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Essential Approach of Maintenance Management System of Office Building

Buildings will be worn-out, dilapidated and dirty as time goes by; but with good maintenance management we can at least prolong the life-span of building longer as well as provide the building services and keep the building performance at it ultimate level. The importance of carrying out a systematic and routine maintenance works as part of works to conserve building performance is often neglected due to various factors including due to misunderstanding on the needs of the maintenance works itself and budget allocated. Thus, the purpose of the present study was to evaluating the level of maintenance management and quality of services in office buildings. This study also sought to answer the following question to determine the basic approach of maintenance management system used for office buildings..

***Keywords**: building maintenance, office building, maintenance management, building performance, facility management*

1. Introduction

Some of the advantages of the involvement maintenance department in early stage are it would be able to check the practicability of the design details, the suitability of patent joint, anticipate leaks, staining, expansion joints and many other things that can prevent further defects in the future caused by miss-design [1]. In respect to what Armstrong stated, we can relate that good maintenance management usually depends at early stage of the building construction that is pre-design stage. At this stage, designer must be able to produce design that considering maintenance work such as route to maintenance access work, ability to maintenance inspection and etc.

However, if the buildings were constructed without considering maintenance aspects, demolishing are not the only choice if that buildings facing the defects and failures. Instead, we can have proper maintenance management to correct the defects and failures in order to sustain and prolong the life of the buildings. For

this research, the main aim is to evaluate the maintenance management in small offices building. An office is generally a room or other area where people work, but may also denote a position within an organisation with specific duties attached to it. Work spaces in an office are typically used for conventional office activities such as reading, writing and computer work. For this research, type of work space chose is team space. Team space is defined as a semi-enclosed work place for two to eight people, suitable for small an office which demands frequent internal communication and a medium level of concentration.

In order to carry out this study, 6 offices were selected for this research is Selakta Indah Enterprise, Baling Bayu Engineering (M) Sdn Bhd, aamsttrack Sdn Bhd, One Community Worlwide Sdn Bhd, Azizah Enterprise and SA Lee Architect Sdn Bhd. These offices respectively located at different state in Malaysia, covering state of Kedah, Pulau Pinang, Kuala Lumpur and Johor. These offices also respectively have their own unique characters and different needs.

For information, during defect liability period, the contractor shall repair any defects on the completed work. In construction in Malaysia, if the contractor fails to do so, any expenses incurred to repair any defect shall be recovered from the performance bond. This period may start from the date of certified completion of work until 6 months, 12 months or may exceed 12 months depends on the complexity of work. After the defect liability period, all defects cost are under owner responsible. In respect that, good maintenance strategies proposed and carry out in offices building can reduce costs cover by the owners. The common nature of maintenance is servicing, rectification, replacement and renovations. In addition, to produce good maintenance management, the principal criteria influencing the decision to carry out maintenance such as costs or budget allocate, age of property, availability of physical resources, urgency, future use and social considerations must be include in consideration of producing maintenance plan.

2. Problem Statement

Maintenance field and maintenance practice outside countries such as United Kingdom, America, Hong Kong and Japan are outstanding but unfortunately when it comes to Malaysia; the awareness about the important of building maintenance practice is still in disappointed level. We go deeper on how bombastic the designs look like but we ignore how to maintain them after it is built up plus the design itself does not provide convenient access routes for maintenance works. The lack of awareness of Malaysian on building maintenance practice is one factor contributes in poor maintenance management in Malaysia's buildings.

This is why nowadays we have too many problems involving the defects and failures in building that resulting in building collapse, dilapidated and deteriorate. If we still ignore the importance of maintenance in building and the problems, it may lead to increasing in cost of building repair. Quoted Tun Abdullah Ahmad Badawi, former Prime Minister of Malaysia in newspaper New Straits Time dated February

20, 2006 stated that; improper maintenance caused the disappearance over RM 4 billion and he suggested a more systematic maintenance conducted to reduce the money loss caused by poor maintenance management. This shown how important the maintenance is.

Regarding conducted survey in this study, small office buildings is under responsibility of their administration department, but they have no official facility management or facility manager that responsible to carry out or/and to manage the maintenance management and carry any maintenance works. Apart from having no facility department, the most contributes factor is financial problem. Sometimes, the maintenance works is restricted to budget allocated and difficult to conduct best corrective repair due to tight cost provided by owners. Additionally, the design of office buildings itself plays a vital role to providing a good maintenance work, for instance the shape of office buildings itself does not have accessible routes to carry out maintenance works. The most common one is route to ceiling or roof for maintenance inspection works. There are three main problems in maintenance which are inadequate financial, bad management from the administration and the poor design of the structure seems very legit and hits the spot in maintenance problems facing by most of countries in the world.

3. Literature Review

Building maintenance plays an important role in maintaining and to keep buildings in satisfactory condition. Lack of maintenance has accumulative results with rapidly increasing deterioration to the fabric and finishes of a building accompanies by harmful effects on building contents and occupants.

3.1 Definition

Below are the different definitions of maintenance by previous people to explain and elaborate the maintenance purposes by defining the term of maintenance itself. Many said the definition of maintenance and some of the definition as follows:

1. A combination of any actions carried out to retain an item in or restore to an acceptable standard [1].
2. Maintenance can be defined in varies among agencies. In the physical sense, maintenance consists of a set of activities directed keeping a structure in a serviceable state [2].
3. The Committee of Building Maintenance in British defined maintenance as; Work undertaken in order to keep or restore or improve every facilities, i.e every part of building, its services and surrounds to a currently acceptable standard, and to sustain the utility and value of the building facility [3].
4. The word comes from the French verb 'maintenir', which means to hold [4].

5. A combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to a state in which it can perform a required function [5].
6. The action is referred to the initiation, organisation, and implementation of series of works. There are two processes of works that envisage, retaining and restoring. Retaining is more to the work carried out in anticipating of failure, and restoring is the work carried out after the failure [6].
7. Maintenance always a must for any structure in order to maintain its serviceability and to prevent deterioration that may shorten the service life. In reality maintenance works are not given attention only but as well as having budget allocated for maintenance works in which seldom become a prior consideration. However, it is a fact that maintenance is the most important and the activity to be carried out to prolong or at least maintain serviceability of structure until the end of its service life [7].

As a summary, maintenance can be defined or rephrase based on previous definition as the preservation of a building so that it can serve its intended purpose. The preservation of a building may include few activities includes cleaning, inspection, repairing and replacing the building's various system and components. Certain key aspects can be drawn from the above list, as following:

- Maintenance involves actions that must be performed.
- Maintenance work must be carried out regularly.
- All of these actions have financial implications for the owner or organisation.
- An understanding of the performance of the components that need to be maintained is essential in order to keep them up to an acceptable standard.

3.2 Maintenance Quality Management

Building maintenance should be properly regarded as describing how a system of maintenance effort could be organised to deal with the problems of building maintenance as whole. It recognises that, aside from locating and rectifying defects, an effective programme to curb maintenance costs must start with the design of the building itself and must eventually justify itself, not only in terms of minimising the costs of maintenance but also maximising the benefits of the investment. Maintenance management can be regarded as the organisation of maintenance with an agreed strategy [8].

There are two concepts in maintenance management as the following:

a. Building Maintenance Management:

i. Routine Maintenance
ii. Improvement and Adaption
iii. Energy
iv. Cleaning
v. Security
vi. Others

Under (i) and (ii), we have:

i. Building services
ii. Building fabric
iii. Civil engineering works
iv. Ground

b. Building Maintenance Technology:

The former essentially deals with the study of the occurrence of building defects, such as deterioration of building finishes and fabrics, and the retouch which defects would required. Building Maintenance Technology involves the application of the principles of the physical sciences to the process of determining the effects of building performance produced by the intrinsic properties of building materials, the loading distribution of the building structure and other related factors. Application of the principle of the physical sciences to the process of determining the effects on building performances due defects of building maintenance can decrease the budget and minimising the failure or defects occurred. Maintenance management is a combination of maintenance works with the administrative management of maintenance activities. The effective maintenance works is closely related with the management system. The management area covers six areas:

i. Determination policy or objectives and maintenance standards
ii. Establishment and management of organisation structure
iii. Determination of an appropriate maintenance system
iv. Work plan and the creation of work program
v. Supervision of work and resources such as cost, manpower and equipment

3.3 Classification of Maintenance

Maintenance can be classified into two main categories – planned and unplanned. Planned maintenance system tends to have higher overhead costs than unplanned systems, but should, if properly devised, lead to fewer breakdowns [5].

i. Planned maintenance

A good balance between the cost of preventative maintenance and the cost of corrective maintenance should be managed in order to achieve optimum use of resources. Preventative maintenance works can be categorised according to the scope of the required work, i.e. Major repair or restoration, periodic maintenance, or routine day-to-day maintenance.

Planned maintenance work as "the necessary work organized and carried out with forethought, control and the use of records to a predetermined plan". Planned maintenance can be sub-divided into corrective and preventative maintenance [8]. Neglect of routine maintenance and preventative measures leads to more exten-

sive periodic maintenance and, in the long run, major repair or restoration which could have been avoided or postponed.

ii. Unplanned maintenance

Unplanned maintenance refers to work that may result from unforeseen breakdowns [8]. Damage caused by external forces such as storms, floods, earthquakes, or power surges, is also classified as unplanned maintenance due to the fact that this type of work is mainly of a corrective nature. Maintenance work can also be categorised as predictable or avoidable. The former is regular periodic work that may be necessary to retain the performance characteristics of a product as well as that required replacing or repairing the product after it has achieved a useful life span; the latter is work required to rectify failures caused by incorrect design, incorrect installation or the use of faulty materials.

Unplanned maintenance is different from planned maintenance [8]. This is because the unplanned maintenance cover maintenance work performed without according to any maintenance plan ahead as planned. This is also because of there is some damage and defects that are difficult to predict when the failure occurred. This also involves the maintenance of an emergency in which the damage and disability that occurs is a sudden

4. Research Methodology

There were 6 office buildings in Malaysia were chosen for this particular research. All buildings are located within the Pulau Pinang, Kuala Lumpur, Kedah and Johor areas.

4.1 Research instrument

In sequence to conduct this paper a few procedures are followed. The first method used in this research is literature review from previous data such as websites, journal, eBooks, articles, reports and dissertation. The second method is by the visual inspection. The purpose of visual inspection is to gather any information based on external factors that may help in publishing this journal, which may not get from first method and third method. Other than this, unstructured interview was carried out to each offices' representative and workers in these buildings to get the necessary data regarding the needs of maintenance and repair in offices and how it affect occupants satisfaction.

4.2 Research Sampling

Firstly, 150 respondents were chosen to answers 35 questions from questionnaire. The respondents are from workers and users whom directly or indirectly attached in these 6 selected case studies. Secondly, the selection of the research

samples is based on the information obtained from the offices representative based on their data-base such as reports regarding the details of maintenance, repair and renovation that undergo in their building as well as visual inspection carried out by the researcher.

4.3 Criteria for the selection of respondents

The respondents are chosen based on their involvement in maintenance management such as facility management or workers who directly facing the problems in using any parts of the building either in services or performance of any parts of the building.

5. Findings and Analysis

5.1 Questionnaires Analysis

5.1.1 Frequencies of maintenance carried out

From Figure 1, there is none of respondent chose yearly as their answers. As we can see, 101 people agreed to choose that their office has been practicing daily maintenance, followed in second highest is weekly 34 votes and the third place is monthly voted by 15 people.

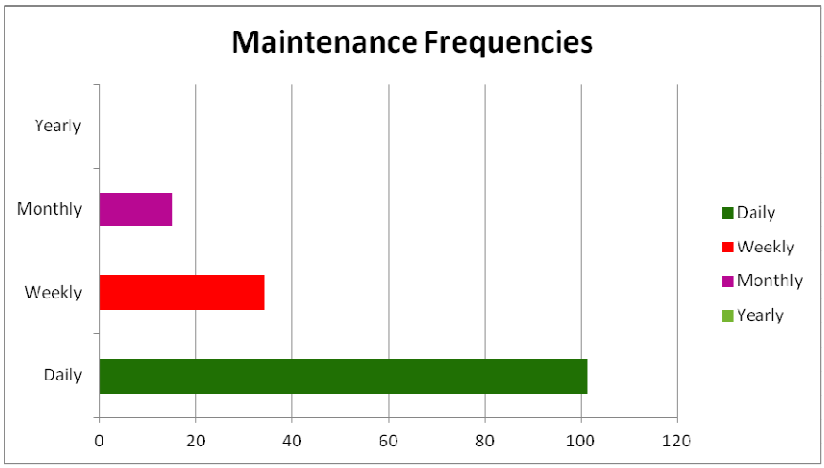

Figure 1. Frequencies of maintenance

5.1.2 Satisfaction Level with Implementation Of Maintenance Management Work In The Office

According to Table 1, data analyses for implementation work on external wall, internal wall, windows repair, electrical installation, door, air conditioning system, lighting system, firefighting system and external building cleanse, the respondents totally agreed with the quality of maintenance management in these elements. The mean index are lies in between 4.50 to 5.00. While for ceiling, sanitary, building structure, floor surface and internal building cleanse, toilet cleansing and finishing the respondents are agree to show their satisfaction level towards maintenance management in these element, the mean index here are lies in between 3.50 to 4.50 except for toilet cleansing element only, respondents satisfaction level is in neutral/undecided, with the mean index value between 2.50 to 3.50.

Table 1: Data interpretation of understanding based on respondents answers

Indicator	Mean Index (MI)
Totally Disagree	0.00-1.49
Disagree	1.50-2.49
Neutral/Undecided	2.50-3.49
Agree	3.50-4.49
Totally Agree	4.50-5.00

5.1.3 Satisfaction level with implementation of maintenance on delivery characteristics

This section discusses on the respondents satisfaction level on delivery characteristics of services in their workplace. We can see based on respondents answer, delivery characteristics on information given on progress of repair work and time taken to complete repair work both are fall under neutral or undecided, while for standard workmanship, overall quality of services provided and general condition of building operation system is in agree standard.

5.1.4 Opinion in improving maintenance management in office building

As we can see based on occupants view on improving all elements; office planning and scheduling, the types of planning and schedule used response on emergency defects. Overall satisfaction of maintenance works and needed in hire professional maintenance manager in office are fall under agree level, and the least number of mean index was 3.86 which fell under the elements of overall satisfaction of maintenance works. The data interpretation can be referred to Table 1.

5.2 Visual Observation and Interview

5.2.1 Ceiling repair

All the 5 offices have a good quality of ceiling except Baling Bayu Engineering. Baling Bayu Engineering's ceiling is not in very good condition. Figure 2 shows the deteriorated condition of the ceiling at Bayu Engineering. All of the offices used the dropped ceiling type. Dropped ceiling is often a secondary ceiling; it is hung below the main (structural) ceiling. Based on interview done with Cik Hazwani from Baling Bayu, the ceiling is in bad shape condition because it is in an old building, approximately more than 40 years. According to her, so far no ceiling fell down although we can see from Figure 1 of the ceiling sheet is loose.

Figure 2. Ceiling in Baling Bayu Engineering sown the loose sheet of ceiling

5.2.2 External building cleanliness

Figure 3. External cleanliness at Azizah Enterprise

During visual inspection, in office Azizah Enterprise the external cleanliness is in bad (Figure 3). The stairs up to this office was smelly and have animal feces in a few places. Apart from Azizah Enterprise, there are no offices that have bad external cleanliness. From the interview with each of offices representative, all the ex-

ternal building is operated by cleaner from Majlis Daerah since all of the offices located in Majlis Daerah buildings. For this building according to Cik Hidayah, every 2 days, the cleaner will come to clean this place.

5.2.3 Lighting system

For lighting inside the offices, there were no problems. The lighting is good enough for occupants to do their work, but for corridors it is bit dark and dangerous. For SA Lee and AAM Strack Sdn Bhd office, it may quite dark and can be dangerous especially at night and for female workers (Figure 4). These offices administrative should consider this matter by adding few more lamps to increase the lighting in this area for safety.

Figure 4. Dark stairs to SA Lee

5.2.4 Toilet cleansing

All offices have good condition in the toilet except Baling Bayu Engineering (Figure 5). The toilet floor have not been clean regularly, so there are mould in floors that can be dangerous to the occupants

Figure 5. Toilet cleanliness at Baling Bayu

5.2.5 Floor surface repair

As far as researcher observation, all offices have good maintenance on floor surface repair. There is none broken or spalling concrete. Most of offices used carpet to avoid from damage floor and for comfort purpose. There is no unevenness or floor bulging that can make occupants from fall down.

5.2.6 Door & Window repair

All door and windows are in good condition for all offices except for Azizah Enterprise. The type of door used in Azizah Enterprise is sliding door, unfortunately the door have been broken and cannot be slide smoothly and always stuck. The problem occurred might be because of age of the door and the way occupants handle the door.

5.2.7 Electrical installation, air conditioning system, firefighting system

For these elements, based on observation all electrical installation was working very well. This included the air conditioning system and fire fighting system. For electrical installation, all socket and plug are in good condition, where there is none broken socket or plug. Besides, all offices representative agreed that their offices did not have any blackout caused by over usage. For air conditioning system, all offices have set the air conditioning system temperature range of 22-28^{o}C. This temperature according to them is favorable temperature and comfortable for them to do work because nowadays the external temperature is quite high. While for firefighting system, all signage has been located in correct place, for example emergency way signage located at stair and door's frame at top. The hose and

sprinkler also have been located and installed to prevent the fire from spread or at least to control the fire before firefighter arrives.

6. Conclusion

This paper summarizes the findings of the basic approach on the level of maintenance management system undertaken for selected office buildings in Kedah, Johor, Pulau Pinang and Kuala Lumpur as well as to evaluate the quality of services in offices building. The case study result is indicated that maintenance approach undertaken for offices building in Malaysia still needs a lot of improvements. Based on the questionnaire survey most of respondents are satisfied with the state of maintenance of their offices. It may found that the major issues contributing to the lack of a proper maintenance program in office building are as follow:

1. The absence of the professional maintenance management in offices especially in small offices such as scheduling or planned inspection concerning the services systems, building fabrics or the structural or non-structural elements.
2. Most of the offices administration preferred to outsource the maintenance work or repairing works to external contractors. With the lack of budget allocated for maintenance work, offices administrations prefer to do corrective maintenance approach rather than preventive maintenance. Based on interviews conducted with each of offices representatives, the budget allocated for repairing and maintenance works are not sufficient and is very limited.

From the survey, we can conclude that most occupants in the selected case studies are satisfied with their maintenance management on buildings elements as well satisfied with delivery characteristics of maintenance works. However, visual inspection on some of elements shows that they are not in a good condition. In order to improve maintenance management, the following are some recommendations made to the existing system:

1. When maintenance works or repairing in progress, experienced contractors should provided information regarding the defects to the building users so that they can gain some knowledge regarding maintenance works, the significance of maintenance and how to prolong the life of services, fabrics and building performance in the correct manner of using facilities.
2. Building users should be encouraged to report quickly and when they detect defects in building elements.
3. Develop a service desk where it is easier and the fastest way for occupants to report and complain any dissatisfaction towards building defects or nonfunctioning elements of the services

Selection of external contractor; it should based on expertise. Repair and maintenance work by general contractor may not adhere to the required standard due to lack of expertise and experience which will cause building devaluation.

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