

SHS Web of Conferences **11**, 01008 (2014)

DOI: 10.1051/shsconf/20141101008

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# A Study of the Renewal Cycle of Hotel Building Elements in Malaysia

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**Abstract.** Penang is the main tourism island which appeals an increasing number of travellers each year. Therefore, the hotels in Penang play a crucial role in the field of Penang tourism. However, recently some problems with the Penang hotels have been brought to light frequently by travellers including domestic and foreign tourists. The reason for this may be due to irregular maintenance as well as the fact that the renewal of the building elements may not have been duly carried out. In light of that, this research investigated the condition of the maintenance and renewal cycle of the building elements of the hotels in Penang. This study was conducted with a quantitative method, using a questionnaire to collect information regarding the condition of maintenance, evaluation of the condition of the building elements and the frequency of building elements renewal. The results revealed that each building element renewal cycle is differing according to the effects of maintenance and its lifespan. In terms of comparison with the renewals in Singapore hotels, there are shortcomings involved in the schedule of element renewals carried out in Penang.

## 1 Introduction

In the recent years, maintenance played a more important role in the entire life-span of buildings. It is considered in the design phase prior to construction as well as in the construction phase and after occupancy, especially since, the evitable process of decay can be controlled and the physical life of the buildings extended as long as proper maintenance is performed on them. Additionally, buildings may fail due to a number of reasons, such as faulty design, faulty construction, faulty maintenance, faulty materials and faulty use. Moreover, faulty maintenance can be divided into two parts: maintenance that is carried out incorrectly, and more generally, where no maintenance is undertaken at all during the entire life of a building [1].

The attention and skills of maintenance are required for the construction of buildings in the twenty-first century. Much of architectural education today is still focused on one-of-a-kind assignments, encouraging the notion of personal fulfilment by leaving a mark for the future generations and obtaining design awards by means of concept drawings. Due to this, many building designers (architects, engineers, technicians) are not involved in the subsequent maintenance of the building designed; they merely regard it as the responsibility of other specialists. In all likelihood, the future occupiers of the building has no formal part: the building contractors merely fulfil their accountabilities in completing the building in compliance with the contract documents, without care of the occupier's needs and wants [2].

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In developing countries, the construction sector usually ranks amongst the largest sectors of the economy and is typically characterized by high levels of investments in new buildings and infrastructures. In developed countries, the renewal of buildings is maturely reflected in the ideas, technologies, policies, etc. due to the advanced development. However, the importance of renewal of buildings has begun to appeal to an increasing number of developing countries concerned. [3].

The contributions of maintenance policies that occur due to building renewals are enhanced at the municipal level [4] and revealed that the vast majority of activities of building renewals focus primarily on supporting day-to-day building maintenance, with only an extremely small number of them providing support for long-term renewal planning. Although the existing systems of building renewals involve many features such as condition assessment [5], inspections still represents one of the most time-consuming and costly processes which hinder the operation of building renewal.

## **2 Methodologies**

### **2.1 Questionnaire:**

The questionnaire involved three sections labelled as Section A (Maintenance of Building), Section B (General Condition of Building Elements) and Section C (Frequency of Renewal of Building Elements). These were given to 13 different hotels in Penang, to be filled up by the hotel maintenance managers or staffs.

### **2.2 Interview**

In this study, the interview was done throughout the entire inspection. It was conducted with the hotel maintenance managers or staffs while they were filling up the questionnaires with respect to the state of maintenance and building element renewals.

### **2.3 Visual Inspection**

Visual inspection can boost up the reliability of the research; it was the approach to obtain the condition of the building elements by researchers instead of merely relying on the building owners. It was carried out with naked eyes and photos were taken during inspection.

## **3 Results and Discussions**

### **3.1 Results of Renewal Cycles of Building Elements**

For this study, the renewal cycle of the building elements were different in terms of the data gathered. Most building fabrics renewal cycles are 10-15 years, including minor and full replacements. But the renewal cycles of windows and doors, are 6-10 years. In comparison, the frequency of building services renewals is mostly 15-20 years, but drainage systems are renewal every 10-15 years. The renewal cycle is 6-10 years with regards to wall and ceiling paintings.

#### *3.1.1 The Renewal Cycles of Penang hotels Fabric*

The renewal cycle of the roof structure is about 18 years and the covering is 14 years in terms of statistics, and the frequency of a Penang hotel stair renewal is 13 years as illustrated in Table 1. Furthermore, the renewal cycles of internal walls and windows are 13 and 7 years respectively. Additionally, the renewal cycles of internal and external doors showed 13 years and 10 years each. The Penang hotels floor covering renewal cycle is 15 years, likewise with ceiling finishes.

#### *3.1.2 The Renewal Cycle of Penang hotels Building Service*

According to the table, the renewal cycle of sanitary facilities in Penang hotels showed an average of 18 years. However, water plumbing systems and air-condition renewal cycles were also 18

years as per Table 1. Compared with plumbing systems, the renewal cycle is actually one year less, that is 17 years. The frequency of Penang hotels gutter and drainage renewals are 14, 15 years respectively.

### 3.1.3 The Renewal Cycle of Penang hotels Paintings

The results of the study show that both wall painting and ceiling painting renewal cycles were 8 years.

**Table 1.** Frequency of Renewal of Building Elements

No.	Element	< 5 years	6 – 10 years	10 – 15 years	15-20 years	> 20 years	Mean of Renewal Cycle (year)
1	Roof (Structure)	0%	0%	33%	49%	18%	18
2	Roof (Covering)	0%	0%	70%	15%	15%	14
3	Stairs	0%	8%	69%	15%	8%	13
4	Internal wall	0%	15%	69%	16%	0%	13
5	Windows	0%	70%	15%	15%	0%	7
6	Internal doors	0%	69%	23%	8%	0%	13
7	External doors	0%	70%	30%	8%	0%	10
8	Floor coverings	0%	15%	70%	15%	0%	15
9	Ceiling finishes	0%	23%	62%	15%	0%	15
10	Sanitary facilities	0%	0%	23%	77%	0%	18
11	Water/plumbing systems	0%	0%	30%	62%	8%	18
12	Air condition	0%	0%	23%	69%	8%	18
14	Electrical (Wiring)	0%	0%	15%	77%	8%	17
15	Drainage	0%	0%	69%	23%	8%	15
16	Gutter	0%	0%	70%	30%	0%	14
17	External works (Landscaping)	0%	23%	54%	23%	0%	13
18	Wall painting	30%	70%	8%	0%	0%	8
19	Ceiling painting	23%	69%	8%	0%	0%	8

## 3.2 Results of Evaluation of Current Hotels Elements Condition

These evaluations are regarding building elements which have undergone regular maintenance and renewal. Moreover, these evaluations are also based on the current conditions of the building elements.

**Table 2.** Evaluation of Building Elements Renewal Cycle

No	Element	Very good	Good	Moderate	Bad	Very Bad
1	Roof (Structure)	54%	38%	8%	0%	0%
2	Roof (Covering)	54%	31%	15%	0%	0%
3	Stairs	26%	44%	30%	0%	0%
4	Internal wall	26%	54%	20%	0%	0%
5	Windows	34%	31%	35%	0%	0%
6	Internal doors	23%	62%	15%	0%	0%
7	External doors	38%	44%	18%	0%	0%
8	Floor coverings	34%	38%	28%	0%	0%
9	Ceiling finishes	28%	42%	30%	0%	0%
10	Sanitary facilities	34%	38%	28%	0%	0%
11	Water/plumbing systems	38%	37%	15%	10%	0%
12	Air condition	38%	38%	16%	8%	0%
13	Electrical (Wiring)	28%	44%	28%	0%	0%
14	Drainage	38%	47%	15%	0%	0%
15	Gutter	21%	44%	35%	0%	0%
16	External works (Landscaping)	38%	47%	15%	0%	0%
17	Wall painting	38%	54%	8%	10%	0%
18	Ceiling painting	21%	54%	25%	0%	0%

### 3.3 Results of Visual Inspection

The results of the visual inspections were photos and notes taken with respect to the defects of the hotels elements. Even though there were some areas which were not accessible for inspection and regarded as a limitation, these photos (Figure 1) still reveal some problems of the hotels maintenance and renewals. Additionally, these photos indicate that the condition of the building elements and the renewal of the building elements are not as good as they were described.



**Figure 1:** Problems of the hotels maintenance and renewal

## 4 Recommendations and Discussion

### 4.1 Comparison of Renewal Cycles of Hotels in Singapore

A research of the renewal cycle of hotels in Singapore was conducted in 1994 by Son et al., George C [6]. They claimed maintenance is needed throughout the entire period that the building remains in use or occupied, so that the various facilities are kept to a standard consistent with the overall policy. Furthermore, feedback is important to indicate success or otherwise of the design, in terms of satisfactory user requirements and maintenance objectives. In developing countries, the construction sector usually ranks among the largest sectors of the economy and is typically characterized by high levels of investments in new buildings and infrastructure facilities. As a country becomes developed, new construction will slow down and the upkeep of existing buildings and other facilities becomes increasingly more important. Moreover, the size of the maintenance sector will depend on the demand of the building owners and the provision of financial support from the government, even including policies enforced by the local government. Admittedly, maintenance is the broad term which encompasses materials used, skills and technologies applied, and maintenance methods chosen. In developed countries, the renewal of buildings is maturely reflected in the ideas, technologies and policies, etc. due to the advanced development. However, the importance of renewal of building now appeals to the increasing number of developing countries concerned. There are three types of results that come out from the comparison. They are illustrated as below:

1. The gap between these two statistics is almost the same.
2. The renewal cycle of hotel elements in Singapore is ahead of those of the hotels in Penang.
3. The renewal cycle of hotel elements in Penang is ahead of those of the hotels in Singapore.

#### 4.1.1 Comparison of Internal Walls

Son et al. [7] stated that the renewal cycle of external walls of the hotels in Singapore is around 10-15 years. 70% hotels in Penang carry out renewal of external walls every 10-15 years as well. Therefore, the frequency of renewal of external walls of Penang hotels is almost on par with the hotels in Singapore under similar climate and environment.

#### 4.1.2 Comparison of Floor finishes

The frequency of the renewal of hotel floor finishes in Penang is every 10-15 years according to the survey conducted. In comparison, the statistics of the renewal cycle of hotel floor finish is every 6

years. Obviously, the discrepancy is noticeable and huge according to the comparison. It may indicate that the frequency of the renewal of floor finishes of Penang hotels is too low and would have an impact on the condition of the floor finish. Therefore, hotels ought to increase the frequency of renewal of floor finishes to guarantee that they are of acceptable conditions.

#### *4.1.3 Comparison of Drainage system*

The renewal cycle for drainage in Singapore hotels is 20 years. In terms of the statistics which were sorted out from the questionnaire, the renewal cycle of hotel drainage in Penang is 10-15 years. Evidently, the frequency of Penang hotels drainage renewal is much higher than Singapore hotels. It may be due to the technologies which determine the lifespan of the drainage, or the periodical maintenance that ensures the regular condition of the drainage system. But, hotels assuming this frequency (10-15 years) can guarantee the good state of the drainage in full measure.

## **4.2 Recommendations on the Renewal of Hotels in Penang Based on the American Standard of Lifespan of Building Elements**

The renewal cycle of building elements is supposedly to link with the expectancy life of the building components. Therefore, the “Study of Life Expectancy of Housing Components” that was conducted by the NAHB (National Association of Home Building) [8] can provide references with respect to the lifespan of building elements, which is regarded as the basis of the schedule of hotels renewal cycles. Hence, it can provide comprehensive and reliable statistics to instruct the Penang hotels on the frequency, approaches, materials etc. of component renewals. There are 3 reasons for selecting the NAHB standard of building elements life expectancy:

1. America as the most developed country in the world; it is the foremost authority in a host of fields, including building renewal cycles.
2. Admittedly, American research institutes have a slew of cutting-edge researches in many fields, there are many researchers and a deal of money is contributed to the building research field annually.
3. Additionally, the NAHB standard is the most revelatory and representative in building element lifespan and it is in possession of valuable directions and suggestions for the improvement of Penang hotels renewal cycles.

There are three types of results summed up according to the “Study of Life Expectancy of Housing Components” conducted by the NAHB (National Association of Home Building). They are illustrated as below:

1. The gap between these two statistics is almost the same.
2. The renewal cycle of hotels elements is ahead of building elements expectancy.
3. The renewal cycle of hotels elements in Penang is behind building elements expectancy.

#### *4.2.1 Recommendations on the Renewal of Hotels Plumbing Systems in Penang Based on the American Standard of Lifespan of Building Elements*

According to the statistics with respect to life expectancy provided by the National Association of Home Builders (NAHB), the lifespan of plumbing systems is 15-20 years. The renewal cycle of Penang hotels plumbing systems is 15-20 years as well, in terms of the data collected. Notwithstanding, the renewal cycle is covered up the life expectancy at this point. But, the schedule of renewal should be ahead of the life expectancy as usual, because building services as well as building components are supposed to be renewed or replaced slightly before they are reach the termination age. Hence, the Penang hotels ought to take measures of minor renewals ahead of 15 years based on the condition of plumbing system or the maintenance condition.

#### *4.2.2 Recommendation on the Renewal of Hotels Doors in Penang Based on the American Standard of Lifespan of Building Elements*

The expected lifespan of an internal door is around 30 years in terms of the American standard. However, the renewal cycle of the internal doors of hotel in Penang is 6-10 years. Obviously, the renewal cycle of the internal doors is less than the lifespan. The renewal of it is mainly minor, carried out upon the internal door. In comparison, the expected lifespan of an external door is about 20 years. With respect to the renewal cycle, it is 6-10 years on par with internal doors. Nevertheless, both internal and external doors need maintenance at regular intervals due to some minor defects. For instance, there were some diagonal cracks crawling upon the doors according to the visual inspection.

#### *4.2.3 Recommendation on the Renewal of Hotels Electric Wirings in Penang Based on the American Standard of Lifespan of Building Elements*

With regards to the expectancy life of electrical wiring, it is 15 years. According to the data collected, it was shown that the renewal cycle of electrical wiring is 15-20 years. Evidently, the schedule of renewal of electrical wiring is little later than its lifespan. Therefore, it would be a potential risk that may cause malfunction of the electrical wiring. Moreover, the electrical wiring is vulnerable to aging, as it is connected with all of appliances in a hotel. Thus, it should be replaced timely and hotels ought to carry out more maintenance on them.

## **5 Conclusions**

The renewal cycle of the building elements of Penang hotels are carried out according to the materials, workmanship in the course of construction, technologies applied and maintenance conditions. In terms of the research of renewal cycles of hotels in Singapore which was conducted in 1994 by Son, Lee How and Yuen, George C, the comparison point out the shortcomings of renewal cycle of building elements of Penang hotels as these two countries are of similar environment and climate. For instance, the renewal cycle of floor finishes is 10-15 years, but compared with Singapore the renewal cycle of hotels floor finishes is 6 years. Thus, the huge discrepancy that arises indicates that the hotels in Penang ought to shorten the time interval for the renewal of floor finishes to some extent. Furthermore, the renewal cycle of building elements is supposed to be linked with expected lifespan of the building components. As such, the “Study of Life Expectancy of Housing Components” that was conducted by NAHB-National Association of Home Building provides reference with respect to the lifespan of building elements that is regarded as the basis of the schedule of renewal cycle of hotels. Hence, it can provide comprehensive and reliable statistics to instruct the Penang hotels on their components renewal in terms of frequency, approaches, materials etc.

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