factors</b>	<b>levels</b>				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
14. Attitude of users and misuse of facilities					
15. Persistent breakdown through indiscipline and ignorance factors of building users					
16. Insufficient fund for maintenance job					
17. Natural deterioration due to age and environment					
18. Inefficient inventory system					
19. Inadequate training and development of personnel					
20. Procurement of spare parts becomes difficult due to unavailable fund					
21. Inflation of the cost of maintenance by the operatives					
22. Lack of skilled manpower to maintain work in buildings designed and constructed by expatriates					
23. Frequent shortage of materials and spare parts due to absence of efficient inventory system					
24. Lack of skilled personnel in maintenance department					
25. No effective maintenance due to de-emphasize in training, retraining and continue education					
26. Lack of discernable maintenance culture in the country					

**If other (please specify)**



**SECTION D: GOOD MAINTENANCE PRACTICES**

In your experience, which of the following factor account for good maintenance practices, please indicate the attitude level responsible for poor maintenance management of buildings.

**1= Least, 2= Lower, 3= High, 4= Higher, 5= Highest**

<b>Factors</b>	<b>levels</b>				
	1	2	3	4	5
7. Adequate/appropriate maintenance of facility plant and equipment for maintenance operations					
8. Involvement of maintenance experts at the design stage					
9. Long term arrangement for the supply of essential parts for replacement					
10. Maintenance programme by the maintenance department					
11. Innovate supports services					
12. Planned maintenance programmes					

**If other (please specify)**

Please suggest some strategies that should be adopted for effective maintenance management practices.

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**Thank you**