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ADDIS ABABA INSTITUTE OF TECHNOLOGY  
SCHOOL OF CIVIL AND ENVIRONMENTAL  
ENGINEERING**

**BUILDING MAINTENANCE MANAGEMENT PRACTICES IN  
PUBLIC HOSPITALS OF ADDIS ABABA**

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## **ABSTRACT**

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 works. The aim of this research is to assess the operational conditions carried out by the maintenance departments of public hospital buildings in Addis Ababa. Other objectives are to determine factors affecting the maintenance management and to evaluate the existence of maintenance policy guideline and desirable qualities and important skills for the maintenance execution.

All the 12 public hospitals which are administrated by Ministry of Health, Addis Ababa health bureau, Addis Ababa University and Ministry of defense were the targeted population of this research. Field surveys and administration of questionnaires were used to collect the data.

The result showed that corrective maintenance was found to be in use and was ineffective in ensuring prompt remedial works. The level of manpower required (skilled) was also lacking and not having long-range plan for building maintenance and supply of essential parts for replacement are the most significant factor affecting maintenance management.

Furthermore, attitude of users and misuse of facilities, lack of discernible maintenance culture, inadequate training, use of poor quality components and materials by the maintenance department are factors attribute to poor maintenance management of Addis Ababa public hospital buildings. In view of these findings and by way of recommendations, it was suggested that management should adopt a maintenance policy for effective use in the institution and the entire scheme of corrective maintenance be re-structured.

The study recommended proactive measures to reduce the occurrence of defects in the buildings elements and services. The Government has to provide adequate funding for the running of maintenance departments of public hospitals. And every hospital either public or private must have maintenance policy guiding the implementation of their building maintenance.

Furthermore, training, seminars and workshops should be organized for maintenance officers to update their knowledge with regard to effective maintenance practices. Building elements should be regularly inspected to ensure their functionality.

**Keywords:** maintenance, public hospital buildings, Addis Ababa

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## List of Abbreviations

AHU	Air Handling Units
CEN	Comité Européen de Normalisation (European Committee for Standardization)
CPM	Critical Path Method
EBCS	Ethiopian Building Code Standards
FMOH	Federal Ministry of Health
GDP	Gross Domestic Product
HSDP	Health Sector Development Program
HVAC	Heating, Ventilating and Air-Conditioning
KPIs	key performance indicators
MAI	Maintenance Achievement Index
MDGs	Millennium Development Goals
NGO's	Non-Governmental Organizations
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PERT	Program Evaluation and Review Technique
RHBs	Regional Health Bureaus
UNECA	United Nations Economic Commission for Africa
VCT	Vinyl Composition Tile

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## CHAPTER 1: INTRODUCTION

### 1.1 Background

It is impossible to produce buildings which are maintenance free, but maintenance work can be minimized by good design and proper workmanship carried out by skilled experts or competent craftsmen using suitable codes of installation, essential building materials and methods. Management of any process involves assessing performance, and maintenance management of buildings is no exception (Adenuga et al, 2007). A prime aim of building maintenance is to preserve a building in its initial effective state, as far as practicable, so that it serves its purpose effectively. The best way to achieve excellent maintenance is to have a maintenance management that matches as closely as possible the expected requirements of the user. (Zawawi et al, 2010).

Hospitals and health care buildings are among the most complex indoor facilities with numerous different end uses of indoor spaces and functions (Balaras et al, 2007). Hospitals represent perhaps the most difficult group of public sector buildings to maintain, because of their complex engineering services (Zawawi et al, 2010). Over the passage of time, maintenance function has continuously gone up in terms of its importance. It is recognized that since poor maintenance practices lead to more frequent breakdowns, which may cause anything from inconvenience to catastrophe, maintenance has to be more reliable, more efficient, and more cost effective (Ikhwan and Burney, 1999). The concept of maintainability was formally initiated by the military services of the United States in 1954. In the past few decades, researchers had realized the importance of maintainability of buildings in achieving cost savings and better functioning of facilities (Silva et al, 2004).

The building maintenance practice in Addis Ababa public hospitals did not get enough attention. There are many responsible factors for the in- advancement of building maintenance in public hospitals, such as low budget cost, lack of technical personnel, non-availability of maintenance guideline and policy, lack of maintenance culture, non-availability of materials and equipment are the most responsible factors for the lesser practice of public building maintenance in Addis Ababa. Keeping in mind the above mentioned problems, there are maintenance practices in most hospitals which are done routinely by some Public hospitals like Alert and St Ammanuel hospitals. Currently there is a major maintenance work in Black lion hospital.

## **1.2 Health Services Situation in Ethiopia**

According to the United Nations Economic Commission for Africa (UNECA) country report (2012) Ethiopia, with a total surface area of 1.1 million square kilometers and an estimated population of 82 million in 2011 and growing at 2.6% per year, is the second most populous country in sub-Saharan Africa. The country has great geographical diversity: its topographic features range from the highest peak at Ras Dashen, 4,550 meters above sea level, down to Affar Depression, 110 meters below sea level.

Administratively, Ethiopia is structured into nine regional states and two city administrations. With only 16 percent of the population living in urban areas, the country is one of the least urbanized countries in the world. Addis Ababa, the capital city, constitutes about a quarter of the urban population of the country.(UNECA country report, 2012)

While 15% of the urban population lives in towns with populations more than 100,000 but less than 250,000 and 37% lives in medium size towns with populations between 50,000 and 100,000 and 23.3% live in urban centers with population size of less than 50,000. Ethiopia is an agrarian country and agriculture accounts for 45 percent of the gross domestic product (GDP).The country experiences a heavy burden of disease mainly attributed to communicable infectious diseases. (UNECA country report, 2012)

In Ethiopia the first three hospitals were constructed in 1896 Dejj. Balcha Hospital, Harar Ras Mekonnen Hospital in 1903 and Menelik II hospital in 1910. In 2005, 139 hospitals (87 public and 52 others) were reported. Remarkable hospital construction was done between 1935 and 1948, and recently between 1995 and 2005; however, in the latter case, private hospitals construction took the large share. (The national Center for Biotechnology Information Health Services Situation in Ethiopia, 2010)

The Ethiopian Government has formulated a series of Health Sector Development Programs (HSDPI, II and III 1997-2010) in line with plan for accelerated and sustained development to end poverty (PASDEP) and to achieve the health related Millennium Development Goals (MDGs). A plan to primary health care has been prepared and embedded in HSDP III. This plan aims to address the service coverage problem of the health system through an accelerated expansion and strengthening of primary health care services. The prime target is expansion of essential health system inputs towards the achievement of the Millennium Development Goals (MDGs) (FMOH 2005-2009)

### **1.3 Health Care Coverage and Utilization in Ethiopia**

Federal Ministry of Health (FMOH) in Ethiopia is considered the main provider of health services (primary and secondary health care). FMOH believes that Ethiopian people deserve the best health services and its sustainability in all health facilities which can be achieved through improving the quality of the medical staff, maintaining the health facilities buildings in good status and expanding the capacity of health facilities.

Important steps have been taken in the decentralization of the health care system. Decision making processes in the development and implementation of the health system are shared between the Federal Ministry of Health (FMOH), the Regional Health Bureaus (RHBs) and the Woreda Health Offices. As a result of recent policy measures taken by the Government, the FMOH and the RHBs are made to function more on policy matters and technical support, while the woreda health offices have been made to play the pivotal roles of managing and coordinating the operation of the primary health care services. (The Africa Strategies for Health Care Financing in Ethiopia, 2014)

### **1.4 Health Care Financing in Ethiopia**

As it has been clearly indicated in the 4<sup>th</sup> National Health Accounts (2010), health service in Ethiopia is primarily financed from four sources: the Federal and Regional Governments; grants and loans from bilateral and multilateral donors; non-governmental organizations and private contributions. Although it has significantly improved over the years, health care financing remain a major challenge for the health care system of Ethiopia. Since HSDP III, a health care financing strategy was adopted by FMOH, mainly focusing on improving the efficiency of allocation and utilization of public health resources, mobilization of additional resources from international donors and health development partners, retention and utilization of user fee revenues at health facility level, introducing private wings in the public hospitals and, more importantly, an initiation in the development of risk sharing mechanisms in the form of public and community-based health insurances.

### **1.5 History of Health Care in Ethiopia**

The Ministry of Health's historical account and timeline of health care in Ethiopia stats that the first modern government run hospital was built by Emperor Menelik II in 1910 in Addis Ababa with only 30 beds and was named Menelik II hospital. Currently, there are 139 hospitals with 7,845 beds, 3,231 clinics, and 723 health stations in the country. Half of the hospitals and two-thirds of existing clinics are run by entities other than the Ministry of Health. (Ethiopia Demography and Health, 2013)

### 1.6 Health Services Situation in Addis Ababa

Based on Addis Ababa Socio -Economic Profile (2013) one of the health access indicators is number of health institutions delivering services for the people. Table 1.1 illustrates, the number of health institutions which were operational in Addis Ababa. Until 2013 there were 49 hospitals (30 private and 13 governmental), the data shows that the lion share belongs to the private health sector. (Addis Ababa City Administration Finance and Economic Development, 2014)

Table 1.1 Number of Health Facilities in Addis Ababa

Ownership Type	Number of Health Facilities			
	Hospital	Health Center	Clinic	Health Post
Addis Ababa Health Bureau	5	53	19	34
Ministry of Health	4	0	0	0
Addis Ababa University	1	0	0	0
Ministry of Defense	1	0	0	0
Police Force	1	0	0	0
<b>Total Government</b>	<b>12</b>	<b>23</b>	<b>9</b>	<b>34</b>
Private sector	30	1	376	0
<b>Total</b>	<b>42</b>	<b>26</b>	<b>507</b>	<b>42</b>

Source: Addis Ababa Health Bureau ( 2012/2013) 2004 E.C Annual Report

Hospitals in Addis Ababa are not limited to providing services for the people residing in the city only. As the city is the center of the country in many socio-economic aspects of peoples' life and due to the expectations that better health services are available in Addis Ababa than in other regional centers. Table 2.1 shows the basic public hospitals in Addis Ababa and their basic characteristics.

Table 1.2 Basic Characteristics of Public Hospitals in Addis Ababa

No.	Hospital Name	No. of Beds	Type	Year of Establishment (GC)	Owner
1	Alert Hospital	240	Specialized	1934	Public
2	St. Amanuel Hospital	261	Specialized	1938	Public
3	Armed Forces Hospital	612	General	1956	Defense
4	Black Lion Hospital	800	General	1973	Addis Ababa University
5	Gandi Memorial Hospital	103	General	1962	Public
6	Menilik II Hospital	263	General	1910	Public
7	Police Hospital	252	General	1963	Police
8	Ras Desta Hospital	103	General	1932	Public
9	St. Paul's Hospital	392	General	1969	Public
10	St. Peter Hospital	200	Specialized	1963	Public
11	Yekatit 12 Hospital	199	General	1923	Public
12	Zewditu Memorial Hospital	166	General	1970	Public

Source: Various reports of hospitals and own computation

All of the state run hospitals were built more than 30 years ago. For a city of an estimated four – five million, state run hospitals are the best medical care alternative centers used mostly by the middle-to-low income inhabitants of the city. Health facilities in Addis Ababa provide service to significant number of population in the surrounding areas outside the city and other regional states. As a result, practically high shortage of hospital services is observed. (Addis Standard, Hospitals maintenance situation in Addis Ababa, 2011)

## **1.7 Research Significance**

### **1.7.1 Problem Statement**

Out of the 12 hospitals, the Federal Ministry of Health (FMOH) administers four, two are under the Army and Police, five are under the city government of the Addis Ababa health bureau and one is under the Addis Ababa University. When the hospitals request a maintenance serviceman team of engineers and architects will administer a field study to investigate the area where maintenance is needed. Then tenders will be out for contractors who have experience on maintenance work. The engineering department in the MOH also supervises and supports local maintenance units in the hospitals.

Studies indicated that many factors are responsible for inadequate maintenance process some of them are; lack of maintenance staff, lack of funds and the poor internal organization of maintenance services. In addition, tasks and responsibilities are not defined, job descriptions are unclear leading to a waste of effort and resources, there is no clear separation of responsibility for maintenance work and supervision of local maintenance teams in the hospitals.

Based on the field survey by the researcher, maintenance departments in public hospitals of Addis Ababa are under-utilized by the hospital management, thus their service is limited on only minor maintenance activities. Poor design and old age of the hospital buildings results an essential problem to integrate those old hospital buildings with the current construction and maintenance technology.

The research problem appeared from the necessary need to maintain the old age hospital buildings specially the main hospitals in Addis Ababa and to conserve the new hospital building arising since. Lack of scheduled maintenance activities which may lead in a huge failure in the hospital system at any time seems a big problem.

In addition, most of the public hospitals do not have guideline to follow for maintenance works, and maintenance is always done as per the request of the hospitals, as a result all maintenance work for the hospital buildings are all corrective and immediate maintenance. Preventive and routine maintenance for the hospital buildings is very rare.

## **1.8 Aim and Objectives**

### **1.8.1 Aim**

The aim of the research is to study the maintenance practice and effectiveness of maintenance management system in Addis Ababa public hospitals.

### **1.8.2 Thesis objectives**

- To assess the operational conditions carried out by the maintenance departments of public hospital buildings in Addis Ababa
- To determine factors affecting maintenance management of public hospital buildings in Addis Ababa.
- To evaluate the existence of maintenance policy guideline, desirable qualities and important skills for the maintenance execution.
- To assess the maintenance need and status of public hospital buildings in Addis Ababa.

### **1.8.3 Research Justification**

Public hospital buildings are places of healing people therefore it is important to improve the operation state (physical-functional condition). This study is essential in the sense that it would not only contribute to knowledge and theory, but will also contribute to good maintenance practice in the public hospitals of Addis Ababa. This is because the study will attempt to find out the factors that have contributed to the present state of maintenance.

Furthermore, the study will assist managers of public hospitals to become aware of the current state of their building infrastructure. Also to put in a place adequate innovative measures to prevent buildings from deterioration which ultimately lead to increased cost in restoring these buildings to their original state.

### **1.8.4 Scope of the Study**

The study is on the twelve public hospital buildings of Addis Ababa which is the total population of the study.

### **1.8.5 Limitations of the Study**

Data gathering suffered due to delay in getting responses because of the schedule of work of the Medical Directors and personnel of the maintenance department. In addition record keeping was a problem for most of the hospitals surveyed. There was also a problem on getting data on

budget allocation for maintenance activities which creates a gap on getting a full picture of budget allocation.

The research department of St. Paul's hospital asks for an ethical clearance from ethical board of the institution in order to get any information for the research, thus the researcher couldn't get the required ethical clearance and forced to exclude St. Paul's hospital.

## **1.9 Thesis Organization**

The thesis is divided into five chapters as follows:

### *Chapter 1 Introduction*

This chapter is intended to give a brief background of research problem and assure the importance of maintenance in public hospitals buildings. As well as, it gives a description of the research importance, scope, objectives, limitations and thesis organization.

### *Chapter 2 Literature Review*

This chapter includes a comprehensive literature review of hospitals buildings maintenance management, maintenance definition, types, building maintenance management, and hospital building characteristics.

### *Chapter 3 Research Methodology*

This chapter presents the research flow chart, sample size, questionnaire design and data collection stage.

### *Chapter 4 Data Presentation and Analysis*

This chapter shows the results of the field study, interview and questionnaire on the status of the hospitals buildings maintenance.

### *Chapter 5 Conclusions and Recommendations*

This chapter presents concluding remarks, main conclusions and recommendations drawn from the research work.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.0 Building Maintenance Management**

#### **2.1 Definition of Maintenance Management**

Oxford Dictionary defines the verb “maintain” as cause to continue. Maintenance, therefore, is ensuring that physical assets continue to fulfill their intended functions (Lam, 2008). According to Parida and Kumar (2006) maintenance is defined as the combination of all the technical and administrative actions, including supervision, intended to retain an item, or restore it to a state in which it can perform a required function.

According to European standard CEN (2001) Maintenance is defined as the combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it, to a state in which it can perform the required function (function or a combination of functions of an item which are considered necessary to provide a given service).

Chanter and Swallow (2006) also discuss about definitions for maintenance as:

A combination of any actions carried out to retain an item in, or restore it to an acceptable condition. From this definition two key components can be identified:

- not only actions that relate to the physical execution of maintenance work, but also those concerned with its initiation, financing and organization.
- the notion of an acceptable condition, which implies an understanding of the requirements for the effective usage of the building and its parts, which in turn compels broader consideration of building performance.

Olajide and Afolarin (2012) showed that 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. Management of any process involves assessing performance, and maintenance management of buildings is no exception. In order for any maintenance manager to measure performance and set priorities, the organizational needs have to be considered i.e. the function and performance of buildings and their appropriate standards will be dependent on the user's perception and their primary needs.

Bin Hashem (2006) discuss that the main responsibility of maintenance unit is to maintain all the facilities and infrastructures. The main supporting system such as lift system, air conditional system, air intake and outlet, electrical system, firefighting system, plumbing and sanitary system, cleaning services, civil and structural building, landscape, safety security, pest control, and telecommunication system should be working properly without any disturbance that could affect the entire office work process.

Queensland Department of Public Works (2011) notes that the following conditions are not classified as maintenance:

- Improvements and upgrading to provide additional or new service capability or function
- Upgrading to meet new statutory requirements
- Major refurbishment and replacements to extend the useful life of the building
- Restoration of the entire building to operational condition after total or near total failure (e.g. resulting from natural disasters)
- Work performed under warranty or defects liability period
- Operational tasks to enable occupancy and use (e.g. cleaning, security, waste management) and supply of utilities (e.g. energy, water and telecommunications).

Silva and Falorca (2009) emphasized on the view of point of the increasing costs of new construction, the maintenance of existent buildings has become even more important. The maintenance indicators are identified to complete with the performance indicators respectively which are known as the performance measurement system as shown below in Table 2.1.

- *Functional*- This aspect covers the management service delivery attributes or the service profiles that the management holds.
- *Technical*- Focuses mainly on the daily and scheduled maintenance services provided to the end users of the office buildings.
- *Image*- Is to analyze the internal and external image of the buildings (NikMat *et al*, 2011).

Table 2.1: The Performance Measurement System (NikMat et al, 2011)

<b>Maintenance Aspects</b>	<b>Performance Measurement Dimensions</b>
Functional Management Service Delivery	Delivery Characteristics
	Assurance
	Reliability
	Responsiveness
	Relevance
	Timeliness
	Validity
	Maintenance Services
	Cleaning & Landscaping
Technical Maintenance Services	General Maintenance
	Lightings
	Air Conditionings
	Lifts/ Escalators
	Mechanical & Electrical
	Sanitary & Washing Facilities
	Access, Signage & Parking
	Safety & Security
Building Image	External Finishes
	Internal Finishes

Bin Hashem (2006) listed some factors that influence maintenance in the design stage for building maintenance such as: deterioration, future needs and faulty of choice materials. Cooper and Jones (2008) defined the key factors that contributed to high levels of dissatisfaction of the approach to maintenance programs: (Sustainable Energy Research Group, Sustainable and social housing maintenance, 2012)

- poor specification of initial requirements;
- unclear aims and objectives and inappropriate frameworks;
- an inability to predict long term cost requirements;
- variations in levels of experience of those conducting surveys;
- unrealistic claims by consultants selling survey services;
- inappropriate or unusable data; poor links to organizational objectives; and
- Lack of fit of survey data.

Shah Ali *et al*, (2010) concluded the most dominant factors affecting maintenance cost were building materials, building services, building age and failure to execute maintenance at the right time.

While Cobbinah (2010) showed another type of factors as being responsible for the poor maintenance of public buildings:

- The age of the buildings,
- lack of maintenance culture,
- inadequate funds and high maintenance cost,
- pressure on building facilities by number of users and poor construction work and
- Maintenance work done by maintenance personnel of the institution.

## **2.2 Aims of Maintenance**

According to Afranie *et al*(1999), the primary aim of maintaining a building is to ensure that the buildings continue to serve the purpose for which it was put up. The purposes for which maintenances are undertaken include:

- a) *To maintain the value of a building-* a better maintained building normally has greater value, however, increased value may be marginal as location and size of site all play an important role in the determination of value.
- b) *To ensure optimum use of buildings:* - good maintenance should allow buildings to be used to their full potential.
- c) *To create or maintain suitable appearance:* - can make a positive contribution to external environment and social conditions. Dilapidated buildings can contribute to social deprivation and badly maintained services and facilities, waste energy and resources and can affect the environment
- d) *To maximize the life of main components and materials:* - maintenance can reduce cost of subsequent maintenance by extending periods between repairs and replacements.
- e) To ensure that buildings do not detract from surroundings and also maintain a suitable appearance.

### **2.3 Maintenance Department Functions and Organization**

According to Dhillon, (2002) a maintenance department is expected to perform a wide range of functions including:

- Planning and repairing equipment/facilities to acceptable standards.
- Performing preventive maintenance; more specifically, developing and implementing regularly scheduled work program for the purpose of maintaining satisfactory equipment/facility operation as well as preventing major problems.
- Preparing realistic budgets that detail maintenance personnel and material needs
- Managing inventory to ensure that parts/materials necessary to conduct maintenance tasks are readily available
- Keeping records on equipment, services, etc.
- Developing effective approaches to monitor the activities of maintenance staff.
- Developing effective techniques for keeping operations personnel, upper-level management, and other concerned groups aware of maintenance activities.
- Training maintenance staff and other concerned individuals to improve their skills and perform effectively.
- Reviewing plans for new facilities, installation of new equipment, etc.
- Implementing methods to improve workplace safety and developing safety education related programs for maintenance staff.
- Developing contract specifications and inspecting work performed by contractors to ensure compliance with contractual requirements.

### **2.4 Elements of Effective Maintenance Management**

Dhillon (2002),also states that there are many elements of effective maintenance management system whose effectiveness is the key to the overall success of the maintenance activity. Many of these elements are described below.

#### **2.4.1 Maintenance Policy**

A maintenance policy is one of the most important elements of effective maintenance management. It is essential for continuity of operations and a clear understanding of the maintenance management program, regardless of the size of a maintenance organization. Usually, maintenance organizations have manuals containing items such as policies, programs, objectives, responsibilities, and authorities for all levels of supervision, reporting requirements,

useful methods and techniques, and performance measurement indices. Lacking such documentation, i.e., a policy manual, a policy document must be developed containing all essential policy information.

#### **2.4.2 Material Control**

Efficient utilization of personnel depends largely on effectiveness in material coordination. Material problems can lead to false starts, excess travel time, delays, unmet due dates, etc. Steps such as job planning, coordinating with purchasing, coordinating with stores, coordination of issuance of materials, and reviewing the completed job can help reduce material related problems.

#### **2.4.3 Job Planning and Scheduling**

Job planning is an essential element of the effective maintenance management. A number of tasks may have to be performed prior to commencement of a maintenance job; for example, procurement of parts, tools, and materials, coordination and delivery of parts, tools, and materials, identification of methods and sequencing, coordination with other departments, and securing safety permits.

Maintenance scheduling is as important as job planning. Schedule effectiveness is based on the reliability of the planning function. For large jobs, in particular those requiring multi-craft coordination, serious consideration must be given to using methods such as Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) to assure effective overall control.

#### **2.4.4 Backlog Control and Priority System**

The amount of backlog within a maintenance organization is one of the determining factors of maintenance management effectiveness. Identification of backlogs is important to balance manpower and workload requirements. Furthermore, decisions concerning overtime, hiring, subcontracting, shop assignments, etc., are largely based on backlog information. Management makes use of various indices to make backlog related decisions.

The determination of job priority in a maintenance organization is necessary since it is not possible to start every job the day it is requested. In assigning job priorities, it is important to consider factors such as importance of the item or system, the type of maintenance, required due dates, and the length of time the job will take.

### 2.4.5 Performance Measurement

Successful maintenance organizations regularly measure their performance through various means. Performance analyses contribute to maintenance department efficiency and are essential to revealing the downtime of equipment, peculiarities in operational behavior of the concerned organization, developing plans for future maintenance, and so on.

### 2.5 Maintenance Work Quality

According to Dhillon, (2002) good quality maintenance work leads to good results: reduction or elimination of unexpected failures, lower costs, better safety, increased confidence in work performed, etc. Good quality maintenance work can only be accurately measured after the specification of expectations. Once the aim of maintenance work is clearly identified, steps such as those listed below can be useful in producing good quality maintenance work.

- *Limit misunderstanding:* -Often the request for maintenance is incomplete and inaccurate. Ensure the work's proper completeness and accuracy prior to taking concrete steps.
- *Define goals:* -Goals should be set by the maintenance team and its supervisors. Ensure that the team clearly understands the objectives for the maintenance work prior to its start.
- *Avoid unsafe practices:* - Do not permit temptation to minimize maintenance time by short-cutting prescribed safety procedures.
- *Do not overlook secondary damage:* - Ensure that less dramatic secondary problems are not overlooked. Otherwise, they could be costly at a later stage.
- *Report as the maintenance work progresses:* - Report all relevant information that could be useful for performing similar tasks in future.
- *Do not use second-hand parts:* -Ensure that failed parts are not replaced with second-hand parts.
- *Reinstall with extra care:* -Due to various factors, the condition of some equipment/system parts or materials may deteriorate with time; thus when new or repaired parts/materials are reinstated, excessive force can damage other parts.
- *Follow a system approach to box up:* - There is tendency to close up quickly after finishing a repair. After the repair, it is important to consider the following factors:
  - Check for safety. Ensure that all hot-keys are returned to appropriate places and involved persons accounted for.
  - Check for all repair tools/equipment used. Do not restart in the event of missing items.
  - Test the repaired item prior to its hand-back.
  - Complete all appropriate job records.

## 2.6 Maintenance Personnel Safety

Usually, emphasis is placed on designing safety into machines rather than on the safety of the operators, maintainers, etc. On occasion, more protection is required for maintenance workers beyond the safety designed into machines or processes. (Dhillon, 2002)

Two important areas of maintenance worker safety are respiratory protection and protective clothing. The main protective clothing's which are necessary for the safety of maintenance personnel are stated below.

- *Ear defenders*: These are necessary where machine or process noise can damage maintenance workers' ears.
- *Boots and toecaps*: Well-fitting boots with steel toecaps can reduce the risk of injury in situations such as dismantling used equipment where heavy metal parts are difficult to hold and are likely to slip and drop unexposed feet.
- *Helmets*: These are useful to protect maintenance workers from head injury
- *Gloves*: These are important to protect hands from injury when performing various types of maintenance tasks.
- *Goggles, visors, screens, and safety glasses*: These items protect eyes from flying chips, sparks, chemical sprays, jetted hydraulic fluid, etc.

## 2.7 Maintenance Type Classification

According to the maintenance definition that is offered at the beginning of the chapter, maintenance is a combination of actions intended to retain an item in, or restore it to, a state in which it can perform the function that is required for the item to provide a given service. This concept leads to a first classification of the maintenance actions in two main groups or types: actions oriented towards retaining certain operating conditions of an item and actions dedicated to restoring the item to said conditions.

Figure 2.1 illustrates type of maintenance those which are categorized by means of terms and definitions as stated below. (BS 3811: 1984)

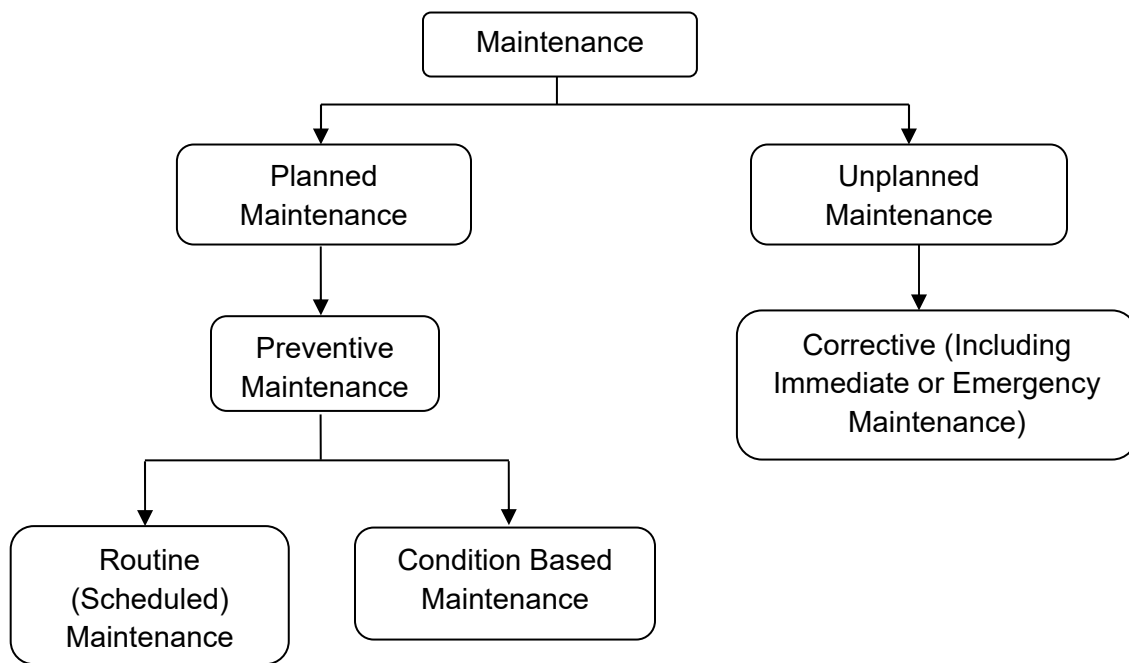


Figure 2.1 Types of Maintenance

Source: BS 3811: 1984 (Glossary of maintenance management terms in terotechnology)

- i. Planned maintenance: ‘The maintenance organized and carried out with forethought, control and the use of records to a predetermined plan.’
- ii. Unplanned maintenance: “The plan carried out to no predetermined plan.” It refers to work necessitated by unforeseen breakdown or damages. For example, the ripping-off of a building, through the action of a storm, and its remedial action constitute unforeseen damages. It can also be termed unexpected and unavoidable maintenance.
- iii. Preventive maintenance: “The maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or the performance degradation of an item.”
- iv. Corrective maintenance: “The maintenance carried out after a failure has occurred and intended to restore an item to a state in which it can perform its required function.”
- v. Immediate (Emergency) maintenance: “The maintenance which it is necessary to put in hand immediately to avoid serious consequences.” This is referred to as day-to-day maintenance, resulting from such incidents as gas leaks and gale damage.
- vi. Condition-based maintenance: “The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.”
- vii. Running maintenance: “Maintenance which can be carried out whilst an item is in service.”

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

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

## 2.8 The Value of Preventive Maintenance

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

According to Seeley(1987) successful preventive maintenance programs should achieve these goals:

1. *Help buildings function as they were intended and operate at peak efficiency, including minimizing energy consumption.* Because preventive maintenance keeps equipment functioning as designed, it reduces inefficiencies in operations and energy usage.
2. *Prevent failures of building systems that would interrupt occupants' activities and the delivery of public services.* Buildings that operate trouble-free allow public employees to do their jobs and serve the public. Because preventive maintenance includes regular inspections and replacement of equipment crucial to operating a building, maintenance staff reduces the problems that might otherwise lead to breakdown in operations.
3. *Sustain a safe and healthful environment by keeping buildings and their components in good repair and structurally sound.* Protecting the physical integrity of building components through preventive maintenance preserves a safe environment for employees and the public.
4. *Provide maintenance in ways that are cost-effective.* Preventive maintenance can prevent minor problems from escalating into major system and equipment failures that result in costly repairs. In avoiding costs of major repairs, preventive maintenance creates efficiencies. Increasing preventive maintenance can reduce time spent reacting to crises, which is a more cost-effective way to operate buildings. Deferring preventive maintenance can generate higher costs over the long term.

## **2.9 Components of Building Maintenance**

Building Maintenance involves a considerable amount of work which Harper (1996) as cited in Afranie et al, (1999) has been categorized into three components namely; Servicing, Rectification and Replacement.

### **2.9.1 Servicing**

Servicing is essentially a clearing operation undertaken at regular intervals of varying frequency and is sometimes termed day-to-day maintenance. Daily sweeping of floors, monthly washing and cleaning of windows and regular painting for decoration and protection every four years are some examples of servicing. Servicing becomes necessary because of constant use of facilities, the effect of the weather and atmospheric conditions on the components of the building.

### **2.9.2 Rectification**

Rectification work usually occurs fairly early in the life of a building; but it can also occur sometime within the life span of the building. It arises from shortcoming in design, inherent fault in or unsuitability of component, damage of goods in transit or installation and incorrect assembly. Rectification represents a fruitful point at which to reduce the costs of maintenance, because it is available. All that is necessary at any rate in theory is to ensure that components and materials are suitable for their purpose and are correctly installed. Rectification work could be reduced by the development and use of performance specifications and codes of installation Lee, (1987 P. 23).

### **2.9.3 Replacement**

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

## **2.10 Other Maintenance-Related Concepts and Definitions as related to Building**

### **2.10.1 Prevention**

It entails protecting housing by controlling its environment, thus preventing agent of decay and damage from becoming active. It involves clearing schedule, good housekeeping and proper housing management.(Cobbinah, 2010)

### **2.10.2 Consolidation**

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

### **2.10.3 Rehabilitation**

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

### **2.10.4 Repair**

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

### **2.10.5 Renovation**

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

### **2.10.6 Refurbishment**

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

### **2.10.7 Extension**

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

## **2.11 Maintenance Policy Framework**

BS 3811:1984 defines maintenance policy as a strategy within which maintenance decisions are made. This may be considered as a set of ground rules for the allocation of resources between the various types of maintenance action that can be taken. Maintenance policy should be considered in the widest possible context throughout all the phases in the life cycle of a building.

Furthermore, it needs to be recognized that policy influences on maintenance may not always be direct ones. In other words, it is possible to distinguish clearly between:

- policy that is specifically directed toward building maintenance
- policy decisions taken with respect to other matters, but which will influence maintenance.(Chanter and Swallow, 2006)

## **2.12 Functions of a Maintenance Department**

According to Chanter and Swallow (2006) functions of maintenance department are classified as advisory function, organizational function & operational function.

### **2.12.1 Advisory Function**

This can be seen as a key area of interface, involving liaison with owners and consultation with senior management, to advice on such matters as: (Chanter and Swallow, 2006),

- the development of the brief for new buildings, their design and procurement
- the production of as-built drawings and maintenance manuals
- the performance requirements of new buildings in general
- the provision of specialist advice, and other services related to the areas of adaptation, refurbishment and extensions/modifications
- determination of standards to be achieved, and the setting of performance indicators in relation to the primary needs of the organization, e.g. quality and response times
- provision of ongoing information on building condition, which in conjunction with financial information may help senior management in budgeting decisions, and also on decisions as to whether to repair, replace or renew
- advising senior management on the organizational needs of maintenance, to ensure that an efficient organization exists, with the correct relationship to the rest of the organization.

### **2.12.2 Organizational Function**

This must be considered with respect to internal functions, and also with points of interface, both within and externally, so that each of the following may be relevant.

(1) The formation of a basic internal administrative system that clearly defines:

- roles and responsibilities
- organizational interrelationships
- communication channels
- chains of command and patterns of accountability
- standard procedures.

(2) The defining of proper protocols for dealing with external organizations, and other departments within the organization. Within this function careful consideration will need to be given to the procedures for communicating information, whether written or oral. Increasingly, information technology is of critical importance when considering administrative and organizational systems.

### **2.12.3 Operational Function**

The relevant operations can be classified under the following headings whether they are carried out in house or by an external agency: (Chanter and Swallow, 2006)

- identifying the work input
- programming the work
- ensuring the work is executed
- monitoring and controlling quality, cost and time
- authorizing and arranging payment
- Providing management information including feedback.

### **2.13 Maintenance and the Building Manual**

According to Chanter and Swallow (2006) a disciplined approach to the preparation of a building manual should generate the following benefits.

- a) Enable a better dialogue to exist between the designer and the maintainer, and also have the effect of promoting some feedback to the design team. If the maintainer has been involved at the brief development stage, as is advocated, then the preparation of the manual should follow quite naturally.
- b) Enable a property to be maintained more effectively, both in the organizational sense, and to the proper technical standard.
- c) Enable and encourage the building owner to plan the effective maintenance of the building, in terms of both planning maintenance programmes, and assisting in the formulation of budgets. It may, in addition, provide an important tool for the maintainer when he seeks maintenance funding.
- d) By helping to ensure that the building is used properly, it contributes to the reduction of avoidable maintenance tasks.
- e) As a discipline for the design team, it fosters a more rigorous consideration of the effectiveness of the building in use, and may encourage a critical appraisal of how well intentions were defined, and then met. In this sense it provides some sort of testing ground for the assumptions made at the earliest stage of the project.

## **2.14 Common Building Defects**

An important segment in the maintenance management system is the analysis of defects in the buildings. Maintenance is now recognized as tool to promote sustainability in buildings.

Table 2.2 shows common types of building defects with their symptoms and possible causes. Common types of building defects include: structural defects resulting in cracks or collapse; defective or faulty electrical wiring and/or lighting; defective or faulty plumbing; inadequate or faulty drainage systems; inadequate or faulty ventilation, cooling or heating systems; inadequate insulation or sound proofing; and inadequate fire protection/suppression systems. Additionally, dry rot, wood rot, mold, fungus, or termite or vermin infestation may also be the result of a building defect. An expert, such as an engineer or architect will be able to determine whether a construction problem is the result of improper design, material, or workmanship (Ahzahar et al, 2011).

According to Lourenco,(2006) humidity is a major source of problems in buildings worldwide, moisture can damage the building structure, the finishing and furnishing materials, besides being a direct cause of human discomfort, high indoor humidity promotes mold growth, which can have adverse health impacts on the occupants.

Ahzahar, (2011) also discuss building maintenance prepared through an accurate program of repeated maintenance plays a major role in preventing building defects. Buildings that neglect building maintenance may fall into several defects which may lead to structural failures.

Table 2.2 Common Building Defects and their Symptoms (Fixit institute, 2010)

Common Defects	Symptoms/Phenomenon	Possible Causes
1. Defective concrete spilling or loose plaster in ceilings	<ul style="list-style-type: none"> <li>• Surface with water/rust staining, water leakage</li> <li>• Patterned cracking</li> <li>• Bulging, falling off of concrete patches with reinforcement exposed, often rusty</li> <li>• Falling off of plaster/tiles</li> </ul>	Defective concrete as a result of ageing is commonly found in old buildings. Persistent water leakage may affect the steel reinforcement. Weak concrete caused by the use of salty water in concrete mix, or overloading are also common causes in spelling
2. Water seepage from external wall, window, roof, or from ceiling	<ul style="list-style-type: none"> <li>• Water staining</li> <li>• Peeling off of paint or wall paper</li> <li>• Water dripping</li> <li>• Growth of fungus</li> <li>• Defective concrete, plaster or tiles</li> <li>• Rust staining</li> </ul>	External water seepage could be due to a variety of reasons including cracks on external wall, honey comb concrete, defective sealant at window, defective water-proofing membrane at roof, defective external water and drainage pipes, etc
3. Structural cracks in Walls	<ul style="list-style-type: none"> <li>• Cracks that penetrate through finishes into the concrete or bricks</li> <li>• Long, continuous cracks across width of wall</li> <li>• Diagonal cracks at corners of window or door</li> <li>• Cracks with rust staining</li> </ul>	Structural cracks may be caused by many factors, e.g. excessive movement of the building structure, unwanted ground settlement, serious overloading, and weaknesses caused by corrosion/deterioration of materials, or damage by accidents, or poor design/construction, etc. Detailed investigation must be carried out to identify the cause(s) which must be removed or rectified before the cracks are repaired
4. Structural cracks in columns and beams	<ul style="list-style-type: none"> <li>• Hairline cracks.</li> <li>• Multi-directional cracks (shrinkage cracks)</li> <li>• Cracks between panel walls and structural elements e.g. brick wall and beams/columns</li> </ul>	Cosmetic shrinkage cracks in plaster or other forms of finishes will affect the appearance only and do not pose any safety concern. They are small hairline cracks developed within the finishes layer not penetrating down to the reinforced concrete structure
5. Defective external wall finishes/mosaic tiles/ceramic tiles/stone cladding/curtain wall	<ul style="list-style-type: none"> <li>• Debonding of finishes/tiles from wall structure resulting in “hollow sound” when tapped with a hammer</li> <li>• Cracking of wall surfaces</li> <li>• Bulging with hollow base</li> <li>• Falling off</li> </ul>	The defects could be due to ageing, structural movements, defective workmanship during installation, thermal movement, defective or missing expansion joints, damage by external factors (e.g. falling objects during typhoon), ingress of water into the gap between the finishes or tiles and the structure, etc.

### **2.15 Hospital Building Maintenance Management**

The need for maintenance arises because buildings inevitably deteriorate with time due to effect of various causes. Building maintenance especially in public hospital buildings as the type that could no longer stand the test of time. Historically, in both public and the private sectors, 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 could be better utilized. (Afolarin, 2012)

A hospital is not a mere building, but a complex social institution that handles the dynamics of life and death situations during the process of rendering health care. What makes a hospital a special facility is the 24 hours a day and 7 days a week facility they provide. Furthermore, a mistake in a hospital building management can cost the lives of many human beings at a time. These characteristics represent unique operating conditions and a bottom-line that involves much greater stakes than the profit-only vision of most business ventures. (Adenuga, 2010) Hospital maintenance means much more than maintaining the equipment to keep the hospital building functional.

Maintenance workers have to maintain the equipment that keeps the patients alive too. That equipment is required for patient needs and is required to be maintained regularly for function ability. Hospital equipment like hospital beds and room equipment needs more precise maintenance to work properly than the building equipment does. This type of equipment that patients use when they're in the care of the hospital and that equipment is what they use to provide the care for the patients for their stay in the hospital facility.(McClay, 2009)

Building maintenance has consistently been treated as the 'poor relation' of the construction industry, attracting only a tacit recognition of its importance, both within the industry and amongst building owners. This manifests itself in a general lack of understanding of both its scope and its significance by all parties to the building procurement, construction, and management processes. In consequence, the backlog of repair and maintenance work required to bring the country's building stock to a minimum acceptable level continues to grow at an unacceptable rate.(Chanter and Swallow, 2006)

## **2.16 Hospital Building Characteristics**

Hospital buildings can be described as sophisticated public areas due to their functional organizations complexity and architectural configuration.(Graip, 2011). The increase in sophistication and complexity of medical services within the health service is reflected in the sophistication and complexity of buildings, their finishes, fittings, contents and services. (Al-Zubaidi, 1997)

Healthcare buildings represent, perhaps, the most difficult group of largely public sector buildings to maintain because of their complex engineering services and their heterogeneous nature. Furthermore, safety and hygiene considerations make the condition of these buildings a particularly sensitive issue. (Chanter and Swallow, 2006)

There are factors such as an increase in patient numbers, demands for more hospital beds, and expansion of hospital divisions, all make the original hospital configuration inadequate, and additions or alterations must be added to the building in order to meet both current and future needs. Because hospitals cannot suspend all medical practices or reject patients, the reconstruction of hospital building must coincide with its normal hospital hours. (Ching et al, 2011)

Hospitals are constantly renovating, whether they are just adding electrical outlets or communications cables, or engaging in more complex projects that involve moving functions and building additions to the existing structures. This kind of change is a result of many factors: changing personnel, new technologies, and competitive pressure. Some changes, however, may affect the use of spaces or facilities originally planned and built for emergency operations. For instance, renovation may inadvertently upset bracing for piping and communications conduits, making them more vulnerable to hazards like earthquakes or high winds.(Kennett, 2006).

Standards and requirements of some of hospital building functions and their characteristics are stated below.

### **2.16.1 Operating Rooms (ORs)**

Operating room is the hospitals largest cost and revenue department, it has a major impact on the performance of the hospital as a whole. Health managers have to anticipate the increasing demand for surgical services (Cardon et al, 2010). Balaras et al (2006) believed that operating theatre design has responded to changes in surgical needs and practice. The size and number of ORs in a hospital depends on the total size of the facility, the number of beds and the type of medical treatment.

For surgeons and medical staff, and of course, the patients, heating, ventilating and air-conditioning (HVAC) installations control indoor air quality and aseptic conditions, and secure healthy, safe and suitable indoor thermal (i.e. temperature, humidity, air quality and airflow) are vital demand conditions. The air in an OR must be aseptic, at a reasonably constant temperature and humidity and have relatively low velocity in order to avoid drafts and swirls that promote the recirculation of microbes and may disrupt the procedures during an operation (Balaras et al, 2006).

### **2.16.2 Ventilation**

Yam et al (2011) emphasized on the idea that since the development of effective ventilation systems, most hospitals were designed as “thick” buildings, where many areas do not have natural light and depend on mechanical ventilation to be usable. The main sources of air supply for most hospitals are natural ventilation and installed air handling units (AHU) that draw air from outside the hospital building.

Chow and Yang (2003) believed that the provision of ventilation system in a hospital operating room is crucial for human comfort and protecting the patient and surgical staff against hazardous emissions. In order to reduce microbial exposure, the use of laminar flow ventilation is the engineering practice in those operating rooms designed for deep wound surgery. The supply air diffuser is located at the ceiling directly above the operation area, with the low-level exhaust outlets at the room periphery. This arrangement develops a down flow of clean air through the breathing and working zones, then to the floor level for exhaust.

### **2.16.3 Rooms Planning**

Arrangement of rooms was considered on particular, decisions were made on the number of bays, single rooms, bed spacing, utilities and toilets. Clinical user groups were formed early in 1998 to ensure that all interests were included. Some clinicians regularly attended and contributed to these meetings. Others did not and as a result may not now have the environment they wished for. (Wilson et al, 2006)

### **2.16.4 Hospital Floor**

Department of veterans (2008) recommend that hospital floors must perform criteria such as durability, slip resistance, hygiene and maintenance, these characteristics are vitally important to suit different healthcare environments. Floors in exam rooms, treatment rooms, and most other spaces should be vinyl composition tile (VCT). Floors in toilet rooms should be ceramic tile with a ceramic tile base. Floors in radiographic rooms require a 10 cm deep depression to facilitate installation of the floor trench duct system. Floors in interventional radiology rooms or radiographic rooms intended to support image- guided or minimally-invasive procedures should be welded seam sheet flooring with an integral base.

## **2.17 Public Hospital Building Maintenance in Addis Ababa**

Federal Ministry of Health (FMOH) in Ethiopia is considered the main provider of health services (primary and secondary health care). FMOH believes that Ethiopian people deserve the best health services and its sustainability in all health facilities which can be achieved through improving the quality of the medical staff, maintaining the health facilities buildings in good status and expanding the capacity of health facilities.

In Ethiopia the first three hospitals were constructed in 1896 Dej. Balcha Hospital, Harar Ras Mekonnen Hospital in 1903 and Menelik II hospital in 1910. In 2005, 139 hospitals (87 public and 52 others) were reported. Remarkable hospital construction was done between 1935 and 1948, and recently between 1995 and 2005; however, in the latter case, private hospitals construction took the large share.

Out of twelve public hospitals the Federal Ministry of Health (FMoH) administers four, two are under the Army and Police, five are under the city government of the Addis Ababa health bureau and one is under the Addis Ababa University. The maintenance and rehabilitation of those public hospitals will be executed by the mentioned responsible offices.

The maintenance of existing Amanuel General Hospital and Mental Health Institution building was completed. In addition the FMOH plans to develop and locate a National Institute of Mental Health (NIMH) at Kotebe area of Addis Ababa. The project has been conducted in two phases; Phase I includes construction of the new general hospital with 161 inpatient beds for children and adults. While, phase II includes the construction of the research center and administration buildings.

Currently, in Black lion hospital the right wing of the hospital is under major maintenance and additional expansion and design changes are under progress. In Alert Hospital, separate waiting area building for the existing out-patient diagnosis block was constructed and maintenance work for the training center building within the hospital was performed.

## **2.18 Previous Related Research**

### **a. Saudi Arabia**

Ikhwan and Burney, (1999) developed research in order to assess the existing maintenance practices in Saudi Arabia; a survey was carried out in twenty hospitals of Jeddah and Taif cities. These hospitals were equally divided between the government and private sectors. On a combined basis; the results present an encouraging picture of the maintenance practices. The proportion of maintenance staff is high, the workers are provided training facilities, they have vocational qualifications, the system of working includes both predictive maintenance and breakdown maintenance and is fairly well developed, the facilities are mostly provided, various maintenance reports are prepared, and Maintenance Planning and Control Offices are there in most of the hospitals. The more serious problems faced are regarding non availability of spares, shortages of technical manpower and lack of funds.

### **b. Palestine**

The aim of the research was to study the maintenance performance indicators in order to control the operation of hospital building maintenance in the Gaza Strip which was prepared by Farida Emad El Shorafa (2013). Another objective of this research is to study the operational conditions and factors that carried out and affect the maintenance management and deriving a suitable framework for the minimum requirements.

The results showed that major of the maintenance department activities in hospitals buildings is getting better and all the large scale maintenance projects are corrective maintenance. The study recommended developing a team vision for hospital maintenance department, changing the work style and culture towards maintenance, making certified periodic maintenance checklists, developing and implementing adequate KPIs for the Gaza strip hospital status.

### **c. Malaysia**

A research examined the process of building maintenance and management in Malaysia with the aim of identifying factors causing poor maintenance in various types of buildings, and delivering a new improved process. The results appeared that maintenance work in Malaysia is described as a service industry. Most buildings face similar problems in terms of breakdowns and other weaknesses that have an effect on the quality of the system. Lighting, HVAC, telecommunications and sanitation need the most maintenance attention. Scheduling and prevention planning would be good solutions to improve this situation (Zawawi et al, 2010).

Another study conducted by Yahya and Ibrahim (2012) aimed to develop a maintenance achievement index (MAI) to benchmark the performance of building maintenance from a number of key performance indicators (KPIs). The findings of study had shown that building maintenance practitioners believe quality, safety, time, cost, functionality, and environmental friendliness can be considered as KPIs for building maintenance activities.

#### **d. Nigeria**

A study was held by Afolarin, (2012) in South-West, Nigeria covered 46 public hospitals representing to examine the labor composition for maintenance works in the public hospital buildings in South-West, Nigeria, and in the process identified if there are any significant differences in the execution of maintenance works using outsourcing and in-house labor. 40% of the total number of existing public hospitals based on stratified random sampling technique. Data collected were analyzed using mean item score, and spear rank correlation coefficient. Findings of the study revealed that the staff strength of the maintenance departments is inadequate and they are not experienced on hospital maintenance management. Majority of the users of public hospital buildings do not have access to any training on effective use of hospital facilities. The skills considered necessary for an effective maintenance manager in executing maintenance operations in public hospitals are also revealed. The cause of low motivation in executing the desired maintenance programs was also established.

#### **e. Ghana**

A study from Ghana was designed to assess the current condition of public buildings, identify the underlying principal causes of poor maintenance of public buildings, analyze the maintenance policy and practice and capacity of the maintenance and estate departments of public institutions and make suggestions and recommendations towards the adoption of effective maintenance policy and innovations that would address the building maintenance problem in public institutions.

The study has established that housing maintenance is a real problem among public institutions in Ghana, with about 83 percent of all residential buildings of public institutions surveyed having maintenance problems. The maintenance problems the study observed have been influenced by the age of the buildings, lack or absence of a national maintenance policy, inadequate funds and high cost of maintenance, low capacity of maintenance staff, apathy and lack of patriotism on the part of occupants, pressure on buildings due to the number of users among others.(Cobbinah, 2010).

## **CHAPTER 3: METHODOLOGY**

### **3.1 Overview**

Research has its special significance in solving various operational and planning problems. The main role of this chapter is to describe the research method adopted. It presents, in clear way, the type of methodology adopted, the data collection methods and instruments used as well as the analysis techniques used.

The purpose of the research and the nature of problem to be solved have a significant bearing on the methodology that needs to be adopted. As mentioned in chapter one there are three objectives for this research:

- To assess the operational conditions carried out by the maintenance departments of public hospital buildings in Addis Ababa
- To determine factors affecting maintenance management of public hospital buildings in Addis Ababa.
- To evaluate the existence of maintenance policy guideline and desirable qualities and important skills for the maintenance execution.

The study is qualitative or descriptive in nature, which is based on secondary data, obtained through different literature, primary data obtained from questionnaires, interviews with key persons and active observations.

### **3.2 Research Flow Chart**

A research needs a design or a structure before data collection or analysis can commence. A research design is not just a work plan. The function of a research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible.

A research design, therefore, is the logical step that links research's empirical data to the research question and ultimately to the conclusion (Yin, 2002) by dealing with what question to study, identifying relevant data, devising mechanisms to collect the data and devising mechanisms how to analyze the results to reach conclusion (Philliber et al., 1980).

A research design involves a critical review and articulation of the research questions that is tailored to the problem statement, the methodical design of the research and philosophical

stand adopted the critical design of the research instrument, collection of the data needed and critical analysis of same to reach to informed conclusion.

Accordingly, the research design for this study is presented in the form of a flow chart divided into nine steps:

*Step 1:* Initiating the research idea and its applicability with the supervisor.

*Step 2:* Beginning of gathering some information about the hospital building maintenance.

*Step 3:* Writing the proposal for the research describing brief summary how the research will look like and get the supervisor's approval.

*Step 4:* Starting an initial survey in hospitals to determine what type of information needed.

*Step 5:* Reading literature review about the type of maintenance systems/ in use, level of defects and remedies in hospitals buildings and preview previous research findings on different countries.

*Step 6:* Design the questionnaire and get the supervisor's approval.

*Step 7:* Starting to fill the questionnaire.

*Step 8:* Statistical analysis of data and extract results using descriptive statistics methods using Microsoft excel.

*Step 9:* Conclusion and recommendations based on the results of the analysis.

All these steps are illustrated in the research methodology flow chart showed in Figure 3.1.

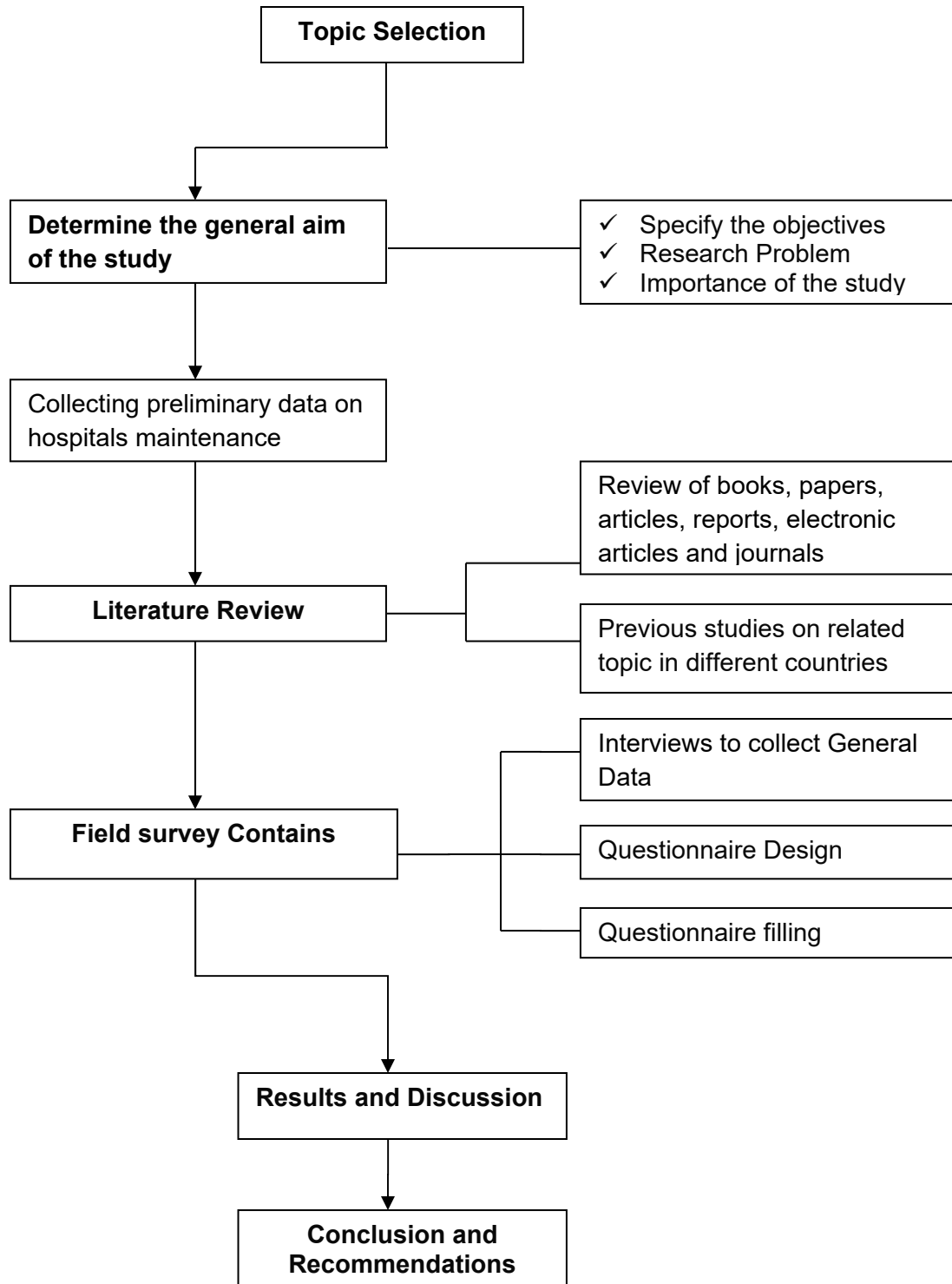


Figure 3.1 Research Methodology Flow Char

### 3.3 Research Population and Sample Size

Currently, Addis Ababa has 12 state run hospitals as shown on Table 3.1 which is the targeted population. The Federal Ministry of Health (FMoH) administers four, two are under the Army and Police, five are under the city government of the Addis Ababa health bureau and one is under the Addis Ababa University.

Table 3.1 Maintenance Center and Hospital under Responsibility

No	Maintenance Center	Hospital Under Responsibility
1	Ministry of Health	Alert, St. Amanuel, St. Paul's and St. Peter Hospitals
2	Addis Ababa University	Black Lion Hospital
3	Addis Ababa Health Bureau	Gandi Memorial, Menilik II, Yekatit 12, and Zewditu Memorial Hospitals, Ras Desta Hospital
4	Ministry of Defense	Armed Forces Hospital
5	Federal Police	Police Hospital

### 3.4 Data Collection

After reviewing the literature and conducting the pilot survey on the situation of public hospitals in Addis Ababa, tools used in this research were an interview and questionnaire. Questionnaire is considered as the heart of a survey operation.

The data is analyzed using various methods such as descriptive statistical method of analysis and the findings were described and presented in the form of tables, graphs and charts format.

#### 3.4.1 Sample Size

In order to get sufficient information and to reach at a reasonable and substantiate conclusion, taking enough sample size is decisive. Therefore, eleven public hospitals (92%) are taken for the study. Accordingly, from a total of maintenance department staff 35% is taken, 10% of medical staff, 12% of administrative staff, 15% of management staff and 2.5% of patients were taken. Comparing with the number of beds the sample size for patients is found to be too low.

Three categories of questionnaires were designed for this study and were directed to the maintenance staff, Hospital staff (Medical, Administrative & Management) and patients of hospitals. The questionnaires were developed both in English and Amharic. Hence, a total of 210 questionnaires were sent out to the eleven public hospitals, as shown on Table 3.2 of which a total of 173 questionnaires were completed and used for the analysis.

Table 3.2 Sample Size and Response Rate

Category	Sample Size	Number Returned	Response Rate (%)
Maintenance staff	28	23	82.1%
Medical staff	64	56	87.5%
Administrative staff	42	35	83.3%
Management Staff	20	17	85.0%
Patients	56	42	75.0%
<b>Total</b>	<b>210</b>	<b>173</b>	<b>82.4%</b>

### 3.5 Questionnaire Design

A questionnaire was designed based on previous literature review and it was modified according to the pilot study. The questionnaire included five parts of questions; these parts were designed to meet the first three objectives.

*Part one* was about general information regarding the hospital buildings location and its occupancy year, hospital bed occupancy, type of maintenance done and maintenance expenditures.

*Second part* included performance measurement dimensions like responsiveness, relevance and delivering characteristics. These were asked as yes or no questions.

*Third part* was about the maintenance staff number, the categorizations and their specialty.

*Fourth part* listed the maintenance department activities in hospitals buildings, which includes maintenance activities frequency.

*Fifth part* includes the maintenance staff skills, trainings, motivation and if there is training on how to conduct assessment for building maintenance. In addition the existences of maintenance guide lines and maintenance log-book.

Table 3.3 Parts Covered in Questionnaire

No	Main Objective	Questionnaire parts
1	Assess the operational conditions carried out by the maintenance departments of public hospital buildings in Addis Ababa.	Part 1. General information of the selected hospitals buildings
		Characteristics of the facility <ul style="list-style-type: none"> <li>• Total number of patient beds</li> <li>• Age of the building</li> <li>• Maintenance Types</li> </ul>
		Part 2. Information of the selected hospitals buildings maintenance department
		<ul style="list-style-type: none"> <li>• No of employees and their categorization</li> </ul>
2	Determine factors affecting maintenance management of public hospital buildings	Part 3. Performance measurement dimensions the performance of building maintenance management department <ul style="list-style-type: none"> <li>• Timeliness</li> <li>• Delivering characteristics</li> <li>• Responsiveness</li> </ul>
		Part 4. Maintenance department Activities in hospitals building
		<ul style="list-style-type: none"> <li>• Problems in hospital building maintenance</li> <li>• Major sources of maintenance related complaints</li> <li>• major cause of non-maintenance of public building</li> </ul>
		Part 5 Maintenance staff skills <ul style="list-style-type: none"> <li>• Trainings</li> <li>• Motivation</li> </ul>
3	Evaluate the existence of maintenance policy guideline.	<ul style="list-style-type: none"> <li>• Does the hospital have maintenance guide line</li> <li>• Historical trends in maintenance</li> </ul>

## CHAPTER 4: DATA PRESENTATION AND ANALYSIS

### 4.1 Introduction

This chapter presents the findings, analyses and outcomes of the questionnaire, interview and field survey. The main findings are summarized in this chapter based on the following research objectives:

- 1) Maintenance department operational current status;
- 2) Factors affecting maintenance management;
- 3) Existence of maintenance policy guideline,

### 4.2 Research Objectives and Results of the Maintenance Department

**The first objective:** Assess the operational conditions carried out by the maintenance departments of public hospital buildings in Addis Ababa.

#### 4.2.1 Maintenance Department's Current Status and General Information

As shown on Table 4.1 the maximum existing surveyed hospital building age is 106 years, while the average Addis Ababa public hospital age is 66 years and the minimum age is 42 years since operation date.

##### a) Building Age

Table 4.1 Hospital Building Actual Ages

Hospital Name	Building Age(Years)
Alert Hospital	81
St. Amanuel Hospital	77
Armed Forces Hospital	59
Black Lion Hospital	42
Gandi Memorial Hospital	53
Menilik II Hospital	106
Police Hospital	52
Ras Desta Hospital	83
St. Paul's Hospital	46
St. Peter Hospital	52
Yekatit 12 Hospital	92
Zewditu Memorial Hospital	45

Figure 4.1 represents that about 50% of hospitals are in their fourth and fifth decade and about 8% of hospitals are close to a century since they are built and start operating. These hospital buildings which are investigated for this research are the first buildings which are built in the hospitals compound. There are other buildings built afterward.

In relation to this on May 04/2015 the expansion project of four hospitals undertaken with an outlay of more than 500 million birr in Addis Ababa. The expansion works were carried out at Yekatit 12 Hospital Medical College, Dagmawi Menelik Hospital, Ras Desta Damtew Hospital, and Gandhi Memorial Hospital. The expansion works carried out in the old hospitals would alleviate shortcomings in rendering services to the public. The expanded wings of the four hospitals will make available 1,000 new beds, meanwhile, cornerstones for two new hospitals to be built at Bole and Lafto Nifas Silk sub-cities laid. (Ethiopia News Agency, 2015)

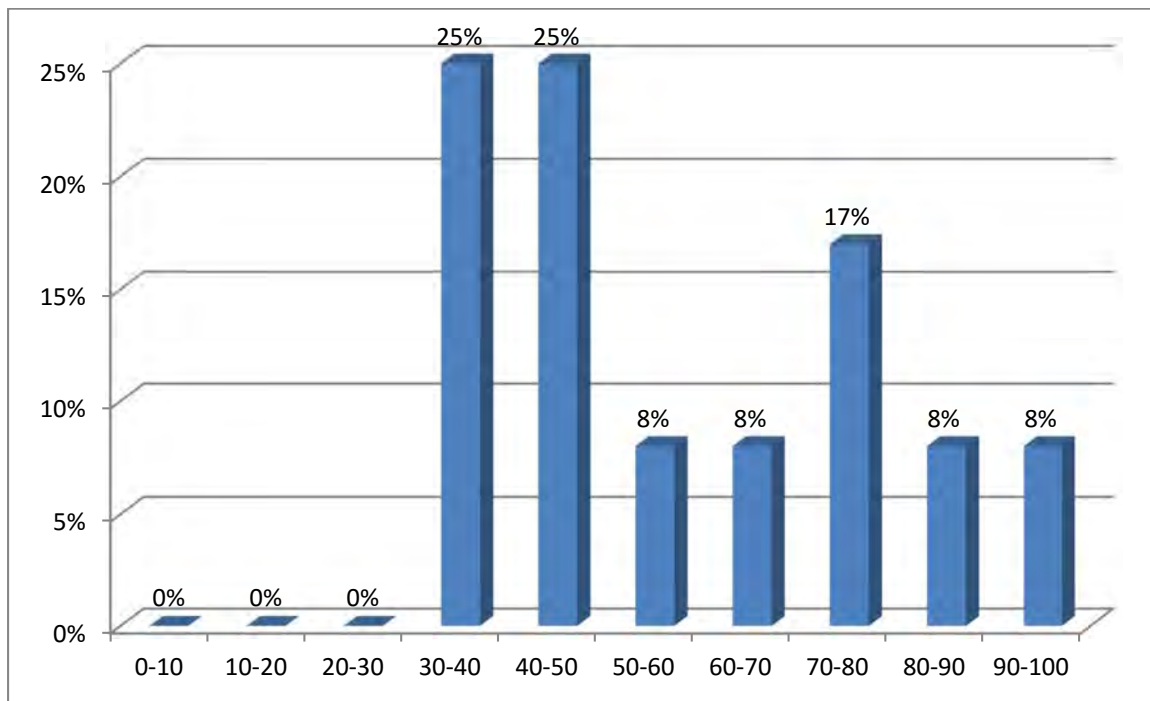


Figure 4.1 Hospital Building Age Group

**b) Maintenance Employees**

Figure 4.2 shows the percentage of technical staffs out of the total maintenance department employees. The three hospitals which have civil engineers in a position of maintenance manager are Alert, St. Ammanuel and Black lion hospitals.

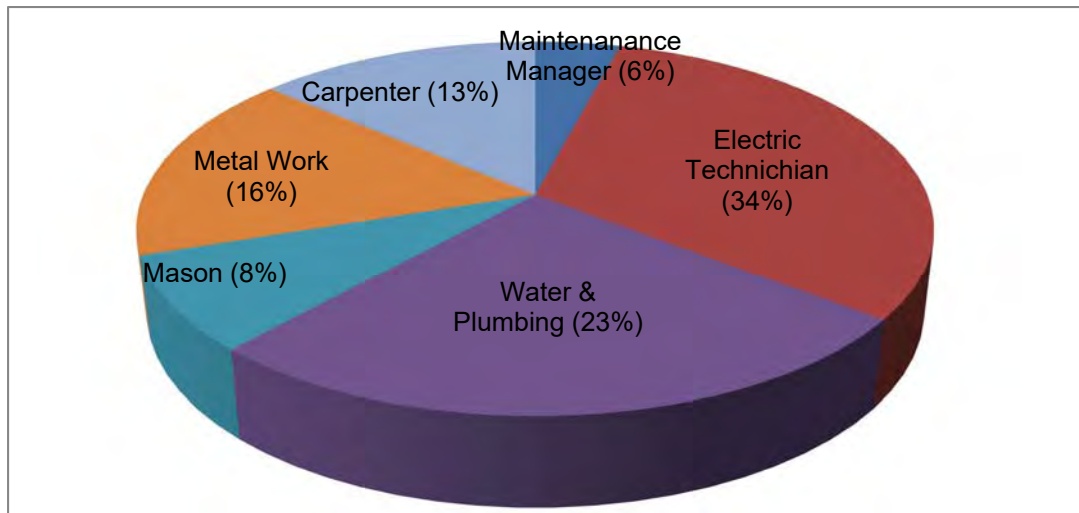


Figure 4.2 Maintenance Employee skills

Based on the reply, as shown on Table 4.2 56% of the response rate indicates that maintenance department staffs work experience is 1-9 years. This is an indicator that there is lack of technical expertise in the maintenance work execution.

Table 4.2 Maintenance Staff Length of Service

Length of Service	Percentage
1 – 9 years	56%
10 – 19 years	32%
20 - 29 years	10%
More than 30 years	2%

Comparing the results with Adenuga, (2007) research in, Maintenance management practices in public hospital environment of Lagos, most of the maintenance departments in the public hospitals have an employee ranging between 10 and 20. This is contrary to the fact in Addis Ababa; similarly hospital buildings in Gaza have no architect and engineers in the maintenance department; according to Farida Emad El Shorafa (2013), a study on Key Performance Indicators for Maintenance in Hospitals buildings in Gaza Strip.

Figure 4.3 also indicated the maintenance department staff professionals in relation with the public hospitals. Alert hospital has more maintenance staff than other public hospitals, because the maintenance department has a work guideline which states the responsibility of each staff. Moreover, each technical team of carpentry, metalwork, plumbing, electrical works have one team leader with sufficient number of skilled staff. In contrary, most of the maintenance departments in the public hospitals have an average number of employees ranging from 1 to 10, so it is difficult to form a separate technical team with insufficient number of maintenance staff at hand.

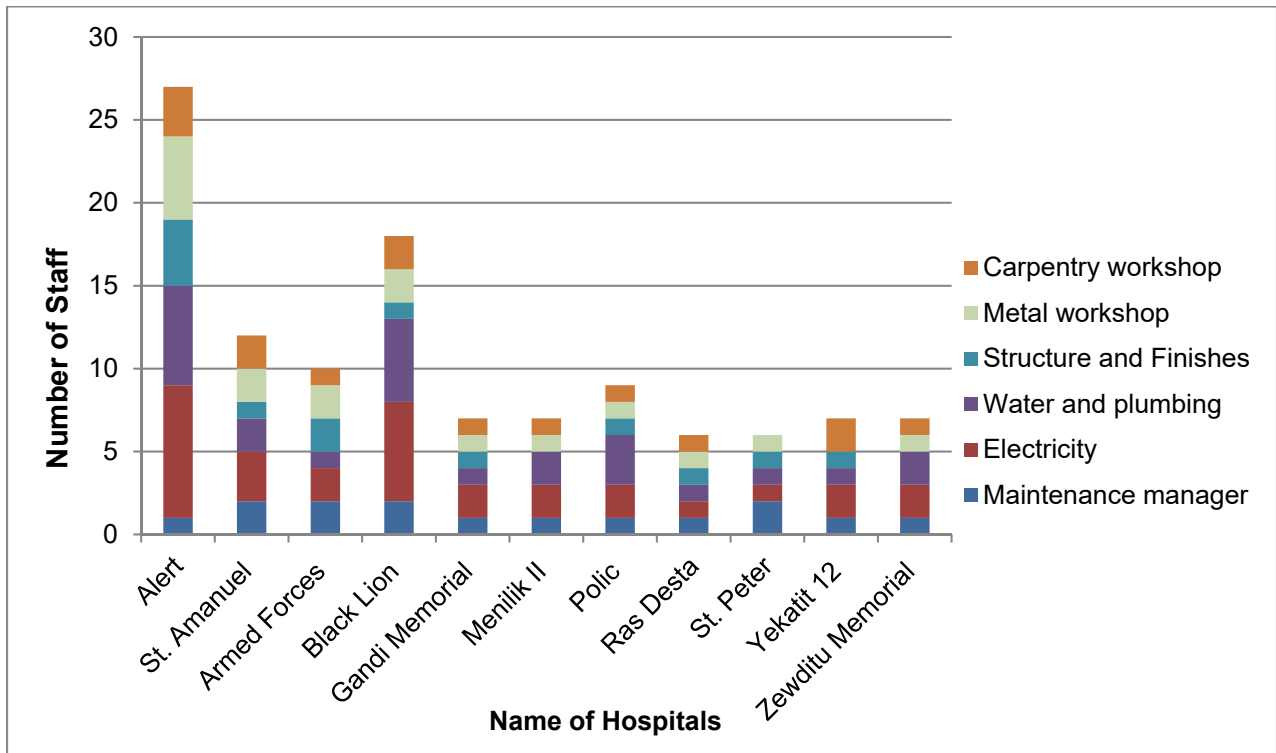


Figure 4.3 Maintenance Employees in Public Hospitals

**c) Maintenance Types**

As stated in the literature review and based on BS 3811:1984 maintenance types are classified as: planned and unplanned maintenance. And they are further categorized as preventive, routine, corrective and immediate maintenance.

The interview results with the heads of maintenance department’s indicated that all hospitals under study have implemented the immediate maintenance, besides the corrective maintenance. Figure 4.4 illustrates that there is routine and preventive maintenance only in three hospitals; Alert hospital, St. Amanuel hospital and Black lion hospital.

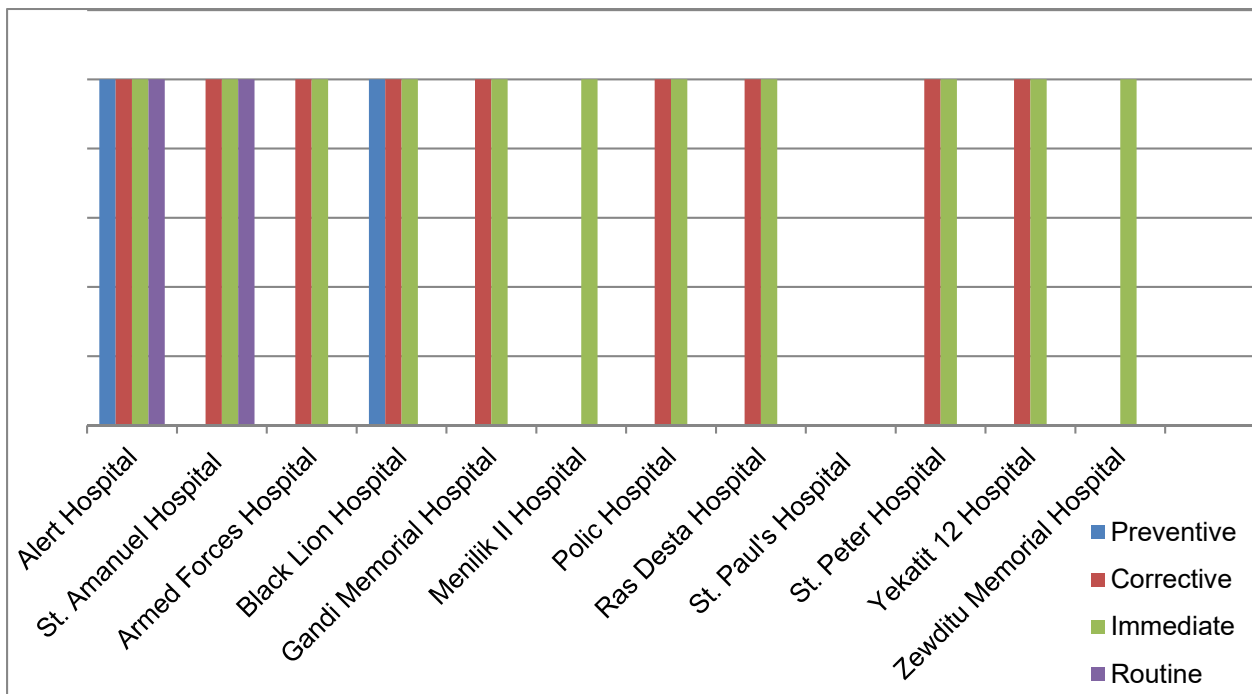


Figure 4.4 Maintenance carried out in Public Hospitals

A research result of users of hospital buildings and maintenance staff indicates most of respondents have the view that the hospital practiced the corrective maintenance most of the time. (See Figure 4.5)

Similarly, the maintenance system practiced at La General Hospital is only corrective maintenance. Also Hospitals buildings in Gaza Strip implement the corrective and preventive maintenance.

In contrary, Ikhwan and Burney, (1999) on their study of Maintenance in Hospitals of Saudi Arabia, found out that the hospitals implement both predictive maintenance and breakdown maintenance and are fairly well developed.

It is advisable to implement planned maintenance, because it is organized and carried out with forethought, control and the use of records to a predetermined plan. In contrast, unplanned maintenance refers to a work necessitated by unforeseen breakdown or damages.

The respondents reply that 40% - 50% of the maintenance activity is corrective maintenance and only 10% is routine maintenance.

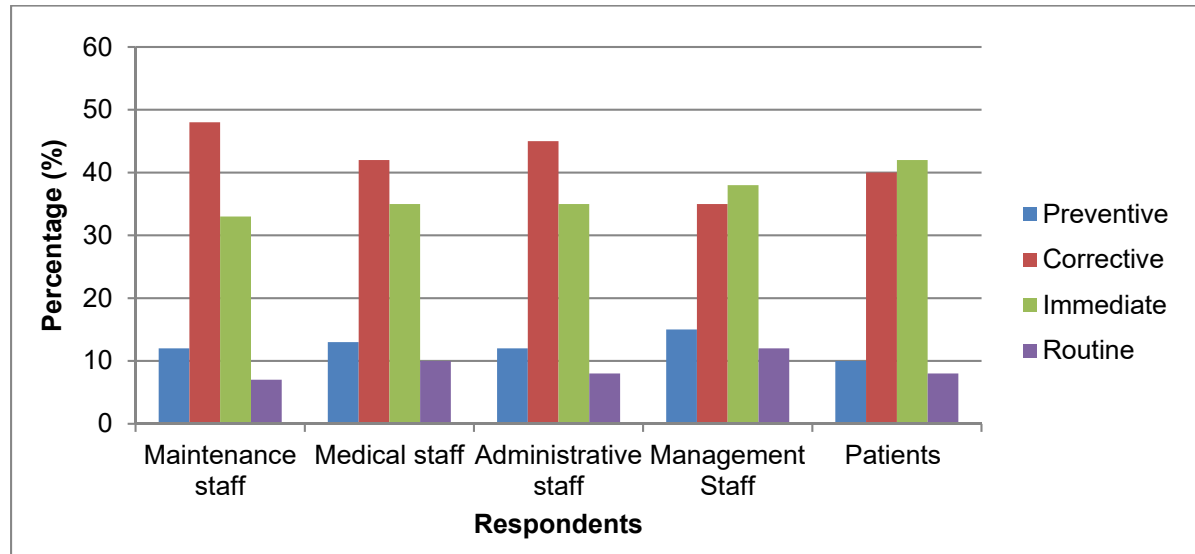


Figure 4.5: Form of Building Maintenance System

**d) Current State of Maintenance Practice**

Current state of maintenance of the hospital buildings is another issue; accordingly the user’s response more than 40% of the administrative staff, management staff, patients and more than 30% of medical staffs have rated the state of maintenance practice in the hospital as ‘good’. More than 35% of all users of the hospital buildings rated the maintenance practice as ‘poor’. In general the overall state of maintenance practiced at the hospital is poor as shown on Figure 4.6. The reply from the patients shows the state of maintenance practice is good and poor at the same time this indicates there rely is based on their understanding and acceptance of the maintenance practice.

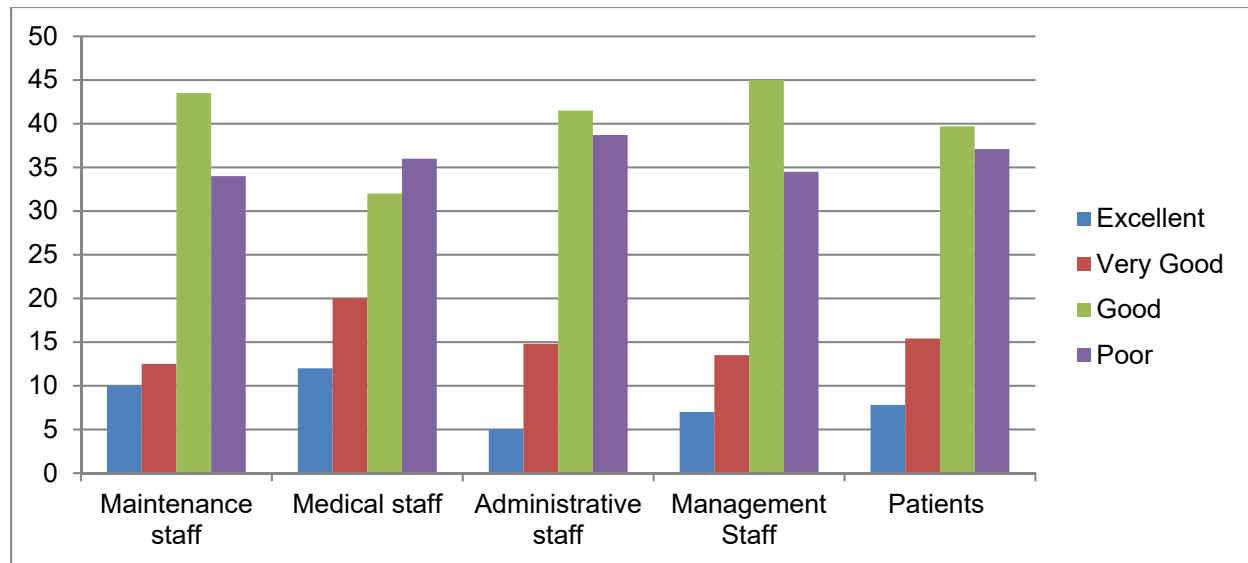


Figure 4.6: Current State of Maintenance Practice

#### 4.2.2 Functional Management Service Delivery of Maintenance Aspects

As discussed in the literature review, functional management service delivery of maintenance aspects has performance measurement dimensions such as: relevance, responsiveness, timeliness, delivery, etc. This aspect covers the management service delivery attributes or the service profiles that the management holds in maintenance departments. Questions are designed to investigate the factors affecting maintenance management of public hospitals which are under study.

##### a) Responsiveness and Timeliness

The results shown on Figure 4.7 indicated that all users of hospitals including the maintenance staffs but with the exception of the administrative staff and patients reply that it took few hours to respond to maintenance requests.

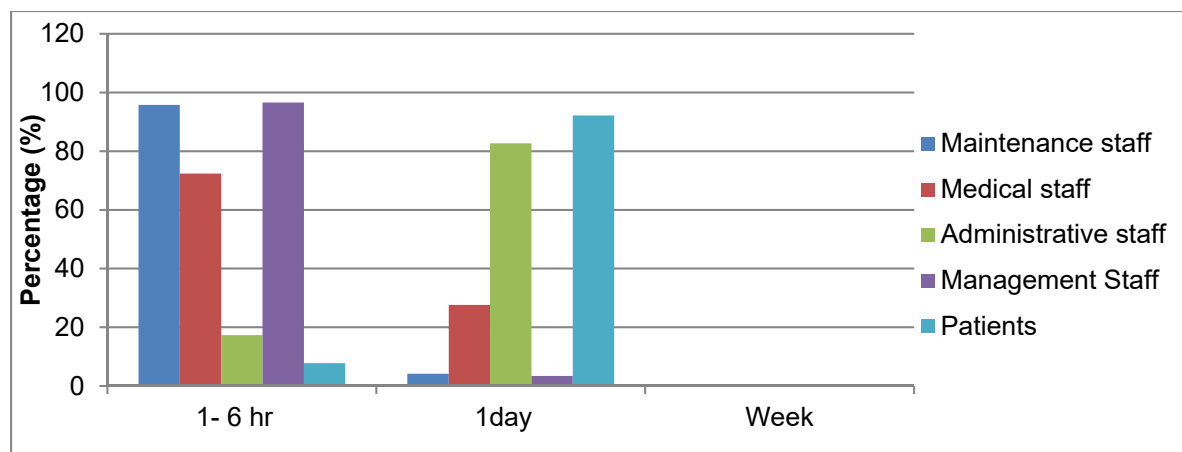


Figure 4.7 Maintenance Department's Responsiveness and Timeliness

**b) Delivering Characteristics**

As shown in the Figure 4.8 the hospital building maintenance conditions is improving year to year. Most of the respondents reply” yes the building condition is improved time to time”.

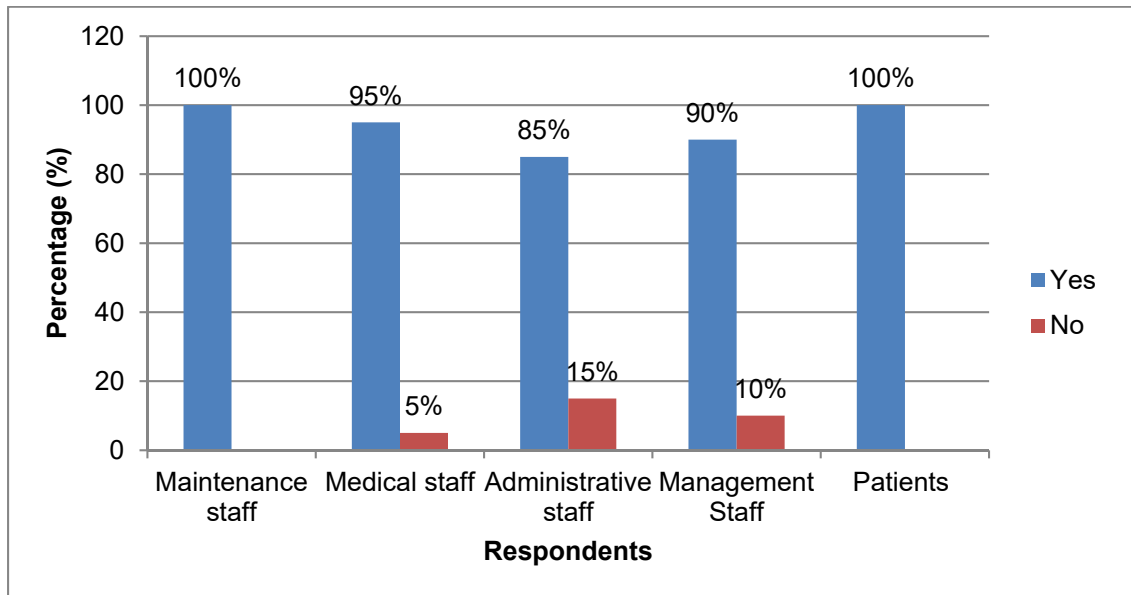


Figure 4.8 Hospital Building Conditions

**4.2.3 Maintenance Department’s Activities**

**a) Long-range plan for building maintenance and Repairs**

As shown on Figure 4.9 67% of the respondents reply that long range plan is not available in most of Addis Ababa public hospital maintenance departments. But as it was discussed in the literature review that, job planning is an essential element of effective maintenance management. According to Dhillon,(2002) a number of tasks may have to be performed prior to commencement of a maintenance job.

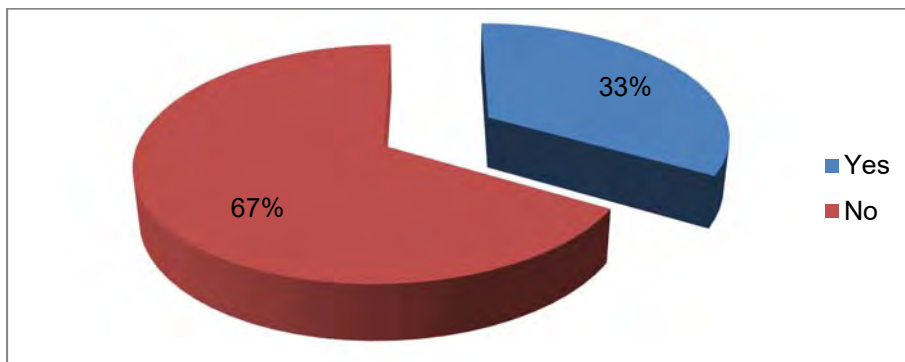


Figure 4.9 Maintenance Department’s Long-range Plan

**b) The mean operational state of building elements of the hospital building**

Based on the response Figure 4.10 shows that building elements of the hospitals are in average state (50% - 60%). Service lines (sanitary appliances, building service equipment, disposal installation, water, heating and ventilation, electrical, gas, lifts, protection installation, drainages, external services) are in bad situation comparing to other building elements.

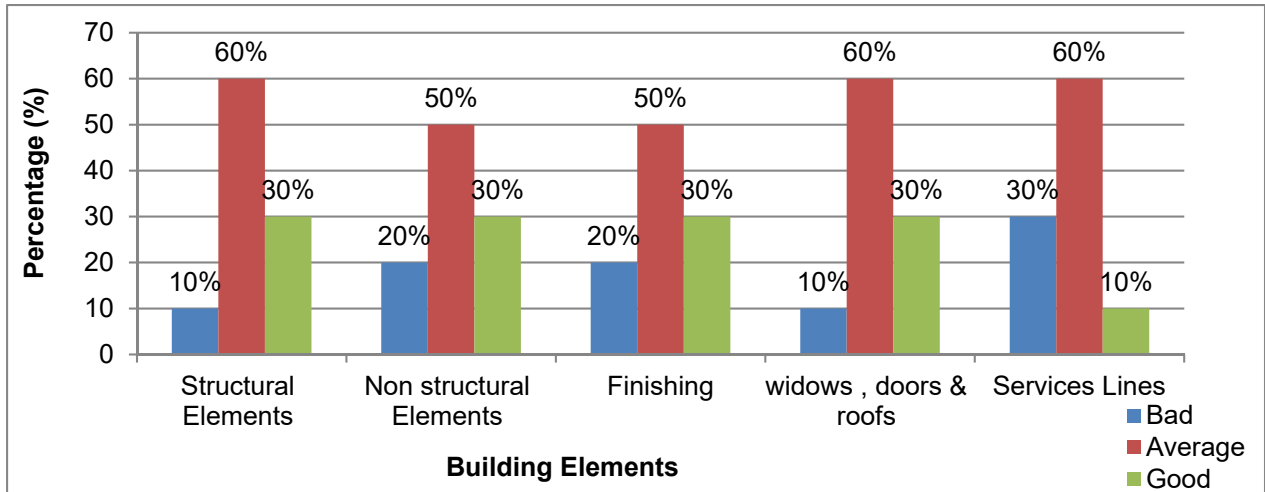


Figure 4.10 State of Building Elements

**c) Means of detecting faults**

According to the response of the users of hospital buildings, 50% - 60% of their reply shows faults on buildings (physical problems) were mostly noticed by maintenance requisition forms. Figure 4.11 illustrates physical reporting is the second way of detecting faults; routine/ periodic inspections are rarely applicable in public hospitals of Addis Ababa because of the inadequate number of maintenance staff.

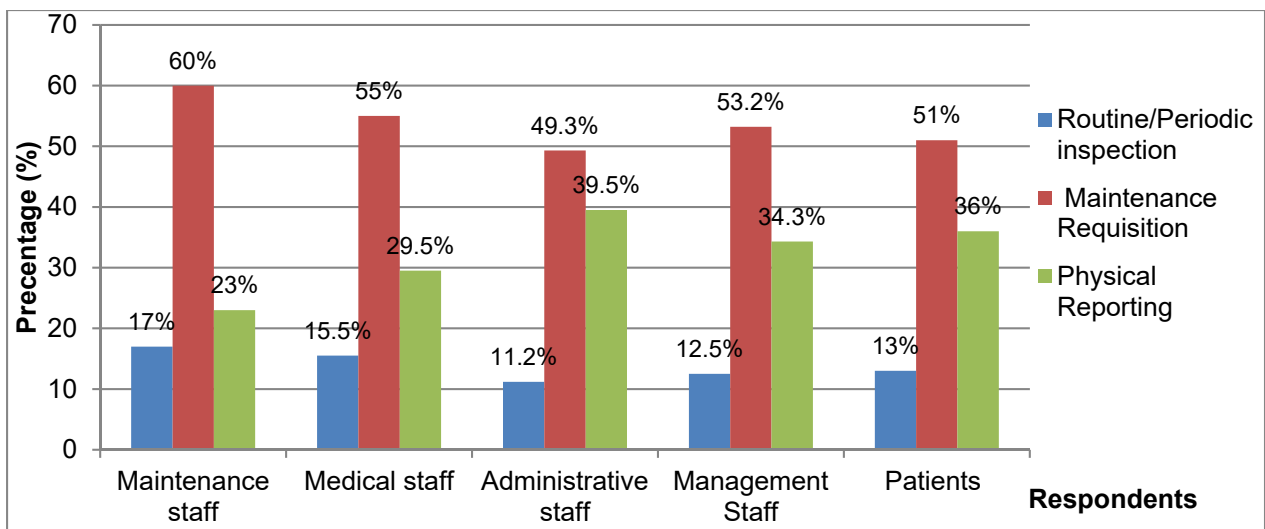


Figure 4.11 Means of Detecting Faults

Especially hospitals like St. Ammanuel an average of 20 immediate maintenance requests are coming every week. This requests are only for major maintenance activities, while minor maintenance like changing light and sanitary fixtures are more. So the maintenance department will not have enough time to do routine inspection with the number of staff at hand.

The study on the overall state of maintenance practice at public health institutes in Accra, Ghana indicate faults on buildings were mostly detected by visual inspection and by periodic inspections designed to detect damage, and faults are reported to the maintenance department of the hospital. (Zakari, 2011)

**d) The overall performance of maintenance activities**

The overall performance of maintenance activities is rated between 'good' and 'fair' as shown on Figure 4.12. The reply indicates 35% - 40% of the response indicates the performance on the maintenance activity is 'good' similarly 30% - 40% is rated for 'fair' by the respondents.

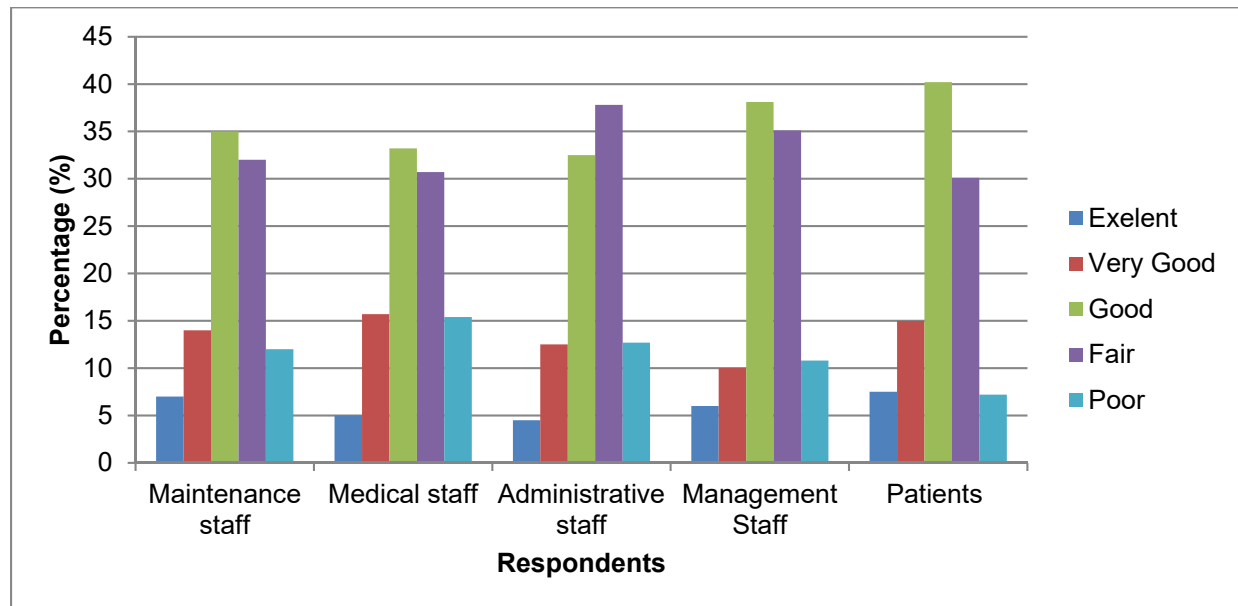


Figure 4.12 Overall Performances of Maintenance Activities

**e) Inspection interval of civil works activities**

In Table 4.3 the main maintenance activities in the buildings and their periodic frequencies are listed. Renewing the electrical installations is the most frequent activity which is on average about 7 times monthly, while drainage and sewage work and water networks is the second frequent maintenance activities. Roof and gutter maintenance have less attention which is twice a year on average. The maintenance work for the listed major maintenance activities should be more frequent to prevent sudden failures.

Table 4.3 Periodic Frequencies of Maintenance Activities

Maintenance Activities	Number of Frequencies	Period (week, month, year)		
		Week	Month	Year
Painting	5			*
Road and pathways repair	4			*
Drainage and sewage work	5		*	
Water networks	6		*	
Roof and gutter maintenance	2			*
Floor finishing	3			*
Electrical rewiring	7		*	
Other: replacement of sinks, shelves, windows and doors	4			*

**Second objective:** Factors affecting maintenance management of public hospital buildings.

**4.2.4 Problems Hospitals Faced with Building Maintenance**

Six most common problems in hospital building maintenance and the response on their significance are shown on table 4.4. According to the responses the main problems found in the hospital building maintenance was not enough staff, not enough budget and too many calls for service. In the others category the misuse of health facilities from patient`s attendants was by far the biggest problem. The management should give awareness how to handle the hospital properties to all people using the health facilities.

Table 4.4 Hospital Building Maintenance Problems

	<b>Common Problems</b>	<b>Percentage to their significance</b>
1	Not enough staff	100%
2	Too many calls for service	64%
3	Not enough budget	73%
4	Building design inefficiencies	55%
5	Service administration inefficiencies	27%
6	Poor construction quality	36%
7	Other(misuse, lack of staff development)	100%

The findings on related studies regarding the maintenance problems that the hospitals facing indicates there is, delays in obtaining spare parts and shortage of technical manpower in Saudi Arabia. Similarly, the study in Gaza hospital building maintenance indicated that the three main problems found was not enough staff, not enough money and poor contractor’s performance on buildings.

#### **4.2.5 Major Sources of Maintenance Related Complaints**

Bin Hashem, (2006) discussed that the main supporting system such as waste disposal, lift system, electrical system, firefighting system, plumbing and sanitary system, cleaning services, choice of materials, sound penetration and telecommunication system that should be working properly without any disturbance and affecting the entire hospital work process.

Major maintenance related complaints in Addis Ababa public hospitals and the response on their significance are shown on Table 4.5. The plumbing system in the hospitals facilities is the major source of complaints. Water supply and repair/replace are also other maintenance related complaints. This problem can be solved by incorporating early input from the maintenance department at the design stage of the buildings.

Table 4.5 Sources of Maintenance Complaints

	<b>Complaints</b>	<b>Percentage to their significance</b>
1	Cleaning	54.5%
2	Plumbing	81.8%
3	Choice of Materials	54.5%
4	Repair/Replace	72.7%
5	Waste Disposal	54.5%
6	Fire Protection	27.3%
7	Sound Penetration	54.5%
8	Design	45.5%
9	Water Supply	72.7%
10	Telecommunications	36.4%
11	Lift System	45.5%
12	Lighting	18.2%

A research examined the process of building maintenance and management in Malaysia (Zawawi, 2010) shows that the major source of maintenance related complaints that need most attention are lighting, HVAC, telecommunications and sanitation.

#### **4.2.6 Causes of Delays in Maintenance Works**

All the eleven hospitals respond that non availability of spare materials is the major cause of delay in maintenance works. Next to that, lack of qualified technical personnel and fund are contributing for the delay of the maintenance work. (See Table 4.6)

Table 4.6 Causes of Delays in Maintenance Works

	<b>Causes</b>	<b>Percent</b>
1	Lack of technical personnel	81.8%
2	Lack of funds	72.7%
3	Non availability of materials	100%

#### 4.2.7 Major Causes of Lack of Hospital Building Maintenance

According to Cobbinah (2010) and as discussed in the literature review some of the factors responsible for the poor maintenance of public buildings are; the age of the buildings, lack of maintenance culture, inadequate budget and high maintenance cost, pressure on building facilities and poor construction work.

Major causes of lack of building maintenance in public hospitals of Addis Ababa are ranked by the respondents as shown on Table 4.7. The main cause is lack of hospital maintenance culture, next is the non-availability of spare materials which limits the maintenance activities; and inadequate budget takes the third place.

Table 4.7 Causes of Lack of Hospital Building Maintenance

<b>Causes of maintenance problem</b>	<b>Rank</b>
Lack of maintenance culture	1
Non availability of spare materials	2
Inadequate budget	3
Bureaucratic reporting process	4
Pressure on facility/building due to number of occupants	5
Poor work done on building	6
Non response to maintenance request	7

The study on the assessment of factors affecting maintenance management of Public Hospital Buildings in Lagos State, Nigeria (Adenuga,2012) shows; the maintenance staff and the users both agreed that insufficiency of fund for maintenance programme is a dominant factor for poor maintenance management of public hospital buildings. In addition, the attitude of users and misuse of facilities are the most significant factor responsible for poor maintenance management of public hospital buildings.

#### 4.2.8 Maintenance Staff Skills and Behavior

##### a) Level of Motivation

The maintenance department staffs complain that the level of motivation by the management is low. This indicates the staff works without encouragements for development and without competition.

The causes of low motivation of maintenance staff are summarized and ranked according to the response from the maintenance staff of the public hospitals. The main causes are poor pay, lack of opportunities for training/development and lack of working tools, equipment, materials. (See Table 4.8)

Table 4.8 Causes for Low Motivation

	<b>Causes for Low Motivation</b>	<b>Percent</b>
1	Lack of working tools/ equipment/materials	54.5%
2	Irregular payment of salaries	36.4%
3	Delayed promotion	45.5%
4	Poor pay	72.7%
5	Lack of opportunities for training/development	63.6%
6	Job insecurity Unsafe/unhealthy working condition	18.2%

##### b) Provisions of Training Programme

According to Dhillon, (2002) a maintenance department is expected to perform a wide range of functions as discussed on the previous chapter of literature review. One of the maintenance department functions is to train maintenance staff and other concerned individuals to improve their skill and perform effectively.

Based on the data gathered from the maintenance staff 73.5% of the hospitals are giving training for their maintenance department in a way of workshop and seminars. However the rest of the response from the users of the hospital indicates the provision of training on how to effectively manage the facilities within the hospital buildings is negligible.(See Figure 4.13)

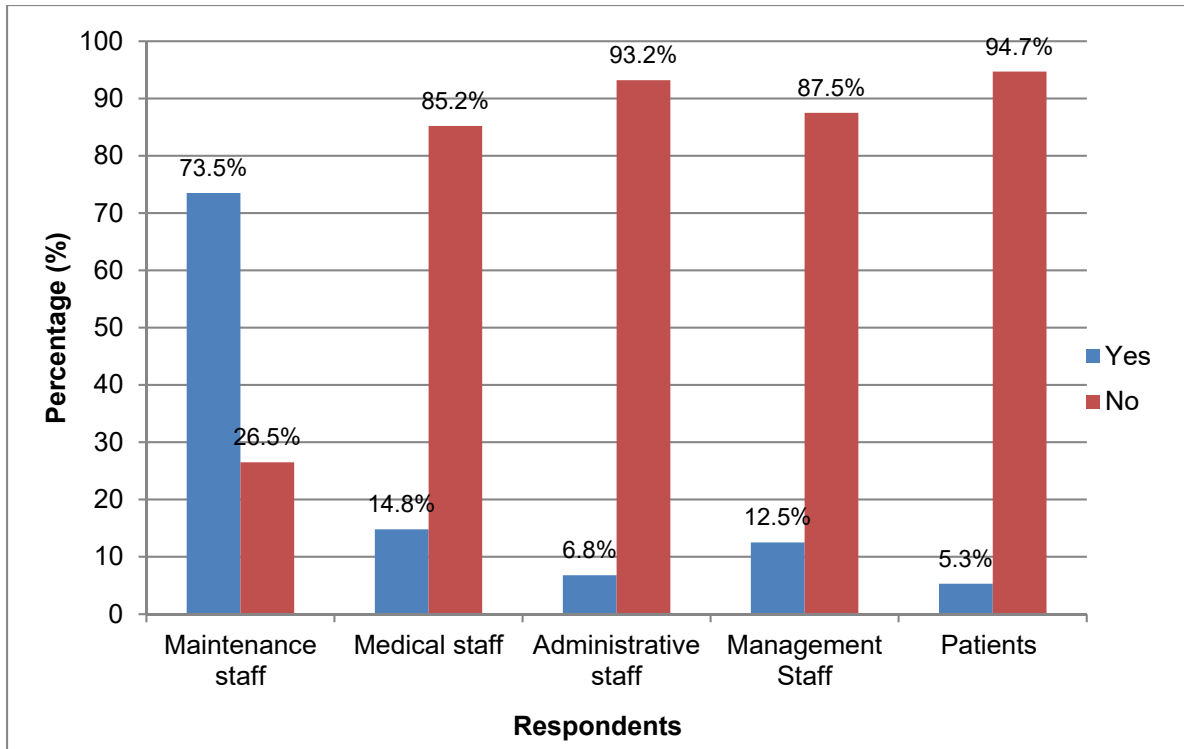


Figure 4.13: Training Programme

The provision of trainings in Nigeria public hospitals is similar to Addis Ababa public hospitals. Maintenance in Hospitals of Saudi Arabia (Ikhwan et al, 1999); the results present the proportion of maintenance staff is high, the workers are provided training facilities and they have vocational qualifications.

The building maintenance practice in Saudi Arabia's public hospitals can be considered as a good model comparing to other country's experience which are reviewed in the literature review.

**c) Training Type**

The data gathered from the maintenance staff of the public hospitals shows 32.9% of the training is on service training and 67.1% of training done by the management to the maintenance staff is workshop and seminars. (See Figure 4.14)

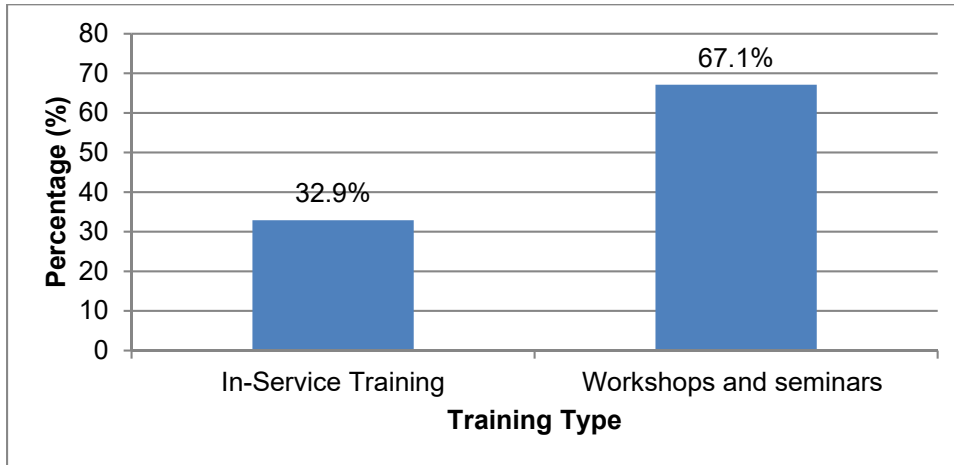


Figure 4.14: Training Type

**Third objective:** existence of maintenance policy guideline and logbook

**4.2.9 Maintenance Policy Guideline**

As stated on the literature review, maintenance policy is one of the most important elements of effective maintenance management. It is essential for continuity of operations and a clear understanding of the maintenance management program, regardless of the size of a maintenance organization. However, as indicated on Figure 4.15 only 26.2% of public hospitals of Addis Ababa have guideline to direct the maintenance activity and facilitate their maintenance department.

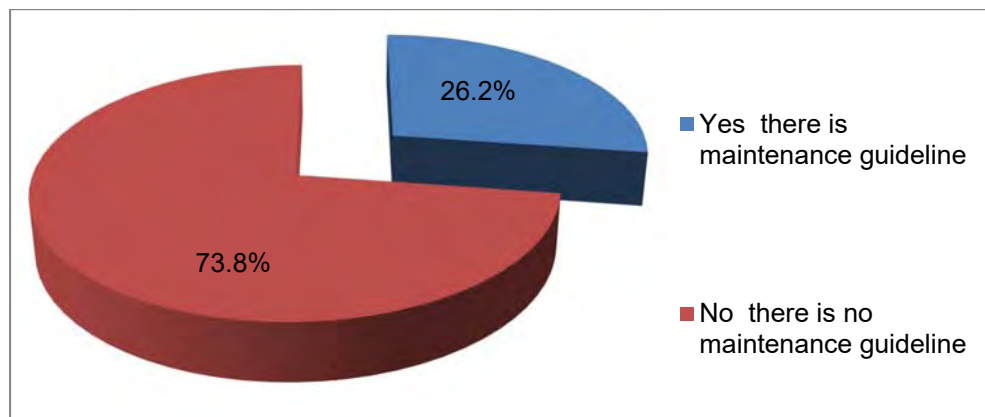


Figure 4.15 Existence of Maintenance Guideline

The study indicates that the majority of public hospitals in Southwest, Nigeria have formal maintenance operation policies.(Adengua, 2007)

Similar to Addis Ababa public hospitals the study on the overall state of maintenance practice at public health institutes in Accra, Ghana indicate there is lack or absence of national maintenance policy.(Zakari et al, 2011)

#### 4.2.10 The Use of Maintenance Logbook

It is also essential to have records of previous maintenance activities In order to identify the maintenance trend of the hospitals. Figure 4.16 shows that there is an adoption of maintenance log-book by the majority of the maintenance operatives in public hospitals in Addis Ababa. 61.3% of the maintenance department's strategy was to collect historical data for the identification of maintenance trends. The result is also similar to the study on the public hospitals of Southwest, Nigeria.(Adengua, 2007)

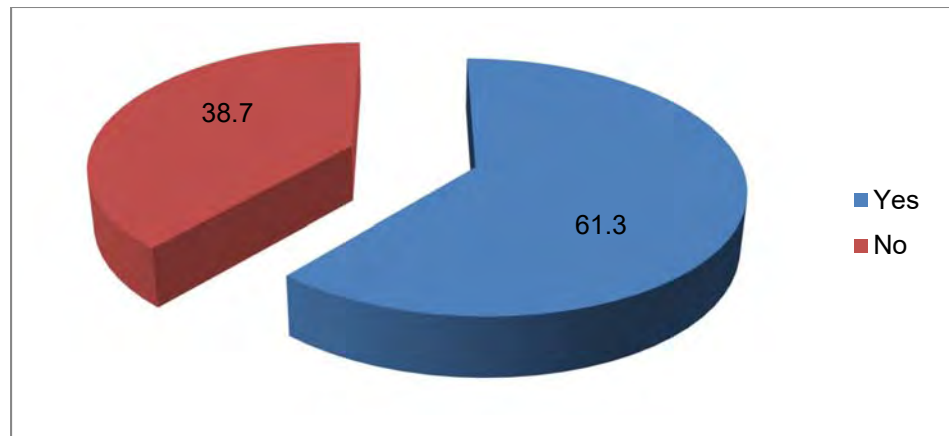


Figure 4.16: The Use of Maintenance Logbook

### 4.3 Summary of Findings

The study revealed that about 50% of the public hospitals in Addis Ababa are in their fourth and fifth decade of service. About 8% of hospitals are close to a century years old since they are built and start operating. Regarding the employees of maintenance department's the average number of employees' ranges between 1 and 10 for each hospital.

More than half of the maintenance staffs in public hospitals in Addis Ababa have a working experience less than 10 years within the maintenance organization. This is a factor that may affect job performance of the maintenance operatives. The number of staffs in the maintenance departments is found to be inadequate.

The result on the maintenance type carried out by the public hospitals indicated that all hospitals under study have implemented immediate and corrective maintenance system. Regarding the current state of maintenance of the hospital buildings, the users response shows administrative staff and patients have rated the state of maintenance practice in the hospital as 'good'.

About 33%of maintenance departments have long-range plan for building maintenance and repairs. Operational state of building elements like service lines (sanitary appliances, building service equipment, disposal installation, water, heating and ventilation, electrical, gas, lifts, protection installation, drainages, external services) are found to be in bad situation.

According to the data gathered application of routine / periodic inspection is very rare. Delays in carrying out maintenance works at public health institutes in Addis Ababa are mainly due to non-availability of spare materials.

The main problems found in the hospital building maintenance are found to be not enough staff, not enough budget and too many calls for service. In the others category the misuse of health facilities from patient`s attendants was by far the biggest problem.

Workshops and seminars are the major training types given to the maintenance operatives. The maintenance operatives are found not to be well motivated. This may be attributed to poor pay, lack of opportunities for training/development and lack of working tools, equipment, materials. Only few public hospitals of Addis Ababa have guideline to direct the maintenance activity and facilitate their maintenance department. But there is an implementation of maintenance log-book by the majority of the maintenance operatives.

## **CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

The main aim of this research was to study the building maintenance management practices in public hospitals of Addis Ababa. This chapter includes the conclusion, and applicable recommendations to improve the maintenance practices in Addis Ababa public Hospitals.

### **5.2 Conclusions**

Based on the results the following conclusions are extracted.

1. The number of staff in the public hospitals of Addis Ababa is inadequate and they do not have much experience on hospital maintenance. Also the type of maintenance all public hospitals implement is immediate and corrective maintenance, only few hospitals execute routine and preventive maintenance.
2. The maintenance requisition forms are the main tools to detect the problems on the buildings and the maintenance departments took few hours to respond to maintenance requests.
3. The major operational state of building elements like service lines are in bad situation and in most of public hospitals routine / periodic inspections by the maintenance departments are not well exercised. There is an adoption of maintenance log-book but the existence of formal maintenance policy guiding the maintenance work execution is uncommon.
4. Delays in carrying out maintenance works at public hospitals in Addis Ababa are mainly due to non-availability of spare materials. In addition not having enough staff and enough budget are the main problems found in the hospital building maintenance departments. The misuse of health facilities from patient`s attendants is also the biggest problem.
5. The study also revealed that maintenance operatives are not well motivated and this was attributed to poor pay and lack of training/development in executing the desired maintenance in the hospitals. Other reasons are lack of working tools, equipment, materials.
6. The manpower and resource of maintenance departments are under-utilized by the management as shown on the findings of the study. The maintenance departments will not stay long with their current condition to give full service which they are expected to render.

### 5.3 Recommendations

In light of the research findings, and conclusions, the following recommendations are made in order to improve the practice of maintenance management in public hospital buildings in Addis Ababa.

1. Maintenance departments have to be well organized in manpower and material according to the demand of the hospital.
2. Maintenance staffs are to be well motivated by giving trainings, monetary and non-monetary rewards and other intensives in order to deliver their best during the maintenance work execution.
3. Start to implement preventive maintenance is recommendable even if on small scale in getting better building conditions other than fixing what is damaged.
4. Estimating an average or the minimum financial budget which can be available from the financial unit and design the maintenance plan.
5. Maintenance staff and users of hospital buildings should be given opportunities for further training on their jobs also on effective use of hospital facilities. This is necessary to reduce the occurrence of defects, which will consequently bring about better physical and functional hospital building elements and services.
6. Designing and developing new buildings should incorporate early input from the maintenance department.
7. Inefficiencies and inflexibility through the imposition of bureaucratic impediments to operational effectiveness should be avoided in hospital environment due to the sensitivity of the services being rendered.
8. The management of the hospital should make sure the availability of building manuals including as built drawings to facilitate the maintenance activity and to have record of the final design.
9. Maintenance is an important function in Ethiopia because of the fast development of building constructions. In order to get maximum economic life out of these assets it is necessary that they be systematically and properly maintained. The government has to acknowledge this fact and have all along realized the importance of sound maintenance practices. As it is impossible to construct any kind of building without following the Ethiopian building code standards (EBCS) also national standard guideline should be available for maintenance works

10. The final recommendation is for further research on the process of building maintenance and management for various types of buildings in Addis Ababa. Focusing on, factors causing poor maintenance and delivering a new improved process. In addition, to improve the management of building maintenance, setting up organizations, policies and quality standards.

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# **Appendix A**

## **Questionnaire**



**ADDIS ABABA UNIVERSITY  
ADDIS ABABA INSTITUTE OF TECHNOLOGY  
SCHOOL OF CIVIL AND ENVIRONMENTAL  
ENGINEERING**

***Questionnaire for Thesis In***

**MAINTENANCE MANAGEMENT PRACTICES IN PUBLIC  
HOSPITAL BUILDINGS OF ADDIS ABABA**

Advisor: Abebe Dinku (Prof, Dr. Ing.)

Prepared By: Mekdes Sahelu

March, 2015

Dear Sir,

I am a graduate student at Addis Ababa University. I am now preparing a master thesis in the Construction Technology and Management program. The title of the thesis is:

**“Maintenance Management Practices in Public Hospital Buildings of Addis Ababa”**

The purpose of the study is to:

- Evaluate the practice and effectiveness of maintenance management system in public hospitals in Addis Ababa.
- Evaluate the existence of maintenance policy guideline and desirable qualities and important skills for the maintenance execution.
- Determine type of defects occurring in public hospital buildings.
- Assess factors responsible for poor maintenance management in public hospital buildings in Addis Ababa with a view of providing solutions to them.
- Specify the minimum requirements for the management of maintenance.

The results of the study will be of great help to the industry and offering valuable results for all. As you are one of the large organizations working in this field in Addis Ababa, we are kindly inviting you to participate in filling this questionnaire with the required data which is an important element in this study.

The information provided by you will be analyzed as whole, and we ensure you that this information will be held in strict confidence and used for the scientific research purpose only.

We realize that there are numerous demands on your time. However your involvement is a vital requisite for this study. We appreciate your anticipated cooperation in answering this questionnaire.

Thank you for your anticipated cooperation.

Best regards.

Advisor: Abebe Dinku (Prof, Dr. Ing.)

Researcher: Mekdes Sahelu

**Part 1: General Information of the Selected Hospitals Buildings**

1. Hospital Name: \_\_\_\_\_

2. Hospital location: \_\_\_\_\_

3. Year of occupancy \_\_\_\_\_

4. Hospitals Building Age:

1 – 5 years

6-10years

11-15 years

16-20years

21-25years

26-30years

more than 30 years

5. Total Number of beds: \_\_\_\_\_

6. What type of maintenance has been carried out in hospital building?

Preventive Maintenance

Corrective Maintenance

Immediate Maintenance

Routine Maintenance

\*Corrective maintenance means to bring an item back to working when it has failed

7. Please indicate types of maintenance activities during the 2014:

.....  
.....  
.....  
.....  
.....

8. Maintenance annual total budget? \_\_\_\_\_ Birr

**Part 2: Performance measurement dimensions:**

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

- from 1- 6 hr       1day       week  
 month       more than 1 month

10. Do technicians receive training to conduct the condition assessments of the buildings?

- Yes       No

11. Does the department have a written long-range plan for building maintenance and repairs that extends out a minimum of three to five years?

- Yes       No

12. Have building conditions in the hospital improved or stayed at acceptable levels from year to year?

- Yes       No

13. In general, describe the final situation of the maintained building:

- Better       the same       worse

14. The mean operational state of building elements of the hospital building.

<b>Building Elements</b>	<b>Very bad</b>	<b>Bad</b>	<b>Average</b>	<b>Good</b>	<b>Very good</b>
structural elements (beams, columns, upper floor slabs and stairs)					
Non structural elements (external and internal walls)					
finishes (wall, floor finishes and ceilings)					
windows , doors & roofs					
services (sanitary appliances, building service equipment, disposal installation, water, heating and ventilation, electrical, gas, lifts, drainages)					

15. How faults are detected on buildings

- Routine/Periodic inspection       Maintenance Requisition

**Part 3: Information of the Selected Hospitals Buildings Maintenance Department**

16. Number of maintenance professionals

Profession	Number of Jobs		
	Engineer	Technician	Other (specify)
Maintenance manager			
Electricity			
Water and plumbing			
Structure and Finishes			
Metal workshop			
Carpentry workshop			
Total			

**Part 4: Maintenance Department Activities in Hospitals Buildings**

17. Please indicate the number of Civil works activities frequency

Activities	No.	Period (week, month, year)
Painting and washing down		
Road and pathways repaired		
Drainage and sewage work performed		
Water networks		
Roof and gutter maintenance performed		
Floors finishing		
Electrical rewiring		
Other: replacement of sinks, shelves, windows and doors		

18. **What do you believe are the problems that hospitals face in terms of building maintenance?** (Please tick as many as appropriate)

- |   |  |
|---|--|
| <input type="checkbox"/> Not enough staff           | <input type="checkbox"/> Building design inefficiencies        |
| <input type="checkbox"/> Too many calls for service | <input type="checkbox"/> Service administration inefficiencies |
| <input type="checkbox"/> Not enough money           | <input type="checkbox"/> Poor construction quality             |
| <input type="checkbox"/> other, please state        |  |

19. **What are the major sources of maintenance related complaints?** *Please tick as many as apply*

- |  |   |                                   |
|--|---|-----------------------------------|
| <input type="checkbox"/> Cleaning            | <input type="checkbox"/> Plumbing           | <input type="checkbox"/> Design   |
| <input type="checkbox"/> Choice of Materials | <input type="checkbox"/> Repair/Replace     | <input type="checkbox"/> Lighting |
| <input type="checkbox"/> Equipment           | <input type="checkbox"/> Waste Disposal     |                                   |
| <input type="checkbox"/> Fire Protection     | <input type="checkbox"/> Sound Penetration  |                                   |
| <input type="checkbox"/> Water Supply        | <input type="checkbox"/> Telecommunications |                                   |

20. Who is responsible for the supervision of maintenance works?

- Maintenance officer  
 Engineer  
 External Personnel

21. Causes of delays in maintenance works

- Lack of technical personnel  
 Lack of funds  
 Non availability of materials  
 Others

22. **Number of general repair requests in 2014.....**

23. **Major Cause of Non Maintenance of Public Hospital Building**

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

**Part 5: Maintenance Staff skills and behavior factors**

24. Level of Motivation of Maintenance staff by the management

- Very low       Low       Average       High       Very high

25. Causes of low motivation of maintenance workers

- Lack of working tools/ equipment/materials
- Irregular payment of salaries
- Delayed promotion
- Poor pay
- Lack of opportunities for training/development
- Job insecurity Unsafe/unhealthy working condition

26. Are there training programme for users on how to effectively manage the facilities within the hospital buildings?

- Yes  No

27. Training type given by the management to the users through Maintenance Department:

- In-Service Training  Workshop and seminars  
 User's guide distributed for reading

28. Does the hospital have maintenance guide line to facilitate the maintenance department?

- Yes  No

29. Do you use historical data (maintenance log-book) to identify maintenance trends?

- Yes  No

30. Hospital buildings maintenance needs special training, what kind of training you receive in the department of maintenance.

.....  
.....  
.....

31. Satisfaction levels with outsourced maintenance services

- Poor  Fair  Good  
 Very good  Don't know

**THANK YOU!!!**

## **Questionnaire for Hospital Staff**

### **Part 1: General Information**

Hospital Name: \_\_\_\_\_

1. The occupancy of the staff: \_\_\_\_\_
2. His/her employment time in the hospital \_\_\_\_\_
3. What type of maintenance has been carried out in hospital building?  
 Preventive Maintenance                       Corrective Maintenance  
 Immediate Maintenance                       Routine Maintenance

### **Part 2: Performance measurement dimensions:**

4. How long does it take to respond to maintenance request/needs of personnel?  
 from 1- 6 hr                       1day                       week  
 month                       more than 1 month
5. Is there a request form to fill when there is a need for maintenance?  
 Yes                       No
6. Have building conditions in the hospital improved or stayed at acceptable levels from year to year?  
 Yes                       No
7. In general, describe the final situation of the maintained building:  
 Better                       the same                       worse

8. The mean operational state of building elements of the hospital building.

Building Elements	Very bad	Bad	Average	Good	Very good
structural elements (beams, columns, upper floor slabs and stairs)					
Non structural elements (external and internal walls)					
finishes (wall, floor finishes and ceilings)					
windows , doors & roofs					
services (sanitary appliances, building service equipment, disposal installation, water, heating and ventilation, electrical, gas, lifts, protection installation, drainages, external services)					
Storage & ware house facilities.					

**Part 4: Maintenance Department Activities in Hospitals Buildings**

9. What do you believe are the problems that hospitals face in terms of building maintenance? (Please tick as many as appropriate)

- Not enough staff
- Building design inefficiencies
- Too many calls for service
- Service administration inefficiencies
- Not enough money
- Poor construction quality
- Poor contractor performance
- other, please state

10. What are the major sources of maintenance related complaints? Please tick as many as apply

- Cleaning
- Indoor Air Quality
- Plumbing
- Choice of Materials
- Repair/Replace
- Heat Loss/Gain
- Storage
- Equipment
- Waste Disposal
- Fire Protection
- Sound Penetration
- Design
- Water Supply
- Telecommunications
- Lighting

## Questionnaire for Patients

### **Part 1: General Information**

Hospital Name: \_\_\_\_\_

1. His/her stay in the hospital \_\_\_\_\_

2. In general, describe the situation of the building:

Good                       Average                       Bad

3. The mean operational state of building elements of the hospital building.

<b>Building Elements</b>	<b>Very bad</b>	<b>Bad</b>	<b>Average</b>	<b>Good</b>	<b>Very good</b>
structural elements (beams, columns, upper floor slabs and stairs)					
Non structural elements (external and internal walls)					
finishes (wall, floor finishes and ceilings)					
windows , doors & roofs					
services (sanitary appliances, building service equipment, disposal installation, water, heating and ventilation, electrical, gas, lifts, protection installation, drainages, external services)					
Storage & ware house facilities.					

4. **Based on your observation what are the major areas in need of maintenance? Please tick as many as apply**

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Cleaning   | <input type="checkbox"/> Indoor Air Quality | <input type="checkbox"/> Lifts              |
| <input type="checkbox"/> Waste Disposal   | <input type="checkbox"/> Lighting           | <input type="checkbox"/> Windows, doors     |
| <input type="checkbox"/> Fire Protection  | <input type="checkbox"/> Water Supply       | <input type="checkbox"/> Telecommunications |
| <input type="checkbox"/> Painting   | <input type="checkbox"/> Road & Pathway     | <input type="checkbox"/> Floor finishing    |
| <input type="checkbox"/> Structural elements (beams, columns, upper floor slabs and stairs) |   |   |

**ሆስፒታሉ ተጠቃሚዎች የቀረቡ ጥያቄዎች**

**ክፍል 1 ፡ አጠቃላይ መረጃ**

የሆስፒታሉ ስም \_\_\_\_\_

በሆስፒታሉ ስራ ድርሻ \_\_\_\_\_

በሆስፒታሉ የተቀጠሩባት ጊዜ \_\_\_\_\_

1. ሆስፒታሉ ውስጥ ምን እይነት የጥገና ሥራ እየተካሄደ ነው

- የመከላከል ጥገና                       የእርማት ጥገና  
 አፋጣኝ ጥገና                               ዘላቂ ጥገና

**ክፍል 2 ፡ የአቅም መለኪያ**

2. የጥገና ጥያቄዎችን ለመመለስ የጥገና ክፍሉ ምን ያክል ጊዜ ይፈጅበታል?

- ከ1-6 ሰዓት                       1 ቀን                       1 ሳምንት                       1 ወር ከ 1 ወር በላይ

3. የጥገና ጥያቄዎችን ማቅረቢያ ፎረም ሆስፒታሉ አለው?

- አለው                       የለውም

4. የሆስፒታሉ አጠቃላይ ገጽታ አስመት አመት እየተሸሻለ መጥቷል መልስ ባለበት ሁኔታ ነው ያለው?

- አዎ                       አይደለም

5. በአጠቃላይ የሆስፒታሉን የጥገና ሁኔታ እንዴት ይመለከቱታል?

- ጥሩ                       ለውጥ የለውም                       ጥሩ አይደለም

6. የሆስፒታሉ የህንፃ አባላት አጠቃላል ገጽ

የህንፃው አካላት	በጣም መጥፎ	መጥፎ	አማካኝ	ጥሩ	በጣም ጥሩ
ስትራክቸራል አባላት ( ቅጫ ማገር/ ወለል/ ደረጃዎች)					
ስትራክቸራል ያልሆኑ አካላት (የውስጥ እና የውጭ ግድግዳዎች)					
ፊኒሽን ሥራዎች (ግርግዳ, ወለል, ኮርኒስ)					

በር, መስኮት, ጣሪያ					
የመጸዳኛ ቤት ቁሳቁሶች, ፈሳሽ ማስወገጃዎች, የውሃ መስመሮች, የኤሌክትሪክ መስመሮች, አሰንሰሮች .....					

**ክፍል 3: የሆስፒታሉ የጥገና ክፍል እንቅስቃሴዎች**

7. በሆስፒታል የጥገና ሥራ ክፍል ውስጥ ሁሉ ችግር ካለው የሚሏቸው የትኞቹ ነው?

- በቂ ያለሆነ የጥገና ሰራተኛ ብዛት  የህንፃ ዲዛስታ ችግር
- በርካታ የሆኑ የጥገና ጥያቄዎች  የጥገና አሰራር ችግር
- በቂ በጀት ያለመኖር  የግንባታ ስራ ጥረት ጉድለት  ሌሎች ለችግሮች ካሉ ይጥቀሱ

8. የጥገና ችግር መንስኤዎች

- ጽዳት  የጥገና እና ቅሬታ  የፈሳሽ ማስወገጃዎች
- የዕቃው ምርጫ  የድምጽ ብክለጽ  የመብራት መሠመሮች
- የውሃ ምርጫ  የስልክ መስመሮች
- የእሳት መከላል  የቧንቧ መስመሮች

## **Appendix B**

### **Samples of Maintenance Work Order Forms**

<b>BLACK LION HOSPITAL</b>	<b>REQUEST FOR INTERVENTION</b>	<b>No 235151</b> /96	<b>MAINTENANCE DEPARTMENT</b>
Department _____	Floor _____	Room No. _____	
Name of applicant _____	Date _____	Signature _____	
Request _____			
Work completed by _____	Date _____		
Needed Material _____			
		No. of RS _____	
Comments _____			

Figure B.1: Black lion Hospital Maintenance Request Form

<b>የቅዱስ ጴጥሮስ ቲቢ ስፔሻላይድ ሆ/ል</b>			
St peter TB Specialized Hospital Facilities Maintenance work order form			
<b>የጥገና መጠየቂያ ፎርም</b> Table completed			
<b>ጥገናውን የጠየቀው ክፍል</b> Name of case team	<b>ቀን</b> Date		
<b>ጥገናውን የጠየቀው ሰራተኛ</b> Name of making request	<b>ፊርማ</b> Signature		
<b>Description and location of the problems</b>			
To be completed by facility management			
<b>የጥገና ትዕዛዝ የደረሰበት ቀን</b> Date request received	<b>ቅደም ተከተል</b> Priority: High	low	
<b>ሰራው የተሰጠው አካል</b> Task allocated to			
<b>በጥገና ባለሙያ የሚሞላ</b> To be completed by maintenance technical			
<b>ጥገናው ተጠናቋል</b> Was repair completed yes No			
<b>ለጥገናው በጥቅም ላይ የዋለ መለዋወጫ</b> Spare parts used			
<b>መለዋወጫ</b>	<b>ብዛት</b>	<b>መለዋወጫ</b>	<b>ብዛት</b>
<b>ካልተጠናቀቀ ምክንያቱን በመግለጽ የትዕዛዝ ወረቀቱን ወደ ፈ.ሲ.ሊ.ቲ አስተዳደር መላክ</b> If no stat reason work not completed and return work order Form to Head of Facility management			
<b>ጥገናው የተጠናቀቀበት ቀን</b>	<b>የጠ.ጋኙ ስም</b>	<b>ፊርማ</b>	

Figure B.2: St. Peter Hospital Maintenance Request Form

**የሥራው ክፍል**

የሕንፃ እና የቢሮ ጥገና

የሕክምና ዕቃዎች ጥገና

**የሥራ ማዘዣ ፎርም**

ይህን ፎርም ሞልተው ለሚመለከተው ክፍል ይሳካ  
ፎርሙን የሞላው ሰው ስም

---

የሥራ ክፍሉ

---

የሚጠገነው ዕቃ በዝርዝር

---

ሰሪያል ቁጥር \_\_\_\_\_ ያለበት ችግር

---

እንዲጠገን የተጠየቀበት ቀን

---

**በኃላፊዎች የሚሞላ**

በጥገና የተመደበው ሰው ስም \_\_\_\_\_ ፊርማ

---

ለጥገና የተመደበው ሰው የሥራ ድርሻ

---

የጥገና ትዛዝ የተሳሰረበት ቀን \_\_\_\_\_ ሰዓት

---

**የሚጠገነው ሰው የሚሞላ**

በሚጠገነው ዕቃ ላይ የደረሰው ችግር በዝርዝር

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Figure B.2: Alert Hospital Maintenance Request Form

## **Appendix C**

### **Sample of Maintenance Work Guide Line**

**የአሰሪዎች ማህበረሰብ የጠቅላላ ጥገና ቻርተር**

**1. የቻርተር አዳማ፡፡**

- የማዕከሉን የተለያዩ የሥራ የማቀላጠፍና የማከናወን ማረጋገጥ
- የውስጥና የውጭ ተገልጋዮችን የማዕከሉ ጠቅላላ ጥገና አገልግሎቶችን የአገልግሎት አወጣጥ መረጃ የማገኛት ውጤት ለማረጋገጥ
- ለተገልጋዮች ፈጣን እና ጥራት ያለውን ወጤታማ አገልግሎት መስጠት
- ኃላፊነትን በሚሰጡ የአገልግሎት አሰጣጥ ላይ የባለሙያነትና ስሜት ተሰምቷቸው አስተያየትና ግብአት የሚሰጡበትን ሁኔታ ለማግኘት ነው፡፡

**2 ራዕይ**

-በ2020 የምርምሩ የሆስፒታል እና የስልጠና አገልግሎት አስተማማኛ የሚያደርጉ ደጋፊ/አጋዥ/ አገልግሎቶችን በማቅረብ በመስጠት ቀዳሚ ሆኖ መገኛት እና ለተለያዩ መሰል ሆስፒታሎች ተምሳሌ እና አንዳንድ ግብዓትን ተጠቃሚ እንዲሆኑ ማድረግ፡፡

**3 ተልዕኮ**

- ተገቢ የህንጻዎች ምደራ ግቢ ጥገናዎች አድሳት እና አንዳንድ አዳዲስ ስራዎች በመፍጠር የህክምና የስልጠና የምርምር አገልግሎቶች ያለምንም መታወክ ተልዕኮአቸው አንዲወጡ ዋስትና መስጠት ነው፡፡

**4 እሴቶች**

- Commitment /ቁርጠኛነት
- አላማችንን ከግብ ለማድረስ የፀና አቋም ትዕግስትና የሚቋረጥ ጥረት
- Experience / ልምድ  
አገልግሎት ስንሰጥ በቆየንባቸው ጊዜያት የጨመሩልን አውቀት ክፍሎች ችሎታ ከግባችን አንደምነደርስ እርግጠኞች ያደርጉናል፡፡  
Integrity/ አንድነት
- የጋራ መግባባት ታማኝነት አንደነት እና መደጋገፍ አላማችንን ከግብ ለማድረስ ያግዘናል
- Tolerance/ መቻቻል
- በአስተሳሰብና በድርጊት ችግር ፍቺ የጋራ መግባባት እና ትዕግስት መላበስ ወደ ግባችን የሚያደርስን ጎዳናዎችን ናቸው፡፡

**5 የአገልግሎታችን ተጠቃሚዎች፡-**

- የሆስፒታል አገልግሎት ባለሙያዎችና ተካሚዎች
- የምርምር አገልግሎት ባለሙያዎችና ተገልጋዮች
- የስልጠና አገልግሎት ሠራተኞች ስልጣኞች እና እንግዶች
- የድጋፍ ሰጪው የተለያዩ የሥራ ክፍሎች ሠራተኞች እና ተገልጋዮች

**6 የጥራት መርሆዎች፡-**

በአክብሮትና በትህትና አገልግሎት አንሰጣለን

ለተገልጋዩ ጥያቄ እና አስተያየቶች ፈጣን ምላሽ አንስጣለን  
ቀልጣፋ ጥራት ያለውና ውጤታማ አገልግሎት እንሰጣለን  
የመለካም አስተዳዳሪ የግለፅነትና የተጠያቂነት አሰራር በመከታተል አገልግሎት እንሰጣለን።

**7 የአገልግሎት ተጠቃሚዎች መብቶች፡-**

ፈጣን ምላሽ የሚፈልጉ የቀዶ ጥገና ማዋለጃ ተኘተው የሚታከሙ እና የምርምር ክፍሉን በልዩ ተኩረት ማስተናጅቅ  
ቅሬታን አስተያየት የማቅረብ እና ለቅሬታው ፈጣን ምላሽ የማግኘት  
በሚሰጡ አገልግሎቶችና ውሳኔዎች ካልረኩ ስርዓቱን ተከትሎ ለተቋሙ ሀላፊ ቅሬታቸውን ያማቅረብ

**8 የተጠቃሚዎች ግዴታና ማሟላት የሚገባቸው፡-**

- የተለያዩ አገልግሎቶችን ለማግኘት ክፍሉ የሚጠይቃቸውን ቅደመ ሁኔታዎች ማሟላት
- የማዕከሉን አንፋራስትራክቸር እና ንብርት በአግባቡ መጠቀም ደህንነታቸውን በመጠበቅና መንከባከብ ሲበለሹም ማሰወቅ
- አሳሰፈላጊ ከሰነድ-ምግባር ውጭ የሆኑ ባህሪያትን አሰማስየት
- እያንዳንዱ የሥራ ክፍል ባለሞያ አስፈላጊና ጠቃሚ መሆኑን በመገነዘብ ተገቢውን ክብር መስጠት

**9 በኬዝ ቲሙ የሚሰጡ ዋና ዋና አገልግሎቶች ተግባራት**

- ለማዕከሉ የህክምና ክፍሎች እንዲሁም በድጋፍ ሰጪ ህንፃዎች እድሳት እና ማሻሻያ ማድረግ
- ለማዕከሉ አጠቃላይ ህንፃዎች መብራት ሲንቧ ውስጥ ለውስጥ መንገዶች እና የመጸዳጃ የቲሊቲዎች ጥገናና እድሳት እናደርጋለን
- የማዕከሉ የተለያዩ መገልገያ ማሽኖች ጥገናና እድሳት ያደርጋል
- የማዕከሉን የምገብ ማብሰያ ሀይል አቅጣጫ ይሰጣል

በጠቅላላ ጥገና ከ ዝቲም የሚሠጡ አገልግሎቶች የአገልግሎት አሰጣጥ

ተ.ቁ	የሚሰጡ አገልግሎቶች	አገልግሎቱን የሚሰጡ የሥራ ክፍሎች	የአገልግሎት አሰጣጥ / ስታንዳርድ /		የሚሰጥበት ሁኔታ	ወጪ	አገልግሎት ለማገኘት የሚጠይቀው ሁኔታ
			ጊዜ				
			አጭር	ረጅም			
1	በመዕከሉ የሚገኝ ስጦታ ምን እንክብካቤ እድሳት ብተዘረጋው ስር ዓት እና ከናውና ለን	በጠቅላላ ጥገና ቡድን	1 ሰአት		በቅደም ጥገና ቅኝት ሱፐር ቪሽን ግሮች ተጠንተው ሲታወቁ እና ሲለዩ		ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ጎሳ ፈፋ ችግሮች ለመፍታት ስጦታ ምን እና ስጦታ ምን ቅፅ
2	የመዕከሉ የፈሳሽ እና የባንባዎ መሰመሮች ጥገና	ባንባዎ ክፍል	1 ሰአት	1 ቀን	በቅደም ጥገና ቅኝት ሱፐር ቪሽን መረጃ ግሮች		ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
3	የመዕከሉ የውሃ መስመር የአስቸኩዎይ ጥገና	ባንባዎ ጥገና		30 ደቂቃ	በቅደም ጥገና ቅኝት ሱፐር ቪሽን እና በአስቸኩይ ጥገና ፈላጊነት ቅጽ ተሞልቶ ሲቀርብ	የህንጻ እድሳት የመከላከል ስር ማት ጥገና	ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
4	የመዕከሉ የውሃ መስመር የአስቸኩዎይ ጥገና	በመብራት ጥገና ክፍል		30 ደቂቃ		በተለያዩ የካፒታል ስራዎች	ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
5	የመዕከሉ የውሃ አግልግሎት ክትትል እና እንዳይቀረጥ ክትትል ያደርጋል	የመብራትና ባንባዎ ክፍል					ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
6	የመብራት መሰመሮ እድሳት	የመብራትና ጥገና ክፍል	1 ሰአት	1 ቀን			ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
7	አዲስ የፈረንሳይ ጥገና ም	የፈርኒቸር ክፍል	1 ሰዎንት	1 ወር	በቅደም ጥገና ቅኝት ሱፐር ቪሽን ግሮች ተጠንተው ሲታወቁ እና ሲለዩ		ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
8	የመዕከሉ የፈርኒቸር ጥገና ም	የፈርኒቸር ክፍል	30 ደቂቃ	ሰባት ቅን	በቅደም ጥገና ቅኝት ሱፐር ቪሽን መረጃ ግሮችና በሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ		ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ሀላፊዎች ተፈርም የቀረበ የአስቸኩይ ጥገና ቅጽ
9	የህክምና መሳሪያዎች እድሳት ጥገና እና ከናውና ለን።	በመዕከሉ የህክምና መሳሪያዎች ጥገና ክፍል	20 ደቂቃ	2 ቀን	በአስቸኩይ ጥገና ቅፅ ሲሞላ በክፍሉ ቅደም ጥገና / ሱፐር ቪሽን መረጃ ተጠንቶ ሲቀርብ		ቅደም ጥገና ቅኝት / ሱፐር ቪሽን መረጃ ግሮችና በክፍሉ ጎሳ ፈፋ ችግሮች ለመፍታት ስጦታ ምን እና ስጦታ ምን ቅፅ

## **Appendix D**

### **Pictures Testimonial**



Picture 1: Leaking sewerage lines on ceiling due to poor sanitary line design and installation at St. Peter Hospital.



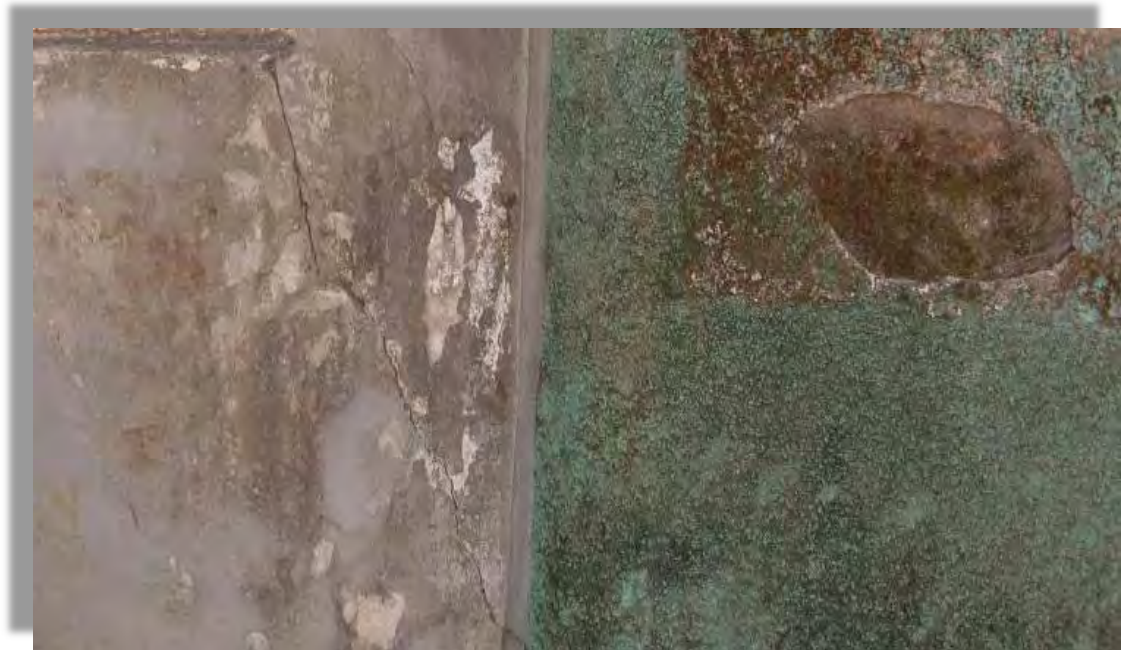
Picture 2 :Exposed utility lines at delivery wards which is hazardous for patients and all the users of the ward. This shows a design and room height problem (St. Peter Hospital).



Picture 3 :Moisture in ceiling of patient's bed room due to a leakage from the roof.



Picture 4 : Moisture in wall due to seepage of moisture from outside of the building.



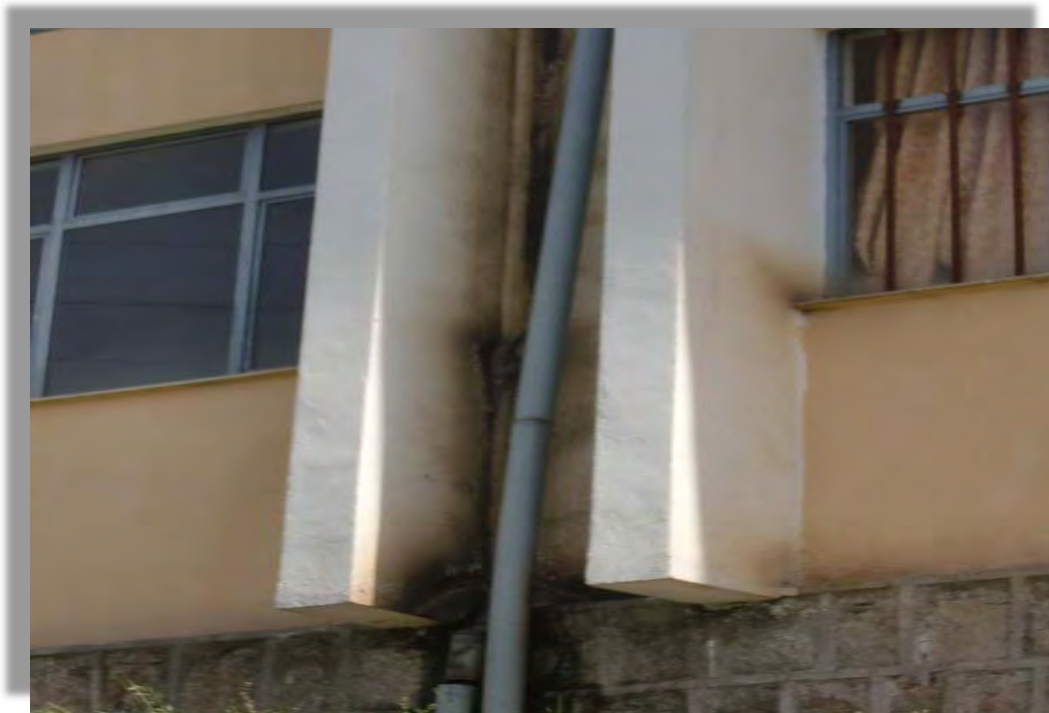
Picture 5:Bad appearance on external wall due to ageing.



Picture 6 :Crack on wall due to poor design and construction.



Picture 7 : Moisture in wall due to seepage of moisture from outside of the building.



Picture 8 : Drainage pipe leaking and damaging external wall.



Picture 9:Moisture in Ceiling due to improper installation of ventilation system at Alert Hospital kitchen.



Picture 10:Doors need to be changed which is not good for safety and appearance at Alert hospital

## DECLARATION

I declare that this thesis is my original work and has not been presented for a degree in other university and all source of materials used for the thesis have been duly acknowledged.

Mekdes Sahelu

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August, 2015

Addis Ababa University

This thesis has been submitted for examination with my approval as university advisor.

Abebe Dinku (Prof, Dr. Ing.)

SUBMITTED BY:

_____	_____	_____
Student	Signature	Date

APPROVED BY:

1. _____	_____	_____
Advisor	Signature	Date

2. _____	_____	_____
Examiner	Signature	Date

3. _____	_____	_____
Chairman, Dep.'s Graduate Committee	Signature	Date

4. _____	_____	_____
Dean, Graduate School	Signature	Date