Common Defect of Colonial Buildings in Malaysia

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Common Defect of Colonial Buildings in Malaysia

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Abstract. Defects and damage to heritage buildings constitute a significant problem to be understood and addressed by the organisation. Lack of information on defects towards the heritage buildings results in decisions or actions made by the authorities not meeting the proper targets. Therefore, this research purposely to identify the types of defects inherent in the heritage buildings and to determine the degree of errors in the heritage buildings surveyed. Nine (9) heritage buildings from eight (8) states in Malaysia reviews and Systematic Visual Assessment (SVA) approaches apply to the main building comprises seven (7) major building component namely roof, wall, column and beam, windows, doors, floor, stair and apron including building services (air-condition). A total of thirty-three (33) defect generally occurs in the heritage building by previous researchers, and the assessment result indicates that twenty-two (22) type of glitch with dampness problems at twenty-nine (29.1%) dominates the cumulative count compares to others listed defect. The defect frequently occurs for nine (9) study building starts with wall component at (33.67%) deficiency followed by the column and beam (21.67%), roof (15.0%). Therefore to organise heritage building in general, the relevant authority and stakeholders' must prioritise the three (3) critical components and dampness problems as a framework in mitigating overall issues related to the heritage building.

1. Introduction

The diversity of tourism products that have attracted tourists to come to Malaysia include the beauty of nature[1–3], cultural activities, historic cities [4–6], sports and offers to high-quality health packages. Physical care of tourism products such as heritage buildings not in parallel with the arrival of tourists in this area. The existing buildings are still in critical stages due to lack of repair information and consistent developmental pressures. As a result, much potential pre-war building demolishes as a sacrifice for a new development with economic reason. Awareness and the desire to change for the better will need to be in every organisation and individual that is directly involved with this historic building. Organizations that make a decision based on information and advice from experienced experts are often seen to have no solid foundation in setting specifications and technical standards in addressing issues related to conservation. Therefore, this study will focus specifically on information on defects and damage to heritage buildings. Information gathers will facilitate the organisations or individuals involved in understanding and subsequently plan the necessary improvements towards the existing asset

2. Literature Reviews

The practice of securing information on heritage buildings has been considered fundamental towards

understanding the existing building conditions and defects [7]. Most of the heritage building deal with defect issues and facing a huge challenge due to improper defect treatment and management from tenant or owner itself. The heritage building defect defines as a defect in the design, the craft, or in the materials or systems used on a building that fails a component of a structure and non-structure that causes damage to the property, resulting in financial harm or the safety issues to the owner. Building defects caused by various mechanisms and influenced by multiple factors. In general, the primary cause of disability caused by a defective agent categorised into four main parts, namely mechanical agents, biological agents, chemical agents and natural disasters. Table1. below, indicates a summary of defect agent in the heritage building.

Table 1. Defect Agent towards heritage building in Malaysia.

	Agent	Description
Mechanical	Wind Vibration Water	The condition in which it occurs due to external factors such as water, wind, the vibration that consistently stress on the surface of any building especially old building. The damage effects arising from this agent are like fractures on the floor and openings, open tiles and broken, paint peeling, wall cracks, settlement and sediments on the floor of the building.
Biology	Human Animal Plant Micro-organisms	It is a life that always put pressure on the existence of a heritage building. Divided into four (4) main parts namely human, animal, plant and micro-organism. The consequences of this agent are damage to building walls such as fractures, vandalism, surface walls of coatings and peeling paint, fissures on the barriers caused by foreign plants, the presence of birds and bird nests on ornaments and crevices causing the roof to be damaged; as a result drainage channel blocked.
Natural Disaster	Earthquake Tsunami Flooding Landslide Firestorm	Natural disasters[8,9] refer to natural events such as floods, earthquakes, landslide, wildfires, tsunami or typhoons that will cause damage or loss of life. Well-known as a destructive force that is consistently damaging places and human life including country's art, artefacts, and cultural heritage as well as the heritage building.
Chemical Reaction	Radiation Climate change Greenhouse effect Urban heat	Interactions of two or more chemicals that produce one or more new chemical compounds, or alter the properties of mixed chemicals. Most reactions require heat, pressure, radiation, other conditions, or the presence of accelerator (catalyst). For this chemical reaction, property reference refers to the situation where decay and erosion affected continuously towards building materials such as limestone, lime-plaster, clay bricks, iron and wood-based materials.

Source: 2018

Building defects[10–12] and damage exist into two types namely structure and non-structure. Structure defect defines as physical damage to the designated load-bearing elements of the building caused by the failure of load-bearing elements which affects their load-bearing functions to the extent that the building becomes unsafe. It is a defect inherent in building structures that can threaten safety for users. For example, the decay at the roof structure[13] in the roof and the broken column or beam of the building, it has directly abolished the function of the building. These cases will technically be monitored directly by professional consultants in structural. While non-structural defects[14] exist in

building components such as roofs, walls, column, beams, windows, doors, floors, stairs and apron. The extent of damage that exists does not involve safety but must be restored to maximise the functionality of the building. For examples, the paint peeling and decomposition of lime mortar, it only involves minimal repairs and at regular maintenance. Table 2 listed a common defect in heritage building by the previous researcher in Malaysia.

Table 2. Common defect towards the compenant in heritage building in Malaysia by previous researchers

	Previous Researcher	Defect
Roof (R)	[7,14,23–26,15–22]	1.Broken Tiles 2.Missing Tiles 3.Fungus Attacks/Harmful growth 4.Damage Gutter / Rain water downpipe (RWDP) 5.Dampness at ceiling board 6.Flaking Paintwork 7. Cracking of ceiling board/ Leaning board
External Wall (EW)	[7,14,23–26,15–22]	1.Dampness raising/falling 2. Cracking of Walls / Leaning Walls 3.Peeling paint 4.Flaking Plaster 5. Fungus Attacks/Harmful growth
Column and Beam (CB)	[7,14,23–26,15–22]	1.Dampness raising/falling 2.Peeling Paint 3. Cracking of column / beam 4.Defective Plastered Rendering
Windows (W)	[7,14,23–26,15–22]	1.Insect Attacks 2.Cracked Glassless 3.Steel Corrosion 4. Peeling paint 5.Decay Timber frame 6. Distortion of Shape
Doors (D)	[7,14,23–26,15–22]	1.Insect Attacks 2.Decay of Timber Frame 3.Peeling paint 4.Distortion of Shape
External Floor, Stairs and apron (EFSA)	[7,14,23–26,15–22]	1.Dampness 2.Cracks 3.Timber Decay 4.Fungus attack 5.Mould Attacks
Building services	[7,14,23–26,15–22]	1.Poor Installation of Air-Conditioning Units

Source : Authors 2018

The research aims to identify the type of defects, the number of the defect and affected component involves in the selected case study towards heritage building. Specifically to generalise the common

defect [10,28,29] treat to heritage building that exists in Malaysia built heritage environment, and technically proposing the global organisation management counters to mitigate the affected assets

3. Methodology

Visualization and observation technic uses to mitigate the research study. Target building rectifies with the defect at components such as structure (load bearing wall, column, beam, and roof structure) and non-structure (roof, wall, windows, door, floor, stairs.). Strict procedure imposes to four (4) main elevation of the building namely front elevation, back elevation, right elevation and left elevation. Technically, the visual defect assessment result indicates the number and location of the type of defect in the heritage building. Information gathers systematically used by the potential stakeholder in mitigating issues related to the future conservation works. A total of nine (9) heritage building choose from seven (7) state of Malaysia to summaries the general defect that has in the building. Three (3) essential criteria indicate the nomination process namely, building category 1 with ages more than 100 years, adopting an adaptive reuse concept and last but not list, the building is gazetted as a Heritage Building under the rules of laws in Heritage Act 2005 and managed by National Heritage Department (JWN). Table 3 below indicates the building lists for the research purpose.

Table 3. Heritage building profiles.

State	Building category	Building
Penang	National Heritage	Municipal Town Hall
Johor	Heritage	Dato Jaafar Building
Penang	Heritage	City Council
Melaka	National Heritage	Stadhuys Building
N.Sembilan	Heritage	Pejabat Daerah dan Jabatan Ukur, Seremban
Pahang	Heritage	Komplek Pejabat Kerajaan Kuala Lipis
Perak	National Heritage	Larut District Building
Penang	Heritage	Immigration Office
Terengganu	Heritage	Historical Union Building

Source: National Heritage Department, 2018

A visual assessment survey form as a research instrument used to mitigate the study and consists of two (2) significant area, namely building profile consist of location, the name, constructed year, influence architecture, building type, floor level, as well as original building function. Also, the defect assessment towards the building component which are the roof, external ceiling, external wall, column, beam, external stairs, doors, windows, floor, apron and internal drainage. Research Procedure conduct in two (2) stages namely preliminary study and field study. The approach is crucial towards the validation of the research. The combination of primary and secondary data will strengthen the foundation of the theory and practice towards the research outcomes. Preliminary study conduct to required and obtaining building information as well as carry out a study covering the location, year built, building ages, original building function, architecture influence, and building anatomy. An Initial review either in writing, telephone or site visit to get information, as well as the description of the prefix of the building. As well as to set up access to the place to be reviewed externally; and finally research or make inquiries and get accurate information from the relevant authority. Pilot study conduct with existence information gathers to ensure that the assessment form with two (2) segment was namely building background information and defect profile function as its required. Building component involves namely roof, wall, column, beam, windows, doors, floor including the staircase and affected building services establishing according to the previous researcher. Inspection and assessment of building conditions conduct to ensure the validation of defect existence meticulously recorded. Any discrepancy during fieldwork noted accordingly to assist the defect investigation outcomes.

3.1 Limitation

The study limits to the selected external heritage building in Malaysia because of the cooperation, limited time and financial constraint in covering several other building structures and non-structures with same defective symptoms. As a result, nine (9) building with adaptive reuse concept (new function or mixing with the original and new role chooses meticulously to mitigate the research outcomes.

4. Analysis and Finding

Table 4 below clearly shows that the building built year range from 1650 to 1919 indicating the strong characters manifested in the enormous dominant physical look with different architecture influence.

Table 4 : Building profile by ages

No	Building	State	Year Built	Building Ages	Architecture Influence
1	Municipal Town Hall	Penang	1873	145	British Colonial
2	Dato Jaafar Building	Johor	1893	125	British Colonial
3	City Council	Penang	1903	114	British Colonial
4	Stadhuys Building	Melaka	1650	368	Dutch Colonial
5	BangunanPejabat Daerah dan JabatanUkur, Seremban	Negeri Sembilan	1870	148	British Colonial
6	Komplek Pejabat Kerajaan Kuala Lipis	Pahang	1919	99	British Colonial
7	Larut District Building	Perak	1856	162	British Colonial
8	Pejabat Imigresen	Penang	1890	128	British Colonial
9	Historical Union Building	Terengganu	1909	109	British Colonial

Source : Author 2018

Ages minimum at 109 with maximum up to 368-year-old building exceeding the building life cycle at average 200 years technically need extra conscious from relevant stakeholders, especially for organisation managerial namely federal, state and local authority. Most of the listed building commence the British colonial architecture influence in the various area in Malaysia excluding building from Melaka with Dutch Colonial architecture influence. Most of the building erected at colonial-era consume the design from Dutch and British mixing with local (Malays, China, India). As a result, the building outlook much differs from others place in the worlds.

Table 5. Defect by Type of defect

No	General Defect towards components in nine (9) Heritage Building from eight (8) states in Malaysia.	Components ID	Number of Defect	Total Defect (with defect type ratio)	Total Defect by Components	Total Defect by Components (%)
1	Dampness raising/falling	EW	34.00	1.03	0.11	11.33
2	Fungus Attacks/Harmful growth	EW	25.00	0.76	0.08	8.33
3	Dampness raising/falling	CB	25.00	0.76	0.08	8.33
4	Poor Installation of Air condition unit	BS	24.00	0.73	0.08	8.00

5	Peeling Paint	CB	23.00	0.70	0.08	7.67
6	Dampness	EFSA	23.00	0.70	0.08	7.67
7	Peeling paint	EW	21.00	0.64	0.07	7.00
8	Fungus attack	EFSA	16.00	0.48	0.05	5.33
9	Damage Gutter / Rain water downpipe (RWDP)	R	15.00	0.45	0.05	5.00
10	Fungus Attacks/Harmful growth	R	14.00	0.42	0.05	4.67
11	Cracking of Walls / Leaning Walls	EW	11.00	0.33	0.04	3.67
12	Defective Plastered Rendering	CB	11.00	0.33	0.04	3.67
13	Peeling paint	W	11.00	0.33	0.04	3.67
14	Flaking Plaster	EW	10.00	0.30	0.03	3.33
15	Dampness at ceiling board	R	6.00	0.18	0.02	2.00
16	Flaking Paintwork	R	6.00	0.18	0.02	2.00
17	Decay Timber frame	W	6.00	0.18	0.02	2.00
18	Cracking of ceiling board/ Leaning board	R	4.00	0.12	0.01	1.33
19	Cracking of column / beam	CB	4.00	0.12	0.01	1.33
20	Cracks	EFSA	4.00	0.12	0.01	1.33
21	Fungus Attacks/Harmful growth	R	2.00	0.06	0.01	0.67
22	Decay of Timber Frame	D	2.00	0.06	0.01	0.67
23	Peeling paint	D	2.00	0.06	0.01	0.67
24	Distortion of Shape	W	1.00	0.03	0.00	0.33
25	Broken Tiles	R	-	-	-	-
26	Missing Tiles	R	-	-	-	-
27	Insect Attacks	W	-	-	-	-
28	Cracked Glassless	W	-	-	-	-
29	Steel Corrosion	W	-	-	-	-
30	Insect Attacks	D	-	-	-	-
31	Distortion of Shape	D	-	-	-	-
32	Timber Decay	EFSA	-	-	-	-
33	Mould Attacks	EFSA	-	-	-	-
			300	9	1.0	100

Source : Authors 2018

Table 5 above structurally indicates the range in type of defect by the defect occurs. A total of thirty-three (33) type of defect shows that only twenty-four (24) kind of defect consistently appears from studied buildings. The rest consider as irrelevant defect type for this study towards heritage building output. Out of twenty-four (24) kind of defect, dampness (raising/falling) at the external wall (EW) with 11.33 % perceive maximum range followed by dampness (raising/falling) and fungus attacked/harmful growth with 8.33%. Ranging from 7.0-7.9 % indicates the peeling paint and

dampness followed by fungus attack by 5.33%. The lowest range is the distortion of shape at windows with 0.33% and the rest ragging from 0.33% < x > 5.33%.

Table 6. Building Defect by Compenants

ID	Components	Defect (A)	(A /B)	Total Defect (A /B)*100	Ranks
R	Roof	45.00	0.15	15.00	3
EW	External Wall	101.00	0.34	33.67	1
CB	Column and Beam	65.00	0.22	21.67	2
W	Windows	18.00	0.06	6.00	6
D	Doors	4.00	0.01	1.33	7
EFSA	External Floor, Stairs and Apron	43.00	0.14	14.33	4
BS	Building Services	24.00	0.08	8.00	5
		300.00 (B)		100.00	

Source : Authors 2018

Table 6 above indicates a total defect in each study components, where External Wall (EW) at 33.67% with maximum range (rank 1) in a complete 101 number of defect followed by column and beam with 21.67% and roof component for 15%. External Floor, Stairs and Apron (EFSA) at fourth rank with 14.33% and the rest components at 8% and below.

Table 7 below initiates the total building defect by grouping the type of defect that continually occurs in the heritage buildings.

Table 7. Building defect by Type of Defects

Type of Defect (TD)	ID	Defect	Total Defect	X/Y	Z*100	
			X	Z	(%)	Rank
Cracking of board/ Leaning board	R	4				
Cracking of column / beam	CB	4	23	0.08	7.67	4
Cracking of Walls / Leaning Walls	EW	11				
Cracks	EFSA	4				
Damage Gutter / Rain water downpipe (RWDP)	R	15	15	0.05	5.00	6
Dampness	EFSA	23				
Dampness	R	6	88	0.29	29.33	1
Dampness raising/falling	EW	34				
Dampness raising/falling	CB	25				
Decay of Timber Frame	D	2				
Decay Timber frame	W	6	8	0.03	2.67	7
Defective Plastered Rendering	CB	11	11	0.04	3.67	7
Distortion of Shape	W	1	1	0.00	0.33	8
Flaking Paintwork	R	6	16	0.05	5.33	5
Flaking Plaster	EW	10				
Fungus attack	EFSA	16	57			2

Fungus Attacks/ Harmful growth	EW	25		0.19	19.00	
Fungus Attacks/ Harmful growth	R	14				
Fungus Attacks/Harmful growth	CB	2				
Peeling Paint	CB	23				
Peeling paint	EW	21	57	0.19	19.00	2
Peeling paint	W	11				
Peeling paint	D	2				
Poor Installation of Air condition unit	BS	24	24	0.08	8.00	3
Overall Defect (Y)		300				

Source : Authors 2018

Statistic measure indicates that dampness cumulative is higher compares to others with 29.1% gaping 10.1% from the second rank namely peeling paint and fungus attack/harmful growth at 19.0%. Followed by poor installation of air condition unit at 8% distinguished by a massive gap at 11% compared to the upper rank. Strictly to the fourth rank at 7.67% with crack conditions becomes one of the significant threats for the heritage building. The rest at 5.33% and below.

5. Concluding Remark

The defect pattern suggests that careful attention needs to be prioritised at the component base so that proper mitigation will adhere to the existing defect and future treat neutralises efficiently. The practical approach to handling and managing the current and co-existing deficiency in heritage building is necessary and prudent. Overall the research outcomes are meeting the purpose of the study to enlighten the defect issues on the heritage building in theory and practices. All parties are recommended to improvise the result of this study to establish a further defect framework for their related asset concerning heritage building. As for managerial organisation, prevention is better than cure conceptual must lead the foundation of theory and practice to mitigate the defect treat towards the old and dilapidated building. Holding to the concept will ensure that the conservation activity implemented is the best and there is no repetitive action towards the repair work in future. The individual or organisation involved in heritage building conservation must establish the technical and financial need to overcome pertaining issue base on the common defect towards the building components.

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