

BUILDING CONDITION ASSESSMENT VISUAL INSPECTION ONLINE
SYSTEM

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DEDICATION

Dedicated to my beloved father, mother, siblings, friend and lecturers

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ABSTRACT

Building condition assessment (BCA) is an assessment that provides the information of deficiencies of the property to support the decision-making and management of its maintenance and rehabilitation. Most of the practice of BCA nowadays is still using the manual inspection, which has many disadvantages and is no longer practical. Therefore, the aim of this study is to create a web system of BCA to be implemented in today's practice. To achieve this aim, BCA was conducted on three heritage buildings in Johor Bahru, which are Istana Zaharah, Dato' Abdullah Jaafar building and Keretapi Tanah Melayu (KTM) building to obtain all the required information to be input into the system and to identify the outcomes that should be presented. Heritage buildings were chosen as the case study because they are more likely to have more defects for data maximization. Apart from that, available standards and findings from previous studies were referred as guidelines in developing this new system. The BCA was conducted based on the structural and architectural elements i.e. maintainability, security, functionality and the sustainability of the original construction material. From the case study conducted, each defect on the building was identified and rated according to its condition and maintenance priority. From each defect, by using the matrix calculation, the overall rating, from 1 to 5, of the building was determined. As a result from the building assessment and matrix analysis, it was found that Istana Zaharah is rated 5, requiring further investigation, which may lead to major maintenance and rehabilitation or demolish to reestablish to its original state. Whilst the condition rating of Dato' Abdullah Jaafar building and KTM building are 3 and 4 respectively, indicating Dato' Abdullah Jaafar building can be used partially but both building required further detailed investigation to determine the integrity of the buildings. To test the functionality and verification of the developed system, professionals were appointed in this study to conduct BCA in real situation. A set of questions was distributed to obtain their feedback on the system for further improvement before it can be widely used. The feedback from the professionals agreed that the BCA online system reduced the time of on-site inspection work as compared with the manual method that they used previously. Finally, after some improvements made, with the feedback obtained from the professionals, a BCA web system was developed. The outcome of the system is the overall condition rating of a building inspected together with the recorded detailed defects data.

ABSTRAK

Penilaian keadaan bangunan (BCA) adalah penilaian yang memberikan maklumat kecacatan harta benda sebagai sokongan dalam membuat keputusan dan pengurusan penyelenggaraan dan pemulihannya. Kebanyakan BCA yang dijalankan sehingga hari ini ialah dengan menggunakan pemeriksaan manual yang mempunyai banyak kekurangan dan tidak praktikal. Oleh itu, tujuan kajian ini dijalankan adalah untuk menghasilkan sistem web BCA untuk dipraktikkan. Bagi mencapai tujuan ini, BCA telah dijalankan ke atas tiga buah bangunan bersejarah di Johor Bahru iaitu Istana Zaharah, bangunan Dato' Abdullah Jaafar dan bangunan Keretapi Tanah Melayu (KTM) untuk mendapatkan semua maklumat yang diperlukan dalam penghasilan sistem dan mengenal pasti hasil yang akan dikeluarkan. Bangunan bersejarah dijadikan pilihan sebagai kajian kerana dipercayai mempunyai lebih banyak kerosakan untuk memaksimumkan data. Selain daripada itu, piawaian sedia ada dan penemuan daripada kajian terdahulu dirujuk sebagai panduan dalam menghasilkan sistem baru ini. BCA dijalankan berdasarkan elemen struktur dan seni bina seperti tahap pemeliharaan, keselamatan, fungsi dan keaslian bahan binaan. Oleh itu, tujuan kajian ini adalah untuk mengenal pasti kecacatan bangunan dan menilai mengikut keadaan dan keutamaan penyelenggaraannya. Dari setiap kecacatan, penilaian keseluruhan bangunan ditentukan daripada tahap 1 hingga 5. Dari penilaian bangunan dan analisis matriks, didapati bahawa Istana Zaharah dinilai pada tahap 5 yang bermaksud ia memerlukan penyiasatan yang lebih mendalam, yang mungkin menyebabkan penyelenggaraan dan pemulihan besar atau dirobuhkan untuk mengekalkan keadaan asalnya. Walaupun tahap keadaan bangunan Dato' Abdullah Jaafar dan bangunan KTM adalah 3 dan 4 yang menunjukkan bangunan Dato' Abdullah Jaafar masih boleh digunakan tetapi kedua-dua bangunan memerlukan siasatan terperinci untuk mengetahui integriti bangunan tersebut. Bagi menguji fungsi sistem, ia telah digunakan oleh beberapa orang profesional telah dilantik dalam kajian ini untuk menjalankan BCA. Satu set soalan telah diedarkan untuk mendapatkan maklum balas terhadap sistem untuk pembaikan lanjut sebelum ia digunakan secara meluas. Maklum balas yang diterima daripada profesional bersetuju bahawa sistem BCA telah mengurangkan masa pemeriksaan di tapak jika dibandingkan dengan cara manual yang digunakan sebelum ini. Selepas pembaikan dilakukan, bersama dengan maklumbalas yang diterima daripada pihak profesional, sistem BCA telah dihasilkan. Hasil yang dikeluarkan oleh sistem ini ialah penilaian keseluruhan bangunan yang diperiksa beserta senarai data kerosakan yang terperinci.

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LIST OF ABBREVIATIONS

BCA - Building Condition Assessment

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CHAPTER 1

INTRODUCTION

1.1 Background of Research

Living and working in a safe property is essential for all people. The role of property manager and building owner is to ensure that their buildings are maintained to preserve the asset and to protect the building occupants. Building condition assessment (BCA) provides comprehensive building deficiency information and forecasts possible future maintenance or rehabilitation for a building. Neglecting the process of BCA for a building could risk the occupant's life and people around the area. Gradually, BCA has grown to be an important element in the Built Environment and Asset Management in Malaysia in supporting the decision making and also critical to the maintenance management.

The main purpose of BCA is to evaluate the physical condition of the building by listing the defects existed in the building systems and to provide a long-term renewal and maintenance planning. The standard is a tool to assess the technical status of the properties to underpin the long-term maintenance expectations. Condition assessment is not meant for preparing the annual maintenance budget and planning of the work but needed in the phase of preparing for the execution of remedial work.

The importance of condition assessment is that it should be used as a strategic management tool in assessing the technical performance of the properties to underpin the long-term maintenance expectations. Building inspectors can provide facility managers with objective data about performance loss and defects in building components. The assessment and setting priorities for planned maintenance work is one of the ways to counter problems of maintenance funds shortage. Lacking of condition assessment on structures is one of the critical issues as a result of structure

degradation due to aging. These show that condition assessment of structures, specifically buildings is very important in so many aspects and should be operated regularly.

Since BCA is a crucial process in Built Environment, an alternative solution to a manual building assessment, which is easier and more practical, should be provided to enforce building condition assessment to all building owners or management. The solution to this problem is discussed in this research. Developing an online system, which eliminates lengthy data analysis process, is one way of advancing building condition assessment and it is a more sustainable approach, since it reduces the usage of papers. Therefore, it saved a lot of time to summarize the result. The rating of each data collected can be directly provided either for a section or a whole building, according to the inspectors' requirement.

1.2 Problem Statement

To reduce multiple task and human's mistakes, a document management system is developed within this study. BCA has gained a huge request from property owners and building managers. The objective of BCA in maintenance management systems is to support coordination, maintenance monitoring and maintainability of a structure. It is critically important for a building to undergo condition assessment, but there is a drawback for the manual method used in current practice of BCA, which is the innumerable amount of data and proper managing system are hard to be organized and achieved.

BCA can increase data acquisition and monitoring for building maintenance and contribute to good quality, productivity and performance of a building. Parties who undertake building management system faced many issues due to few reasons such as bad service delivery, less-competent contractor and defect repetition, which makes conventional method practices are no longer effective. The knowledge sharing and transferring between the parties for assessment process in the maintenance management of building projects is limited while using paper-based

form assessment. There is a potential for a conflict to occur during the process of data and result analysis with improper assessment and complicated maintenance system of the performance-based specification. This resulted in affecting the sustainability of building maintenance in Malaysia as claimed by Kamar et al [1] and supported by Sadafi et al [2].

The conventional method of assessment i.e. paper-based method has been criticized for various inadequacies. Due to the weakness of conventional method, the parties handling maintenance management often had difficulties to analyze the recorded data, which contributes to negligence in assessment and repairs planning for structural components that are exposed to defects repetition at construction site. The main function of computer-aided applications is to record, analyze and use specific information for particular maintenance activities, which can help in facilitating communication between the maintenance management parties and to identify the problem to be resolved and allow the feedback on maintenance works that have been completed.

1.3 Objectives of Study

The objectives of this study are as follows:

1. To investigate each building components and types of defects that are required in building condition assessment process.
2. To compute the overall rating of buildings act as case studies based on the condition and maintenance priority rating from the visual assessment and manual calculation.
3. To develop an online system of visual inspection in BCA by using Laravel software.

1.4 Scope of Study

The system developed, whereby the process and data required makes it applicable to any types of buildings e.g: heritage buildings, educational buildings, residential buildings, industrial buildings etc. The description of the building assessed should be described in a section provided in the system as a reference to evaluate the identity of the building. However, the case studies chosen are buildings of more than 50 years aged with bad condition. This is because old buildings are most likely to have more defects in aspect of numbers and severity compared to other buildings. Therefore, the data needed for this study can be maximized.

Since the building condition assessment online system is about producing safety rating, the building components to be assessed are focusing on all structural components such as column, slab etc. and also and architectural components such as broken doors, windows, which may risk the safety of the building users. The building assessors will rate each defect according to their condition and maintenance priority, and the matrix analysis of those two ratings and final result are calculated by the system. This system also can be used to assess the entire building or by section.

The case study chosen for this study is heritage buildings. They were chosen because it is believed that older buildings have more defects and deficiencies. However, since heritage buildings have high values of social, economic and cultural to urban communities, they are strictly guarded and protocols should be followed throughout the assessment.

1.5 Significance of The Study

By adopting condition-assessment approach to maintenance, the facility management personnel can exercise control over the operational maintenance performance levels and costs. Therefore, by providing an online system, it helps the assessors to operate the assessment faster and easier by eliminating the process of

data collection and result analysis of defects manually by the person in charge. This may result in larger number of execution of BCA taken by the relevant authorities.

Document management system offers an effective solution to overcome the risk of data and information loss, and photos taken for each defect recorded can be placed accordingly and prevent the mistakes that may occur during photos selection process. A more practical system applied may contribute to higher statistics of undertaking BCA.

1.6 Thesis Outline

The thesis is aimed to discuss the procedures of building condition assessment and produce an alternative solution, which is much easier to operate the assessment. Chapter 1 discussed the introduction, problem statement, objectives of the research, scope of study and significance of study. This chapter explains what to be achieved throughout this study.

Chapter 2 summarized the literature review from all previous related studies discussing the current practice of building condition assessment, its weakness and problem encountered through the conventional practices. This includes the topic of building maintenance, building condition assessment, which BCA can be applied, the usage of five-point scale rating, and also the BCA procedure conducted by the authorities.

Chapter 3 discusses about the research methodology and approaches to achieve the objectives of the study. In summary, this chapter is elaborating the methods of study, which are the interview with the Government authorities, data requirement for BCA, case study, which involves three buildings in Johor Bahru, and finally the development of BCA online system (BCA-OS).

Chapter 4 revealed the results of BCA alternative method and procedure. It presents the result of the case study conducted on the three old or heritage buildings for BCA using both manual and online system methods. Those results aim to prove the reliability of using BCA online system for any types of buildings.

Chapter 5, the last chapter is the conclusion of all result obtained, the effectiveness and relevance of the system produced throughout this study. Conclusion and recommendations of the study are discussed in this chapter as well.

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