Building Condition Assessment In School Using JKR Standard

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Abstract: Assessment of building conditions is increasing and gaining significance in. Building condition assessment is a real time assessment to gives information of defects and problems issue of the building. The primary purpose of performing a building inspection is to evaluate the building's condition. Through building inspection , a diagnostic can be made in which sector of the building having the most defects. An analysis to the building diagnostics gives confirmation of defects. Also, building condition assesement is the priority key to investigate history of defects prior to whole system in the building. This study involve in three school located in putatan districs. The methodology of this research is using JKR standard building condition assessment form of each defect in civil , electrical and mechanical system in the building. The trend of damage in civil , electrical and mechanical after the analysis.

Keywords: Building Condition Assessment, School Building, Defects Building

1. Introduction

Building condition assessment is growing in Malaysia's building environment [1]. The condition assessment is a comprehensive method of program reconstruction, extension or substitution to sustain the purpose and operations of the company [2]. Building condition assessment is an assessment to determine whether all the building's structural elements are in rational or irrational condition. This provides valuable and relevant data on the quality of construction materials and future maintenance job scheduling [3]. Building condition represents the physical condition of the buildings and therefore their performance toward efficiency.

The building condition assessment is a professional overview of the physical state of buildings [4]. The assessment includes the review of all buildings and materials, such as mechanical and electrical equipment, building frame internal structures and finishes, as well as building sites [5]. BCA systems, Building Condition Inspection for Existing Building Buildings Guideline, have been developed to respond to challenges in managing and maintaining assets in Malaysia in particular for government buildings [1].

A Building Condition Assessment evaluates the condition of a building's envelope performance, structural foundation and superstructure, and mechanical systems, including heating and cooling. A BCA may also include the exterior elements of the property including site grading and drainage, condition of roadway and servicing infrastructure and lighting.

The process of a BCA starts with site review, where surveyor collect photos, measurements, notes and information from property owners as data. Once this information is gathered. The process of evaluates the data and delivers a final report with findings and recommendations. These may be related to the building's existing condition, forecasts for future performance, a maintenance plan and recommendations for repairs to the building. Building Condition Assessment may include Structural & Foundation systems, roofing systems, exterior enclosure, interior systems, parking garages, plumbing systems, electrical systems, mechanical systems, building and fire code issues & accessibility compliance updates, non-evasive technologies and institution evaluation

The result of condition assessment is a condition score. Which is determined by the extent and magnitude of the defects. The related records of defects and their characteristics provide insight into the current condition. The measurement results are useful in drawing up long-term maintenance plans. Furthermore, can be used to substantiate maintenance budgets – and also to demonstrate the consequences of not maintaining buildings at the right time

2. Methods

The method of the study is visual inspection research which is ideal for evaluating a school using the BCA's comprehension. This also focused, methodological scope of JKR BCA studies in school. The first primary objective in conducting this research is to come out with the overall building rating, which is the preliminary procedure before any rehabilitation or maintenance takes place. Inspection method performed is based on the visual inspection by using appropriate tools and results of the BCA are a more systematic approach in building maintenance practices [1].

The BCA checklist was used with reference to the standard for registering the information of the building, identification, characterization, defects in functional element, evaluation of condition of defect, and maintenance action and the information in terms of the defects' condition and priority were assessed [6]. Data were sorted using Building Condition Assessment Rating System and then analyzed with frequency distributions. The score of building condition rating was obtained by deriving the total mark of defects with total number of defects found in the building. Afterward, the defect data were analyzed and summarized to identify the major defective element in civil, mechanical and electrical as in objective number two.
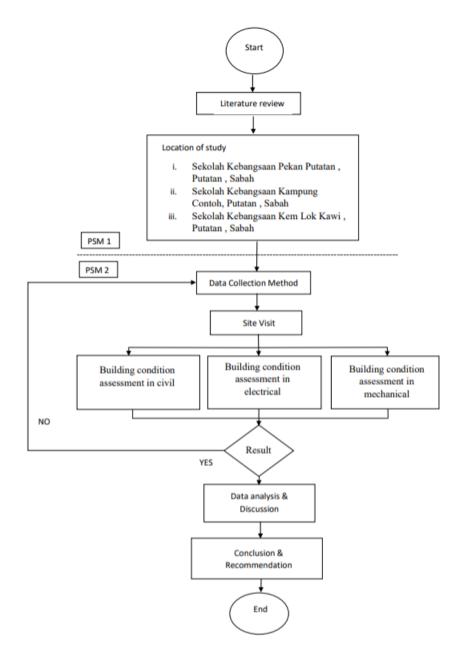
Figure 1: Flowchart Research Methodology

2.1 Location of Study

i.   Sekolah Kebangsaan Pekan Putatan. It was built in 1994. Located in Jalan Pejabat Daerah Putatan, Kota Kinabalu, Sabah. Consisting student of 719 boys and 683 girls, making a total of 1402 students. It has 72 teachers. This school still in operational for primary one till primary 6.

ii. Sekolah Kebangsaan Kampung Contoh. It was built 1998. Located in Sk. Kg. Contoh Petagas, Penampang, Sabah. Consisting student of has 359 boys and 342 girls, making a total of 701 students. It has 49 teachers. This school still in operational for primary one till primary 6.

iii. sekolah Kebangsaan Kem Lok Kawi. Located in SK Kem Lok Kawi, 89580, Kota Kinabalu, Sabah. Consisting student of 539 boys and 464 girls, making a total of 1003 students. It has 67 teachers. This school still in operational for primary one till primary 6.

Figure 2: Sekolah Kebangsaan Pekan Putatan

Figure 3: Sekolah Kebangsaan Pekan Putatan from satellite

Figure 4: Sekolah Kebangsaan Kem Lok Kawi

2.2 Data analysist of BCA

Condition of buildings will be assessed and collected through BCA through JKR standard. The inspections are by visually. The first proses is for element evaluation is Physical state of the building. These includes identifying the types of defects and defects in building physical. Also, identifying any signs of material deterioration. The second process is the condition of the building structure. This by looking defects in the structure with determination of any signs of material deterioration the third process is the evaluation through any additions or alterations affecting the structure of the building. The process is looked to find any additions or changes that may be made affecting the structure of the building. And the lastly is assessment of conditions that may affect the safety of residents based on the function of the building like water tank condition, area of building stability, location, suitability of use of building materials, and design suitability the inspections also covering mechanical and electrical systems. The most possible method of inspection is through methods checks like roof inspections, room to room, basement space, inspection of the environment, exterior of the building and inspection of drainage system and sewage treatment plant.

Table 1: Physical Condition Levels of Building Components [7]

Grade	Inspection Scale	Summary	Desciption
1	Very good	SB	• No defects; • Excellent condition; and • Works well
2	Good	B	• No defects; • Excellent condition; and • Works well
3	Average	S	• There is a defect or major damage; • Simple conditions; and • Still works but needs to be monitored
4	Critical	K	• No / no defects or major / minor damage; • Critical situation; and • Cannot work accordingly service level agreed
5	Very critical	SK	• The situation is very critical; • Not functioning; and • Risk at all possible cause an accident and or injury

Table 2: Maintenance Action Priorities Level [7].

Priority	Scale Rating	Summary	Description
Normal	1	N	• No signs of defect or damage • Components / elements maintained by well, no repair needed
Routine	2	R	• Minor damage / disability • Needs to be monitored, repaired and replaced for avoid defects / defects more serious
Repair	3	PB	• Major damage / disability, • Need major repair, need to be repaired /changed
Recovery	4	PM	• Serious damage / disability, • the need for a repair urgent, urgent and immediate
Replacement	5	PG	• Damage / disability is very serious, • the need for replacement /urgent repairs, urgently needed and immediately • Needs detailed inspection expert

Table 3: Phase Matrix Physical Condition Analysis of Building Components and Maintenance Action Priority Level [7]

Scale		Maintenance action priority level				
		5	4	3	2	1
The physical state building component	5	25	20	15	10	5
	4	20	16	12	8	4
	3	15	12	9	6	3
	2	10	8	6	4	2
	1	5	4	3	2	1

Matrix analysis was calculated based on the following formula and the result is interpreted by referring to Table 3.3.

$$\text{Matrix analysis, } c = a \times b$$

where,

a is Condition Assessment Rating

b is Priority Assessment Rating

A five-point colour-coded rating system has been developed and proved to be most effective as mentioned by (Abbott, 2007). This will ease the method of assessment for staff or inspector to interpret consistently, making reports more user-friendly and easy to interpret, save time, comprehensive and also accessible to non-technical users to use the information. In Table 4, the five-point colour coded building rating is shown as a final result of the assessment.

Table 4: Classification of Building Ratings (JKR 21602-0004-13, 2013)

Rating	Condition	Action Matrix	Score
A	Very Good	Scheduled maintenance	1 to 5
B	Good	Condition-based Maintenance	6 to 10
C	Average	Repair	11 to 15
D	Critical	Recovery	16 to 20
E	Very Critical	Replacement	21 to 25

Overall building condition rating was calculated based on the following formula and the result is interpreted using Table 3:

Building classification rating = d/e
Total marks (d) = $\sum$ of c
Number of defect or damage (e)
where,
  c is Defect Rating
  e is Number of Defects

Score 1 to 5 with very good condition and action matrix to be taken is preventive maintenance, 6 to 10, good condition with condition based maintenance, fair condition with score from 11 to 15 required

for repairs work. Meanwhile rehabilitation work need for poor condition with range scores from 16 to 20. Score from 21 to 25 is very poor condition and needs for replacement work.

3. Results and Discussion

As a result of the collection of observational data, the data were analyzed to identify trend of damage to three school. Observations are made against damage to three school in putatan districts using building inspection forms that are divided into three sections, civil in structural, mechanical systems and electrical system.

3.1 Analysis trend of damage to Sk Pekan Putatan in Putatan district

The trend of damage in civil to SK Pekan Putatan are mostly covered by floor damage at 34.0 %. This mostly by broken floor slab. This followed by pillar structure at 25.0 %. Pillar structure were badly in shape caused by old rusty reinforced iron inside the pillar. Also at 13.0 % are the broken external wall caused by wear and tear throughout the year this school operating. At 8.0 % are the roof and internal construction material that were worn out.

The trend of damage in electrical to SK Pekan Putatan are mostly by low voltage system at 48.0%. This school always faced electrical problem due to old wire system that worn out. The electrical system has not yet upgraded since the school operating in 1994. Followed by communication system is this school covered 35.0 %. Following by lighting system at 17.0 %.

The trend of damage in mechanical to SK Pekan Putatan as mostly by piping system. The piping system were broken at one or two part throughout the whole school. This caused by poor maintenance by the contractor who responsible for all maintenance for this school. Also followed at 33.0 % , this school poorly at having proper firefighting system. The design of this school were old fashion and it's not included proper firefighting system at that time. Minorly at 4.0 % are ventilation system this school has. Adequately ventilation system all over the school.
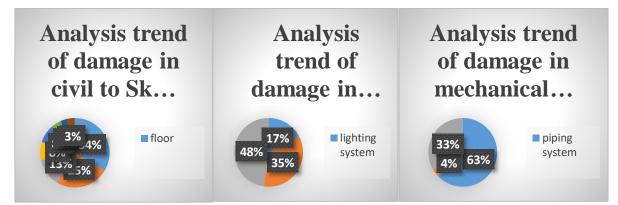

Figure 1: The trend of damage in Civil, Electrical and Mechanical to Sk Pekan Putatan

3.2 Analysis Trend of Damage to SK Kg. Contoh in Putatan District

The trend of damage in civil to SK Kg. Contoh are mostly by roof at 71.0 %. The roof of this school faced broken due to bad weather striking over years. Minor broken happen first and major problem comes later. It can be seen a hole at this school roof. Followed by 29.0 % of internal construction. Pest attack all the wood material at this school. The doors and windows are majorly broken by pest attack

The trend of damage in electrical to SK Kg. Contoh are mostly by low voltage current. This happen due to the main switch for electrical once were in fire. All the electrical system yet still under construction. Also at 35.0 % the communication appliances affected by this fire. Along with internal lighting at 20.0 %.

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The trend of damage in mechanical to SK Kg. Contoh are mostly by piping system at 42.0 %. The piping system were minor maintenance by the contractor while the overflow from the main pipe are not controlled properly. At 27.0 % is firefighting system this school have. The firefighting system were not maintained. This cause the system is not working properly. At 24.0 %, power distribution faced problem from electrical system that were once on fire. This yet still in constructions.
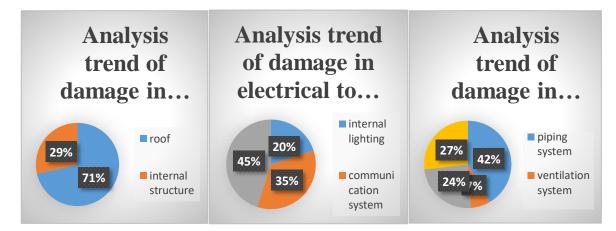

Figure 2: The trend of damage in Civil, Electrical and Mechanical to Sk Kg Contoh

3.3 Analysis trend of damage to SK Kem Lok Kawi in Putatan district

The trend of damage in civil to SK Kem Lok Kawi mostly by base slab and pillar structure at 23.0 %. This majorly caused by poor maintenance performed by contractor. Followed by stair at 17.0 %. The handrail of the stair already rusty and worn out by everyday use. The roof also mostly in bad shape due to bad weather and poor maintenance.

The trend of damage in electrical to SK Kem Lok Kawi mostly by power distribution system at 69.0 %. The school has been used the old wiring system since it was built. Also at 25.0 % the lighting system also faced the same problem. Adequately in lightning system in the school.

The trend of damage in mechanical to Sk Kem Lok Kawi mostly by piping system in the school at 64.0 %. The poor maintenance by contractor with old piping system has been a major problem faced by this school. Also at 32.0 % this school did not have proper firefighting system. It was designed old way where firefighting system still not introduce to the most school. At 4.0 % this school has minor ventilation system.
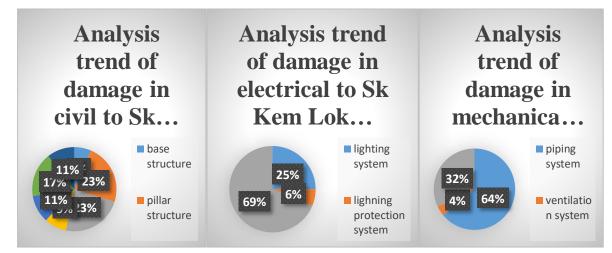

Figure 3: The trend of damage in Civil, Electrical and Mechanical to SK Kem Lok Kawi

4. Conclusion

Overall, the conclusion is most of the schools are still have deficiencies in managing building maintenance work. A government appointed contractors perform a maintenance without specific maintenance guidelines. This is happening due to the lack of guidance to create a practice perfect maintenance. The formation of a maintenance organization is also considered ineffective in carry out more systematic maintenance work. None planning maintenance activities as well as prevention, maintenance repairs are only carried out when damage to the building occurs. Building inspections are carried out when there is an urgent need such as getting complaints of damage on the building. T he results of damage analysis of building elements against three schools achieving the objectives of the study in line with the study literature. The results of the study conducted found three school is still in average condition functioning as desired. Damage the main problem encountered in the study building was damage to the roof elements building. This damage is caused by various reasons, among which is the age factor buildings and permanent defects as a result of construction errors. In addition, the building the old studied suffered damage to the finishing of the building elements such as floors, walls, beams and poles. Damage to the finishing of building elements is due to the quality of construction, weather and nature that causing the surface of the finishing layer to peel off and mossy. Building materials namely wood and iron as door frames and window components on old buildings also experience functional impairment as a result of weather and nature.

Acknowledgement

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