

Repair and Maintenance Works for Low Cost Housing; Issues and Solution to Promote Sustainable Housing Concept

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Abstract

Dwellings are a basic necessity to mankind for the purpose of security, comfort or to display a certain image, prestige or status. The aim of this study is to investigate and identify the repair and maintenance works for low cost flats. The objectives of this research is to identify the factors that most effect the building elements deterioration and to rank the building, mechanical and electrical elements that effect on the deterioration of the building. To achieve these objectives a survey is carried out based on structural questionnaires as well as physical observation by taking photograph of the building elements in the flats. The questionnaires survey conducted is presented using quantitative method (SPSS). The result show that there is growing demand for flats occupants. Based on the objective highlighted, the hypothesis created is tenants can prevent and slow down the building elements deterioration process with the make use of the factors provided. It was concluded that repairs and maintenance works should be done in good manner to satisfy tenants' wants and also reduce the building elements deterioration.

Keywords: low cost flats, repair and maintenance

1.0 Introduction

All buildings deteriorate over time. Deterioration means the condition of a building is lower over time means of quality. The maintenance works are done according to the specification. Other reasons are to maintain the value of the building and to control the quality of the building (El-Haram & Horner 2002).

The administration of maintenance management is important to retain an item in or restore it to a state in which it can perform a required purpose (BSI, 1993). According to Wood, B. (2009) building maintenance is actions that keep buildings functioning effectively. It is important to keep the building operations in good performance especially for health and safety.

The delay in repairs and maintenance works can create problem for the residents' daily life. As the building aging, the damaging was often occurring. In order to keep maintaining the building in good condition, residents must pay the maintenance fees. The problem arose to the building owner to settle all the maintenance fees. Therefore, the objectives of this study are as follows:

- i. To identify the factors that highly contributed to the building elements deterioration.
- ii. To rank the elements that give effect on the building deterioration

2.0 Maintenance for Multi Storey Public Housing

In the 80's the public sector housing is undertaken by Government agencies like the State Economic Development Corporations. The provision of low-cost houses is shared between the public and private sector. The private sector that does the construction of low-cost houses must develop 30% of what they build to be low-cost houses (Hooi, 2008).

The 10th Malaysian Plan, the government has developed 78,000 affordable houses and RM500 million funds to recover housing projects. Government also has implemented guiding principle and policies to protect the low-income group so that they could afford to own house (Suhaida et al. 2011).

According to Seeley (1987) the prime aim of building maintenance is to preserve a building in initial state. The purpose of the building need to be retain through the implementation of building maintenance. The purposes to maintain the buildings as stated below:

- i. Retaining investment value

- ii. Maintaining building in an acceptable condition and required standard
- iii. Presenting a good appearance of building
- iv. Generating income for building owner and surrounding activities
- v. Conserving historical and architectural values of building.

2.1 Type of Repair and Maintenance Works

Maintenance is divided into two categories. The owner of the property must determine the type of maintenance to be done in order to keep the property in good operation. As cited by Rooley (1993) a survey is carried out to the building to determine the maintenance need to be made. There are major and minor maintenance. Based on the survey carried out, the new plan for maintenance is made.

- i. Preventive maintenance
Preventive maintenance means the process of checking and reconditioning the defect elements according to the planned and schedule works. Maintenance will be conducted according to the planned schedule. Thus, it can reduce the building elements deteriorate more quickly (Dhillon& Liu 2006).
- ii. Corrective maintenance
According to Dhillon and Liu (2006) corrective maintenance means unplanned and unprepared maintenance management. The maintenance will be carried out if the failures are arises. The building user waits until trouble arises and then carries out maintenance. Lind and Musingo (2012) stated that corrective maintenance is a breakdown, failure based and unplanned maintenance in a building.

2.2 Building Deterioration

The deterioration of building components are the quality of construction and materials, the local weather conditions or the lack of maintenance (Balaras et al. 2005).In many countries, adverse environmental conditions contribute a major problems in deterioration of concrete structures especially in urban environments (Balaras et al. 2005).Sanchez-Silva et al. (2011) stated that chloride ingress is the cause of deterioration in reinforced concrete structures. This will lead to steel corrosion, loss of effective cross-section of steel reinforcement, concrete cracking, loss of bond and spalling.

Factors contributing building deterioration can be classified into ten categories, as follow;

- i. Workmanship
In many cases their quality of works is low due to lacks of experiences and improper guidance from the relevant parties (Suffian, 2013). Government has conducting field training, seminar and short courses as the effort by government to improve knowledge and skill of those small contractors.
- ii. Environmental condition
The rate of deterioration is influence by environmental conditions that constitute macro and micro-environment. Generally, a frequent change of temperature and pressure, high humidity and abundant rainfall is the environmental condition under tropical climate (Silva et al. 2012). Micro environment is the building's height, size, orientation and usage of the building. The most frequent maintainability problem was stated by Staining if the environmental conditions were ignored in the design process (Chew & Tan, 2003a; Flores-Colen et al. 2008).
- iii. Building's age
All buildings that are completed and in use are stated as start to age (Arditi&Nawakorawit, 1998). All buildings will deteriorate according to building's age. The deterioration of building is cause by various exposure conditions.
- iv. Material
Selection of materials is important such as service life, sustainability, compatibility, maintainability and deterioration mechanisms (Shohet&Paciuk, 2004; Teo&Harikrishna, 2006; Yong, 2007).
- v. Cost growth
According to Lee and Wordsworth (2001) in most cases the longer a defect is left unattended, the more expensive the remedial work, not only to the component affected but also to the surrounding parts of the

structure. It is not possible to lay down any universal rules and in each case the deterioration characteristics of the affected component must be considered as well as the properties of adjoining components.

- vi. Inadequate brief
Human fault could lead to disruption of scheduled operations and damage to property and equipment (Dhillon & Liu 2006). The factors of building defects are inadequate brief and fail to give vital information on the functional requirements of the building may lead to building defects. Usually, there is no indication of the client's attitude towards maintenance (Lee & Wordsworth 2001).
- vii. Faulty design decisions
The faulty design decisions had been stated by Lee and Wordsworth (2001) are:
 - a) Fault to selection of material and design criteria.
 - b) Lack of knowledge the basic physical properties of materials.
 - c) New and innovative materials that not fit to use.
 - d) Material cannot withstand the climatic condition.
 - e) Complicated design of building and specification that has high probability to fail in construction.
 - f) Ineffective communications between members in design team.
- viii. Construction methods
There will be no compensation for the fault of construction method. It may place a heavy burden on the building for rest of its life (Ishak et al. 2007). The quality construction method can speed up the construction process. But, if construction method is bad this can result in careless and skipped work. Labours play the main role to make sure the quality of the building is well. The plants and machineries involve must according to the works needed. The materials are following the specifications.
- ix. User activities
Vandalism is a criminal. Unintentional misuse is the factors of defect in a building. Construction team should design the building according to degree of sensitivity of use. Building deterioration also effected by social attitudes and financial circumstances as they are not afforded to do maintenance in their building (Lee & Wordsworth 2001).
- x. Maintenance
Lee and Wordsworth (2001) the building will get worsen and deteriorate when inappropriate remedial work and wrong identification for cause of the defect. Also, carelessness in carrying out maintenance and inspections may be the causes worsen the building elements.

3.0 Research Methodology

Data were collected using quantitative method. Questionnaires survey is distributed by hand (face to face) among the tenants in the flats using random sampling. First phase, the data collected is 30% which equal to 36 numbers of respondents out of 120 numbers of populations.

Second phase, total data collected is 50% which is 60 numbers of respondents out of 120. The third phase is 82% and total data collected from the respondents is 98. The collection of data did not reach the target because it is difficult to get the respondents cooperation. The data collected are analysed from the questionnaires conducted then presented in the forms of tables using frequency analysis and descriptive analysis

Total numbers of respondents obtained in the research area are 98 numbers of respondents out of 120 surveys sent to respondents. It is about 81.67% the total number of respondents answer the questionnaires. There are three flats involve in getting the respondents. The three flats are located nearby to each other's. So, it will ease the researcher to conduct the questionnaires.

4.0 Factor of deterioration and the ranking of building deterioration

The first research objective to be achieved is to identify the factors that most effect the building elements deterioration. The questionnaires were distributed among the tenants for them to answer. The respondents have to choose whether they are agreed or disagreed with the factors listed in the questionnaires.

i. Vandalism

Building deterioration also effected by social attitudes and financial circumstances as they are not afforded to do maintenance in their building (Lee & Wordsworth 2001).

Table 1 show the factor of building elements deterioration. One of the factors listed is vandalism. The highest percentage is 71.4% contribute about 70 respondents agreed that vandalism is the factor of building elements deterioration. In the other hand, 28 respondents disagreed that vandalism is the factor of building elements deterioration which contribute about 28.6%. Majority of the tenants are agreed that vandalism is the factor of building elements deterioration.

ii. Function of the building

Table 1 show the factor of building elements deterioration. One of the factors is function of the building. The highest percentage is 62.2% contribute about 61 numbers of tenants disagreed that function is the factor of building elements deterioration. While, 37 numbers of tenants agreed that location is the factor of building elements deterioration which contributes about 37.8%. It can be concluded that, function is not the factors of building elements deterioration.

iii. Climatic

Climatic is one of the factors of building deterioration. Based on the finding in Table 1, tenants are disagreed that climatic is the factor of building elements deterioration which contributes about 57.1% with 56 numbers of tenants. The others 42 numbers of tenants agreed with the factors and came out with 42.9%. The result is almost equal between yes and no.

Thus, climatic is part of the factor of building element deterioration because weather in this country is high in humidity yet sometimes weather can be extremely hot. Air coming from the sea can be part of the factor that can promote corrosion. According to Silva et al. (2012) the rate of deterioration is influence by environmental conditions that constitute macro and micro-environment. Generally, a frequent change of temperature and pressure, high humidity and abundant rainfall is the environmental condition under tropical climate.

iv. Maintenance

Table 1 show the percentage and frequency of analyzing data from the questionnaires answered by the tenants. The highest percentage stated is 67.3% and the lowest is 32.7%. Based on the percentage, tenants are more satisfied and agreed that maintenance is the factor of building elements deterioration.

To maintaining the performance right through its service life effective maintenance is needed for building or an infrastructure (Ma´rquez, 2007; Ma´rquez et al., 2009). Obviously, maintenance is important to avoid elements deterioration.

v. Building's age

The data presented in Table 1 stated that building age is the factor of building elements deterioration. The analyzing made show that 67.3% tenants were agreed that building age is the factor of building elements deterioration. While 32.7% of tenants disagreed with the factor stated earlier.

All buildings that are completed and in use are stated as start to age (Arditi&Nawakorawit, 1998). According to Silva et al. (2012) all buildings will deteriorate according to building's age. The deterioration of building is cause by various exposure conditions. In other word, the performance of buildings would deteriorate gradually throughout their service life. The sensitivity and the exposure indicate the speed of the lost performance of the component in the building. Thus, it can be conclude that, building age can be one of the factors of building elements deterioration.

vi. Construction method

The data was analyzed and described in the Table 1. The tenants were agreed that construction method is not the factor of building elements deterioration. The statement can be proven with the percentage presented which is 64.3% tenants disagreed with the factor described. While 35.7% of tenants agreed with the factor.

Tenants were disagreed with the factor because they feel that the condition of the building is good at the early entering the flat. Besides, tenants have less knowledge on construction method. Thus, majority of

the respondents are disagreed as the construction method is the building elements deterioration factor. According to (Ishak et al. 2007) there will be no compensation for the fault of construction method. It may place a heavy burden on the building for rest of its life.

vii .Material

Table 1 shows the highest percentage is 61.2% with the frequency of 60 tenants. Majority of the tenants were disagreed as the material is the factor of building elements deterioration. The least percentage is 38.8% with 38 numbers of tenants agreed material is the factor of building elements deterioration. In conclusion, material is not the factor of building elements deterioration. Selection of materials is important such as service life, sustainability, compatibility, maintainability and deterioration mechanisms (Shohet&Paciuk, 2004; Teo&Harikrishna, 2006; Yong, 2007).

viii. Human behavior

Human behavior can be defined as the actions do by people. It can be positive action and negative action. Table 1 below stated that tenants were agreed that human behavior is the factor of building elements deterioration. The statement is verified with the percentage presented which is 68.4% compared to disagreed tenants percentage that is 31.6%. Therefore, human behavior had the majority of 36 tenants and may enough to be the factor of building elements deterioration.

xi. Cleanliness

Table 1 presented the analyzing data from the questionnaires conducted. Cleanliness is tested to verify it is the factor of building elements deterioration. The tenants were strongly agreed that the cleanliness is the factor of building elements deterioration. The percentage is 68.4% for tenants that agreed with the factor and 31.6% for tenants that disagreed with the factor. So, majority stated that, cleanliness is one of the factors of building elements deterioration.

Table 1 : Factors Of Building Elements Deterioration

Item	Factors Of Building Elements Deterioration	Yes (%)	No (%)
1	Vandalism	71.4	28.8
2	Function of building	37.8	62.2
3	Climatic	42.9	57.8
4	Maintenance	67.3	37.2
5	Building age	67.3	37.2
6	Construction method	35.7	64.3
7	Material	38.8	61.2
8	Human behaviour	68.4	31.6
9	Cleanliness	68.4	31.6

Second research objectives is to rank the building, mechanical and electrical elements that effect on the deterioration of the elements. Table 2 shows the building, mechanical and electrical elements that effect on the deterioration of the building elements. The mean is used to indicate the highest and the lowest elements effected the deterioration of the building. Plumbing is the most effected the deterioration of building elements which contribute about 3.54 of mean. The lowest effect the deterioration of the building elements is ceiling which is 1.39 of mean.

i. Plumbing

Plumbing is presented as the highest mean compared to the others elements. The highest mean is the most elements effect the deterioration of the building. There are three type of plumbing in the flats which are water reticulation plumbing, sewerage plumbing and rain water down pipe.

The effected elements did not affect the respondents' daily life. Other, it is possible that the rain water down pipe is be stolen by irresponsible people. Furthermore, it is difficult to inspect as this is the high building. Any obstacles are difficult to detect yet it may block the flow of the rain water.

- ii. Lift or elevator
The second highest mean is mechanical elements which is lift. The mean is 3.44 compared to the highest 3.54. The lift or elevator was found effected the deterioration of the flats. Based on the observation made the reason why the lift is effected the deterioration of building is the frequency of using the lift. Every day, tenants are using the lift for them to move up and down the flats. So, the probability for the lift to be effected is high. The maintenance works carrying out are irregular and based on report.
- iii. Window
The third highest mean is building element which is window. The mean is 3.35 compared to second highest mean 3.44 and the highest mean 3.54. Related to the mean, window is the third elements effected the deterioration of the flats. According to the tenants, the glazing were not repaired or replaced with new.
- iv. Ceiling
The lowest elements effect the deterioration of building is the ceiling. The mean presented is the lowest among others elements which is 1.39 from 98 numbers of respondents. According to the tenants, the holes are not repaired although reports have been made.
- v. Fire protection
Mean for fire protection element is the second lowest among all data. The mean is about 1.44. Fire protection system is less contributes to damage of the building. According to the respondents, there is no fire occurred since they lives here. The fire protection system is always functioning to keep the tenants in safe condition. Every one month, the local authority such as BOMBA will check and rectify any problem arises.

Table 2: Building, mechanical and electrical elements

Item	Element	N	Mean
1	Plumbing	98	3.54
2	Lift	98	3.44
3	Window	98	3.35
4	Water supply	98	3.09
5	Electric supply	98	3.08
6	External door	98	2.69
7	External wall finishes	98	2.46
8	Painting	98	2.35
9	Internal door	98	2.31
10	External floor finishes	98	2.24
11	Internal floor finishes	98	2.21
12	Internal wall finishes	98	2.18
13	Fire protection	98	1.44
14	Ceiling	98	1.39
15	Valid N (listwise)	N	Mean

4.0 Conclusion

Based on the analysis made, majority of tenants are agreed that the building elements deterioration is based on the listed factors. The factors are vandalism, location, function, climatic, maintenance, building age, construction method, materials, human behavior and cleanliness. The hypothesis is accepted because majority of the tenants are agreed with the factors of building deterioration.

The second objectives is to rank the building, mechanical and electrical elements that effect on the deterioration of the building and the formed hypothesis created is the repair and maintenance works can be conducted according to the frequency of building elements deterioration so that the works can be planned and performed well. Based on the analysis made, clearly show that, there are certain elements that give problems to the building and lead to building deterioration. Majority of the flats are having the same problems and tenants should alert of the problems. The regularity of the building, mechanical and electrical elements problems can be control based the finding made in the analysis.

Therefore, regular and periodic repair and maintenance are necessary. Furthermore, to avoid element like vandalism, special enforcement like penalty can be imposed. Centralize circuit television (CCTV) can also be used to reduce vandalism and the like.

5.0 References

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