

# Assessment on causes of defect and the maintenance management practices on low cost building (A case study of Jimma Town Condominium)

Arif Awol, Dr.Ing. Tamene Adugna, Alemu Mosisa

**Abstract—** Building maintenance management is a medium provider and operator that oversee the components related to building condition and services installation to ensure the optimum it. Existing condominium building in Jimma Town lacks adequate maintenance attention. Most condominium buildings are in very poor and deplorable conditions of structural and decorative disrepair. The main aim of the study is to evaluate the condominium maintenance management practice in Jimma Town, by assessing the current maintenance practices, determining factors affecting maintenance management and identifying causes of defects in Jimma Town condominium.

The methodology used in this thesis work was a case study and physical survey. The data for this work was obtained from government representative through appropriately designing the questionnaires, conducting relevant interviews. Quantitative as well as qualitative analysis was also used.

The main objective of the study is to evaluate the management practice of condominium maintenance in Jimma Town.

The findings show that most low cost housing (Jimma town condominium) defects are caused by leaking pipes, cracking, peeling paint, damp, leaking pipes, timber decay, sagging, fungi, termites, broken tiles, and electrical faults. It is widely accepted that the contributing causes of these defects include weak designs, poor workmanship, and quality of materials.

**Index Terms—** condominium, defects, Maintenance management.

## I. INTRODUCTION

Housing is one of the three most essential human needs. According to the United Nations Universal Declaration of Human Rights 1948 Article 25 (1): "Everyone has the right to a

Standard of living adequate for the health and well-being of himself and of his family, including, Food, clothing, housing and medical care."

The word "condominium" comes from two Latin words meaning common ownership or control.

It describes a legal form of ownership and not a type of building or residence (Hawaii Real Estate Commission, 2009).

Building maintenance is an important programme for the sustainability of infrastructural development. It plays an important role among other activities in the building operations (Zulkarnain et al., 2011).

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It is a well-known fact that the primary objective of building maintenance is to preserve buildings in their initial functional, structural and aesthetic states (Adejimi, 2005). This is to ensure that such facility continue to remain in such state and retain their investment value over a long period of existence.

As the researcher observed Maintenance programme in Jimma has not received much attention in the past. Only Jimma University owned condominiums get maintenance recently. This is also in line with the statement of Kunya et al., (2007) who observed that there is apparent lack of maintenance culture in Nigeria which is similar for this study area. The main aim of the study is to evaluate the condominium maintenance management practice in Jimma.

The Existing condominium building in Jimma town lacks an appropriate maintenance attention. Most condominium buildings in Jimma town are in very poor and deplorable conditions of structural and decorative disrepair.

While considerable of research have been carried out on factors responsible for the poor maintenance of public housing in different country but no research carried out on factors affecting condominium maintenance and causes of defects in Jimma. Only scant attention has been given to the key parameters affecting the implementation of maintenance programmes for condominium buildings (Jit Condominium). There is therefore a need to establish and evaluate the factor affecting maintenance and defects of condominium buildings using appropriate analysis

## II. OBJECTIVES

- To identify causes of defects in Jimma town condominium Building.
- To assess the current maintenance practices of condominium in Jimma town
- To determine factors affecting maintenance management of condominium buildings Jimma town..

## III. METHODOLOGY OF THE STUDY

The methodology used in this paper utilizes a literature review, interviews, and visual inspections involving both public and private sectors, in decreasing defects in buildings. The research strategy will relay extensively on Survey approach where by data is collected through visual inspections, questioners and interviews.

### A. STUDY AREA

The study will be conducted in Oromia regional state, Jimma town. The study area is located in Jimma area of Oromia

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National Regional State. Jimma is located at about 346 Km in the South West of Addis Ababa and has total surface area of 4,623 hectares. The town is divided in to 3Woreda/Higher and 13 Kebeles. The number of households reported in the town is 26,000. The total projected population of the town from 2007 central statistical agency (CSA) census report is 130,254. The town has a temperature that ranges from 20-30 Co and the average annual rainfall of 800-2500mm<sup>3</sup> and the town has an altitude of 1718-2000 m above sea level.

c = number of respondents “somewhat significant and known”  
d = number of respondents “not very significant and partially unknown”

e = number of respondents “not significant and perfectly unknown”

N = sample size = 62

j = number of response categories = 5

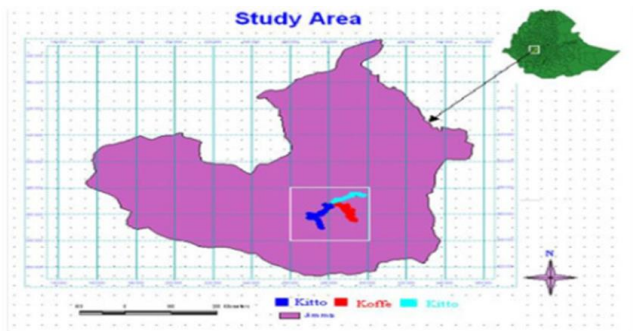


FIG 1. STUDY AREA

Quantitative type of research was extensively be used, because the data to be utilized should be in a concise format and need to test the relationships of variable among each other to generalize findings to larger population.

The statistical tools used for this study include percentage, mean, and relative significance index RSI (also known as Index of Relative Importance, IRI or Relative Importance Index, RII) to determine which of the factors that are affecting housing maintenance and probable solutions to the housing maintenance problems.

The relative significance index ranking (RSI) was used for ranking of the factors studied. These methods had been used in construction research by authors such as, (Elhag T and Boussabaine, A, 1999), , (Faniran, 1999), (Idrus, A.B. & Newman, J, 2002) Kangwa and Olubodun (2003) and Oladapo (2006) among others. Bakhary (2005) gave an equation that could be useful for determining Relative Significance Index (RSI) in prevalence data as:

$$RII = \frac{\sum W}{AN}$$

Where w is the weighting given to each factor by the respondents, ranging from 1 to 5, A is the highest weight (i.e. 5 in the study) and N is the total number of samples. The rating of all the factors for degree of significance was based on the value of their respective relative importance index (RII).

According to (Olanrewaju, 2015), for this type of research work where a 5-point scale was used, the RSI shall be calculated via the equation:

$$RSI = \frac{5a + 4b + 3c + 2d + 1e}{jN}$$

$$(0 < \text{index} < 1)$$

Where: a = number of respondents “extremely significant and perfectly known”,

b = number of respondents “very significant and partially known”

## IV. RESULTS AND DISCUSSIONS

Results are achievement of a study and are the basis for answering the objectives of the research. They also show the overall findings of the study which are used to forward conclusions and recommendations.

Table 1. Professions of the respondents

Participants	Frequency	Percentage
Engineers representatives	9	20.46
Contractors representatives	14	31.82
Home owners	21	47.72
Total	44	100

Table 1, showed respondents occupation. It showed that 20.46% Engineers representative and 79.54% Home owners

### THE PRESENT CONDITION OF THE BUILDINGS ELEMENTS

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

### TYPES OF BUILDING DEFECTS

According to Table 2, the types of low cost housing (Jimma Town condominium) defects addressed in this study include leaking pipes ,cracking, electrical faults, paint problems, damp, broken tiles, mold, and sagging. There aren't any issues of termite attack and timber decay.

Generally, leaking pipes (including sanitary), peeling paint and cracking are the top three type of defect observed in this study.

#### a. leaking pipes

As it was ranked on table 2, Leaking of pipes was the top ranked type of defects. Leaking is water that seeps out from behind walls, under concrete slabs and asphalt, basements, landscaping, water intrusion in roofs, irrigation systems, and radiant heat system. The consequence of leaking is damp.



Fig 2. (a) Pipe leakage due to improper connection.



Fig 2. (b). Leaking of pipes in toilet

#### b. peeling paint

Paint peeling refers to paint that does not adhere to the surface. It can appear in a wide range of geometries. It is usually caused by incompatible foreign materials either in the paint or on the substrate, but can also be caused by incompatible substrate material, and occasionally improper paint application process control.



Fig 3. Peeling of paint on the wall (Saris site)

Peeling paint was the most common defect which was critically found on the building façade, especially on the plastered walls, ceilings, beams and columns. These components were consistently exposed to sunlight, rain, wind and dampness, resulting in peeling paint.

#### c. Cracking

A structure needs to be maintained after a lapse of certain period from its construction completion. Some structures may need a very early look into their deterioration problems, while others can sustain themselves very well for many years depending on the quality of design and construction (Wang, 2011). The excessive exposure spoiled the surface of paint and thus the surface became chalky, flake and blistered. The problem of peeling paint in schools mostly occurred on the walls, internal or external. The paint on ceiling was also gradually peeled off due to the present of moisture.



Fig 4. Cracking on the wall and Floor

Some parts of the inspected Jimma town condominium showed serious cracks while some only showed minor cracks. From the inspection, cracks in wall were in various directions and varying in width from cracks to 5mm or more. The cracks in plaster and other finishes affected the appearance of the structure but fortunately did not pose any safety concern. There were long and continuous cracks across the walls, beams, columns, ceilings and floors. Moreover, a diagonal crack was found at the corner of door where the crack tip was very thin with increased thickness at the initial point.

#### d. Damp

In this post we did discussed the general terms about dampness in buildings and the potential causes and we will, hopefully, go on in future to look at more specific damp problems and their remedies. Dampness in buildings can arise from a number of sources and it is important to trace the cause of the problem before deciding what repairs are required.

According to (Afranie, 1999), the most common causes of dampness are likely to be:-

- Penetrating dampness – Moisture entering the building from the outside due to a defect in the structure, such as a leaking roof, flashing or rainwater pipe.
- Rising Dampness – Moisture from the ground rising up the external walls due to the damp-proof course being absent or defective.
- Leaks on Services – Leaks from tanks, pipes, sanitary fittings or drains that are causing dampness to the fabric of the building

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Fig 5. Wall dampness

Dampness can arise from unintended water caused by leaking pipes, gutters and flashings. The leaking water penetrated into the wall, resulting in horrible water stains. Under long term of dampness penetration and poor ventilation within the building, excessive moisture promoted the growth of mould on the surface of wall (Wang, 2011).

However, damp is less responsible for paint problems. According to data analysis from the check list, approximately 72% (table 4) of the building had damp problems. The locations of damp.

e. Mold and Fungi

The growth of mould and fungi are ordinary consequences caused by excessive dampness. Mould and fungi will grow when they gain enough moisture and nutrients (Wang, 2011). However, the growth of mould causes a lot of problems to the school environment. It not only physically affected the appearance of the building structure, but also led to plenty of health illnesses to the students and staffs.



Fig 6. Mold and Fungi on the wall

f. Broken tiles

Tiles were used as finishes to walls and floors. The types of tiles used in the inspected schools were ceramic tiles and homogenous tiles. There were only certain areas utilized the tiles as finishes because most areas were finished by plaster renderings which were cheaper. The major problems found in the inspected schools were cracked, broken and loose tiles. Heavy objects dropped on the tiles would crack and break the tiles. Defective tiles can further affect the visual appearance

of floors and walls. In brief, this defect was caused by vandalism, impact damage, improper maintenance and poor materials.

g. Sagging or deformation (roof)

Most of the roof systems constructed in each school buildings were pitched roof system. However, there were still flat roof systems in some school buildings. Roof is an important element in a building as it protects the interior from the external weather, such as rain, sun light and wind.

From the inspections, the roof defects found were the blocked gutters, leaking downpipes, leaking roofs, missing roof tiles, slipping roof tiles and also defective soffit and fascia board. The causes of blocked gutters were the growth of plants and accumulation of leaves and debris. As the result, the rainwater will overflow when there was a heavy rain. However, it was also discovered that gutters were not constructed along during the construction stage at some of the condominium buildings.

Table 2. Types of building defects

No.	Type	Percentage	Rank
1.	leaking pipes	88%	1
2.	peeling paint	83%	2
3.	Cracking	76%	3
4.	Damp	72%	4
5.	sagging or deformation (roof)	53%	5
6.	broken tiles	48%	6
7.	faulty electrics	44%	7
8.	timber decay	41%	8
9.	mold or fungi	25%	9
10.	Termite	22%	10

THE MAJOR CONTRIBUTING CAUSES OF DEFECTS

As it was stated on Table 2, the four main causes of defect in the selected Jimma Town low cost housing were weakness in design, poor workmanship, low quality material and lack of awareness by occupants about the maintenance of their houses. While:

1. Low quality material,
2. Poor workmanship and
3. Weakness in design was top three ranked by the respondents.

The secondary data collected from the Jimma housing development agency indicates that, the condominium in Jimma town was constructed by small micros. These small micros are grouped by the government to create job for them, but they have no experience and also qualification for the construction of the building.

The finding from interview indicates that” there is no organized structure for maintenance work in condominium” and also he states that “there is no budget allocated by government for maintenance work, if urgent maintenance was required I will be done by collecting money from the owner of the house.” This indicates that lack maintenance department and lack of sufficient budget from governed were also factor for these defects.

Generally, the major contributing causes of defects are weakness in design, poor workmanship, and low quality material. Furthermore, these defects are also due to a lack of awareness by occupants about the maintenance of their houses.

Table 3. The major contributing causes of defects

No	Causes	RII	
1.	Low quality of material	0.87	1
2.	Poor workman ship	0.64	2
3.	Weakness in design	0.61	3
4.	Lack of awareness by occupants about maintained	0.44	4

#### MAINTENANCE MANAGEMENT

The maintenance strategy for all the condominium was corrective maintenance with no planned preventive maintenance. All respondents agree that the Jimma housing development agency have you formulated a strategic plan for maintenance of the Condominium buildings.

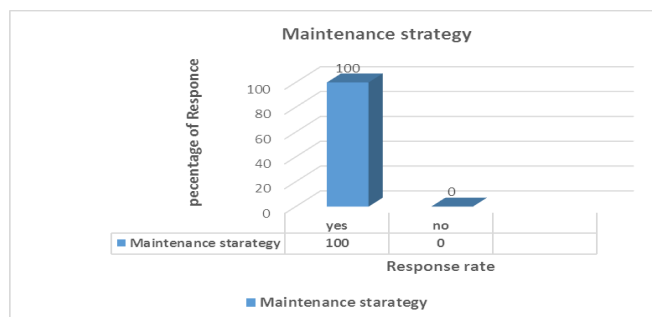


Fig 7. Maintenance strategy

As it was indicated on fig 8, Type of maintenance strategy of the Jimma town housing development agency was the

condition base type of maintenance. This type of maintenance is performed after one or more indicators shows that the building needs maintenance. A good practice for this type of maintenance was the roofing maintenance. Due to rain if the roof of the building is removed the urgent maintenance will be required. This one was the most frequent in the study area

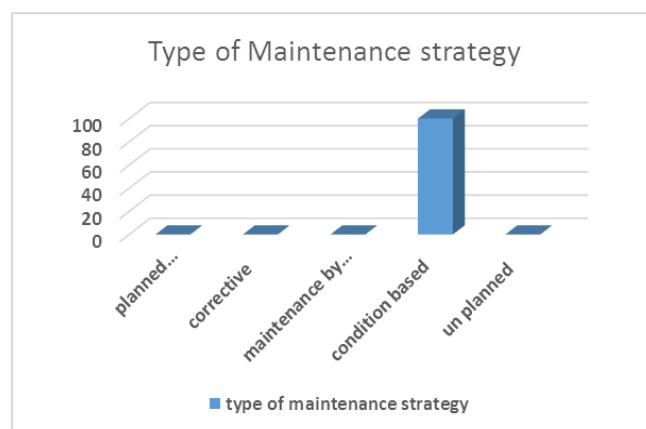


Fig 8. Type of maintenance strategy

#### FACTORS AFFECTING THE HOUSING MAINTENANCE

Table 4. Showed the relative significance index (RSI) of the factors affecting the housing maintenance. Cash flow or budget was ranked first with an RSI value of 0.950, material specifications ranked second with RSI value of 0.877 and Construction supervision ranked third with an RSI value of 0.873. These are followed by Lack of preventive maintenance (maintenance culture) 0.868. They made significant contributions to the conditions of the buildings thus observed.

Table 4. Identified factors affecting housing maintenance

Factors	4	3	2	1	Total	TWV	RSI	Rank
Cash flow (budget)	5	2	1	0	44	208	0.950	1
Material specifications	8	1	3	2	44	193	0.877	2
Construction supervision	8	3	2	2	44	192	0.873	3
Lack of preventive maintenance (maintenance culture)	9	4	4	0	44	191	0.868	4
Design and proper workmanship	4	3	4	4	44	182	0.827	5
Lack of building maintenance standard and policy	1	8	6	0	44	176	0.800	6
Client attitude to maintenance	7	6	4	6	44	165	0.750	7
Incorrect selection of building material component and system	6	2	16	6	44	138	0.627	8
Lack of understanding the importance of maintenance work	5	1	18	9	44	123	0.559	9

#### V. CONCLUSION AND RECOMMENDATION

From the data collection, the findings show that the types of low cost housing (Jimma town condominium) defects

included cracking, peeling paint, damp, leaking pipes, timber decay, sagging or deformation (roof), mold or fungi, termites, broken tiles, and faulty electrics, were identified. The majority defect occurring in low cost housing was cracking. The major contributing causes of defects in the selected

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building were also identified and ranked based on the level of importance as:

1. Low quality of material
2. Poor workman ship
3. Weakness in design
4. Lack of awareness by occupants about maintained

There were no series issues or defects that occurred due to termite attacks, timber decay, sagging, or deformation. Furthermore, the cause of defects was also due to lack awareness by occupants about the maintenance of their house. The consequence of faulty design affects the structure of building through vertical cracks, damp, sagging and deformation of roofs, and drainage systems. Cracks, paint problems, leaking pipes, and faulty electricians are caused by poor workmanship. Unskilled workers were probably used to construct low cost housing projects due to minimal costs. The defects that cause material problems are paint, leaking pipes, faulty electricians, and broken tiles.

The maintenance strategy for all the condominium was corrective maintenance with no planned preventive maintenance. All respondents agree that the Jimma housing development agency have formulated a strategic plan for maintenance of the Condominium buildings. Type of maintenance strategy of the Jimma town housing development agency was the condition base type of maintenance. This type of maintenance is performed after one or more indicators shows that the building needs maintenance. A good practice for this type of maintenance was the roofing

maintenance. Due to rain if the roof of the building is removed the urgent maintenance will be required. This one is the most frequent in the study area.

The factors affecting the condominium housing maintenance was also identified and ranked based on their level of importance. Accordingly, Cash flow or budget was ranked first with an RSI value of 0.950, material specifications ranked second with RSI value of 0.877 and Construction supervision ranked third with an RSI value of 0.873. These are followed by Lack of preventive maintenance (maintenance culture) 0.868. They made significant contributions to the conditions of the buildings thus observed.

The following recommendation were forwarded based the finding of this study.

1. Need for Introduction of maintenance performance evaluation, maintenance departments should develop a condition assessment system for all their built facilities that set minimum condition standards at which various building should be maintained. Likewise they need to introduce or intensify their periodic condition assessment/surveys from which their maintenance workload and prioritization of maintenance work is determined.

2. There is the need for Jimma town condominium to embrace preventive maintenance practice as a high priority rather than emergency maintenance. To gain optimum benefits from preventive maintenance, housing development agency should incorporate preventive maintenance tasks into a work-order system and keep systematic maintenance records, either by computer or manually. They should evaluate the preventive maintenance program to improve it over time.

3. Many condominiums building in Jimma town lack maintenance. Urgent maintenance should be done for some buildings. Unless, many life of the people was in risk.

4. Jimma housing development agency should learn a good lesson from the Jimma university staff condominium (Dippo and Jit) maintenance.

5. All condominium owners should contribute some money and use that money for maintenance until the budget released from the government.

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