BUILDING CONDITION ASSESSMENT ON A HERITAGE BUILDING : DATO' ABDULLAH JAAFAR BUILDING

NADIAH BINTI AZMAN

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Razak Faculty of Technology and Informatics
Universiti Teknologi Malaysia

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DEDICATION

This project report is dedicated to my father, who have been my role model and inspiration ever since I was little. He always reminded me on how important it is to look for knowledge in our life. This is also dedicated to my mother, who never stop believe in me and continue to support me through my study time here.

ACKNOWLEDGEMENT

Alhamdulillah, I have finished my master project. It is a great pleasure to give appreciation to the people who had helped me through this tough journey. Firstly, I would like to thank my supervisor PM. Dr. Izni Syahrizal as he was the one who would always help me whenever I was not able to proceed forward. He also continuously supported me by giving me motivations and sharing his knowledge with me as a guidance for doing my master project under his supervision. Because of him, I had learned and gained a lot more knowledge and experiences in the field of Forensic Engineering. Furthermore, I also would like to thank my fellow friends, Syahirah Binti Md. Noor and Izzuain Binti Ibrahim for helping me from the beginning until the end of my project. I also would like to extend my gratitude to all the people that lend a helping hand during the Building Condition Assessment (BCA) process on the Dato' Abdullah Jaafar building. It they are not around to help, it would have taken me much longer time and great difficulties to finish my inspection work on. Last but not least, I would like to thank my family members and my fellow friends for their unconditional support in helping me completing this project either morally or financially, I am very grateful.

ABSTRACT

Building Condition Assessment (BCA) is the assessment done on a building to rate the condition by assessing the defects present, determining the risks if the structure is left in its original condition without maintenance work and finding out the maintenance work that need to be done in order to preserve the building in its working condition. BCA is executed by comparing information which include the data that had been measured, comments on the structural condition either with or without defect and interpretation of the condition of the deformity present. These information were gathered during the preliminary in-situ investigation which was done to determine the masonry textures, decay patterns and the accountability of the materials and structural elements. This paper is focus on implementing the BCA in heritage building in Malaysia. Thus, in this study, the BCA was done in a heritage building in Johor Bharu which is the Dato' Abdullah Jaafar building. The objective of this study in the end is to develop a rating system to be used as an identification of the defects present according to the priority of maintenance needed. It is also to identify the applicability of existing BCA on heritage buildings. Furthermore, to find out the material used on the heritage building As for the findings of this project, it was found that the existing BCA can be applied in the process of heritage building inspection. Next, the chemical composition of the existing material of the Dato' Abdullah Jaafar building was found. Furthermore, the main conclusion is that the overall rating of the building managed to be obtained based from data gathered through the BCA process done where the building was rated with rating 3.

ABSTRAK

Penilaian Keadaan Bangunan (BCA) adalah penilaian yang dilakukan pada bangunan untuk menilai keadaan dengan menilai kecacatan yang ada sekarang, menentukan risiko jika struktur itu ditinggalkan dalam keadaan asalnya tanpa kerja penyelenggaraan dan mengetahui kerja penyelenggaraan yang perlu dilakukan untuk memelihara bangunan dalam keadaan kerja. BCA dijalankan dengan membandingkan maklumat yang termasuk data yang telah diukur, ulasan tentang keadaan struktur sama ada dengan atau tanpa kecacatan dan tafsiran keadaan kecacatan yang ada sekarang. Maklumat ini dikumpulkan semasa penyiasatan awal dalam-situ yang telah dilakukan untuk menentukan tekstur batu, corak pembusukan dan kebertanggungjawaban bahan dan elemen struktur. Makalah ini memberi tumpuan kepada pelaksanaan BCA di bangunan warisan di Malaysia. Oleh itu, dalam kajian ini, BCA telah dilakukan di bangunan warisan di Johor Bharu yang merupakan bangunan Dato 'Abdullah Jaafar. Objektif kajian ini adalah untuk membangunkan sistem penarafan untuk digunakan sebagai pengenalan kecacatan yang hadir mengikut keutamaan penyelenggaraan yang diperlukan. Bagi penemuan projek ini, didapati BCA yang sedia ada boleh digunakan dalam proses pemeriksaan bangunan warisan. Seterusnya, komposisi kimia bahan sedia ada bangunan Dato' Abdullah Jaafar telah dijumpai. Konklusi utama projek ini adalah untuk mengetahui penarafan keseluruhan bangunan berjaya diperoleh berdasarkan data yang diperoleh melalui proses BCA yang telah dilakukan dimana bangunan ini dikelaskan sebagai kelas 3.

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LIST OF ABBREVIATIONS

BCA	-	Building Condition Assessment
JKR	-	Jabatan Kerja Raya
EDX	-	Energy-Dispersive X-ray Spectroscopy

LIST OF SYMBOLS

e	-	Total defects
d	-	Sum of the values of metric analysis
c	-	Metric analysis

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 General

Building Condition Assessment which is also known as BCA in short is a method used to assess a building condition to determine the maintenance work needed so that the building will continue to function as its initial purpose. BCA is done to detect defects present on the building including the minor defect that will not give structural failure however it will downgrade the aesthetic value of the building. By doing BCA on heritage building, it will give more meaning as heritage buildings need to be preserved for the future generation to enjoy and appreciate them as what we are doing now. However, doing BCA on heritage building is a bit different than doing it on modern building as it needs to protect the originality condition of the building thus no letting it lose its identity. Plus, different materials used in refurbishment might also cause failure to the building.

Khodeir et. al. (2016) said that although many historical buildings are suffering from deterioration problems, they are still being widely considered to be reused. Because of this, the refurbishment process of heritage building is necessary as it can help to improve the performance of the building. In addition to that, heritage buildings require crucial consideration for their special nature needs in order to protect the uniqueness of each historical buildings. In their writing, Khodeir et. al. (2016) stated that there are many procedures that had been considered in identifying the values of heritage building one example being the Welsh government's historic service, Cadw. Cadw is a standardise procedure used in classifying five types of values of historical building. Additionally, the visual of historical building gives out aesthetic value which can bring more benefit for tourism industry that can affect the economy. Thus, the

values need to be well-maintained which can be done with a periodic implementation of BCA.

1.2 Background of Study

This study will be conducted on the Dato' Abdullah Jaafar building. However, in recent years it is known to the public as the Johor Art Gallery. This building is located in Jalan Petrie which is in Johor Bharu. It was built in the year 1910 where it had become the official residence for the third Chief Minister of Johor, Dato' Abdullah Jaafar. This building has also been used as the army post for the Japanese. After being abandoned for a while, RISDA took this building and use it as their temporary office. Then after that, the Education Department used this place as a lodging house for their staff and students. After being abandoned yet again, in 1994 this building was chosen to be an art gallery. However, in 2016 the art gallery was closed down and this building is again, being abandoned. Thus, before any maintenance and repair works to be conducted, a building condition assessment is needed to be done in order to obtain data on the deterioration.

Figure 1.1 Dato' Abdullah Jaafar Building

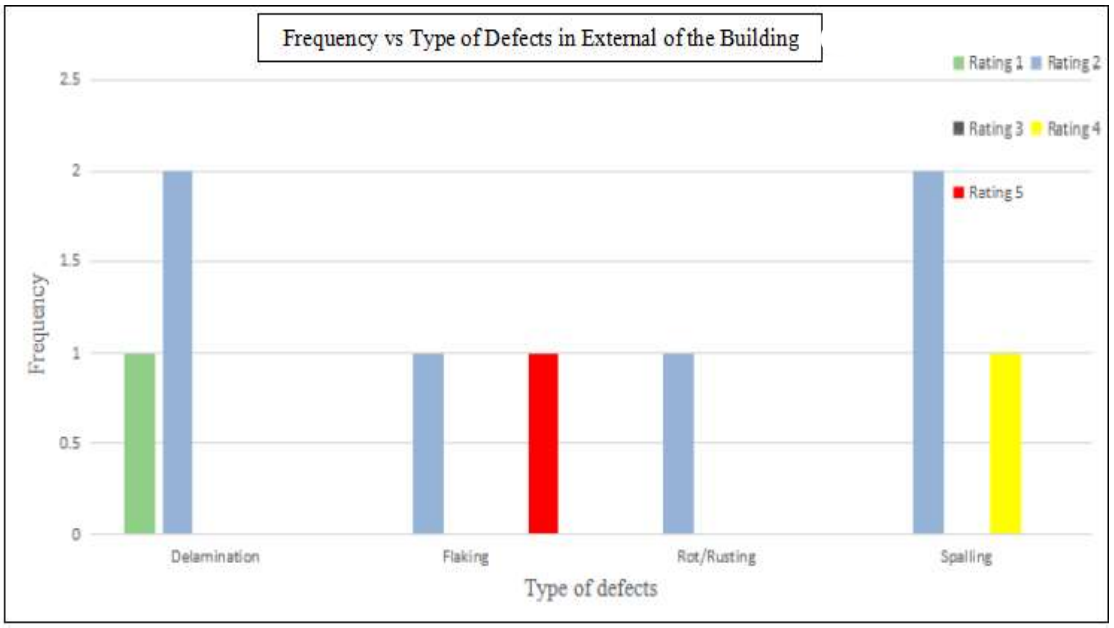

Figure 4.3 Frequency vs type of defects in external of the building

The external part of the building did not really have many defects. Some of the defects that were found on the external part of the building were delamination, flaking, rot/rusting and spalling. The highest rating to occur on the external part of the building is rating 5. However, the highest frequency of defect to occur is rating 2 with the defect being delamination and spalling. The lowest rating on the external part of the building is rating 1 with the defect being delamination. The overall rating of the external part of the building is rating 3 with a total score of 11.

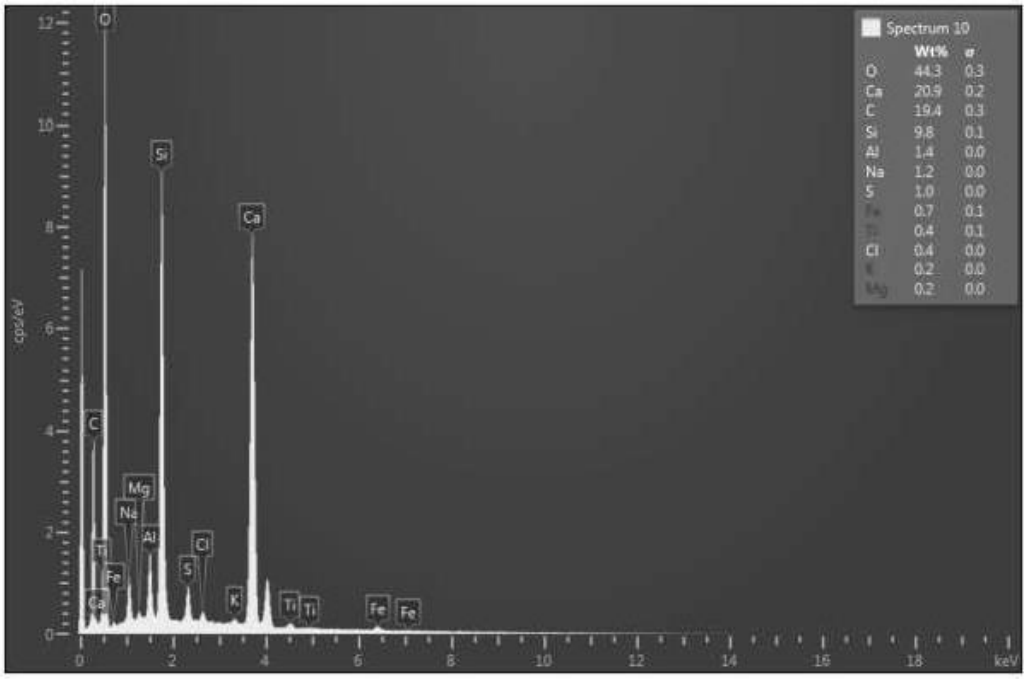

Figure 4.18 Chemical composition of the sample of surface 2

Figure 4.19 and figure 4.20 shows the result of the test done on surface 2-1 where figure 4.19 shows the image of the sample surface 2-1 under microscopic view. Figure 4.20 shows the chemical composition of the sample surface 2-1. In this test, it is seen that oxides has the highest percentage present in the material. Silica being the second highest compound with other compound found such as calcium and carbon.

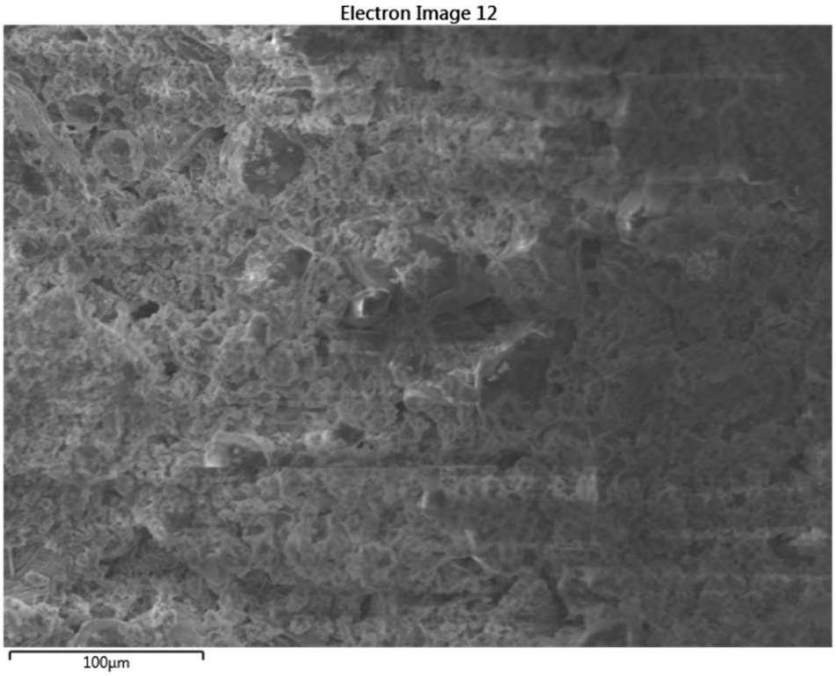

Figure 4.19 Image of the sample of surface 2-1 under microscopic view

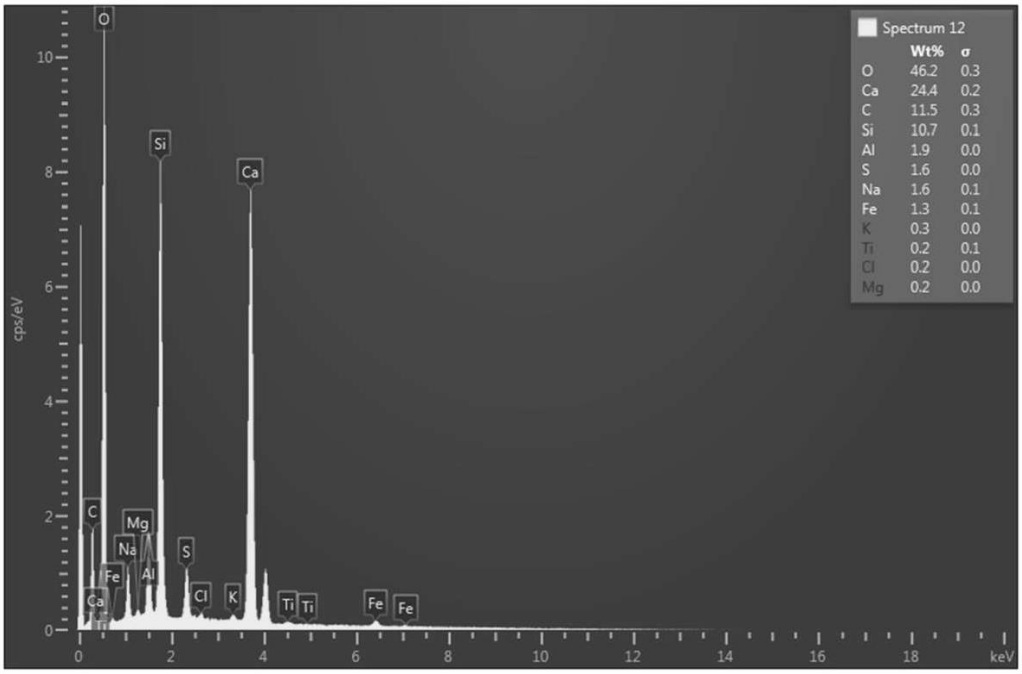

Figure 4.20 Chemical composition of the sample of surface 2-1

Figure 4.21 shows the image of the sample of surface 2-2 under microscopic view and figure 42 shows the chemical composition of sample of surface 2-2. In this sample we can see in figure 4.22 that the highest chemical compound found was oxides. In addition to that, calcium, oxides, silica and carbon were also very abundant in the material.

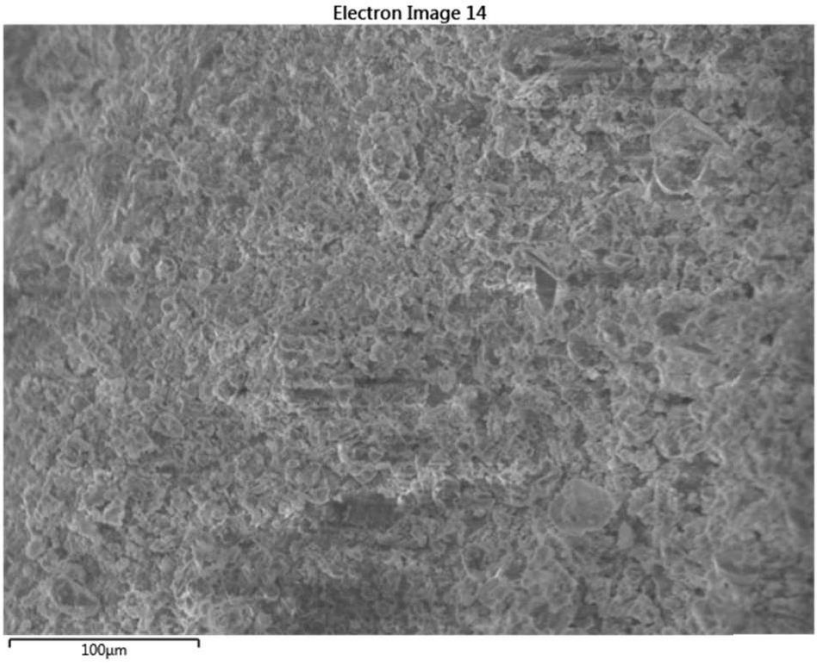

Figure 4.21 Image of the sample of surface 2-2 under microscopic view

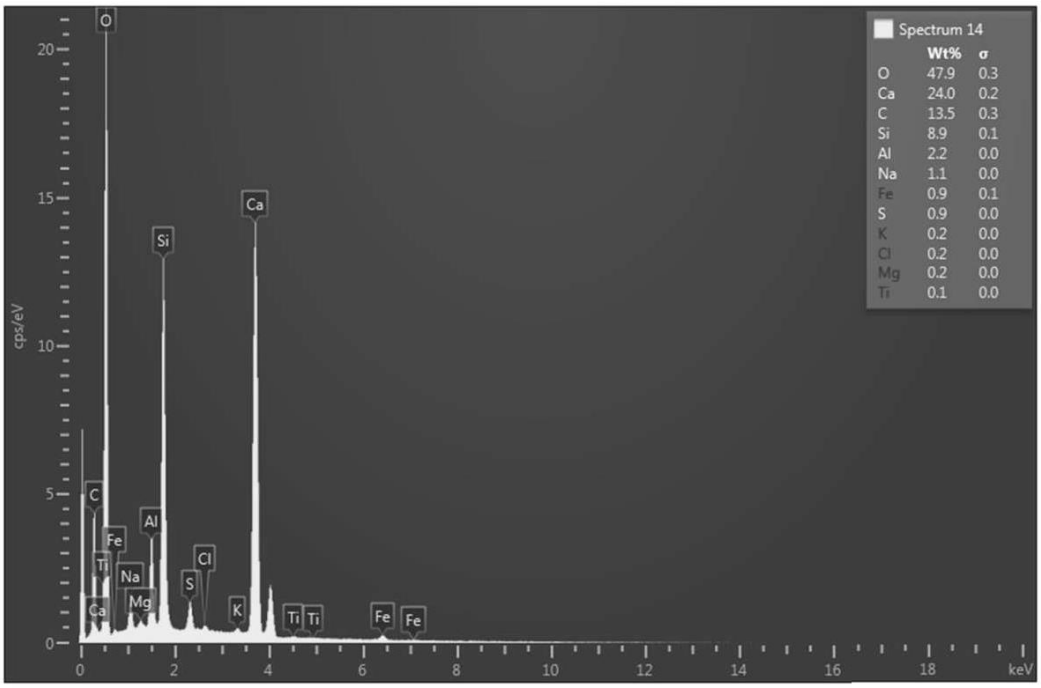

Figure 4.22 Chemical composition of the sample of surface 2-2

Figure 4.23 and figure 4.24 shows the result of the test done on surface 3 where figure 4.23 shows the image of the sample surface 3 under microscopic view. Figure 4.24 shows the chemical composition of the sample surface 3. It is observed that oxides has the highest percentage present in the material. Silica and carbon being the second highest compound with other compound found such as carbon.

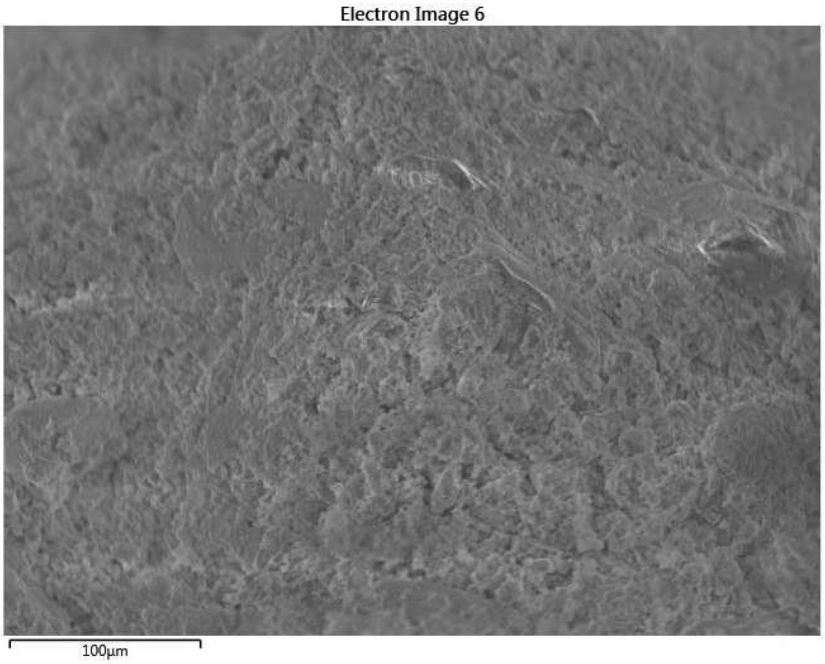

Figure 4.23 Image of the sample of surface 3 under microscopic view

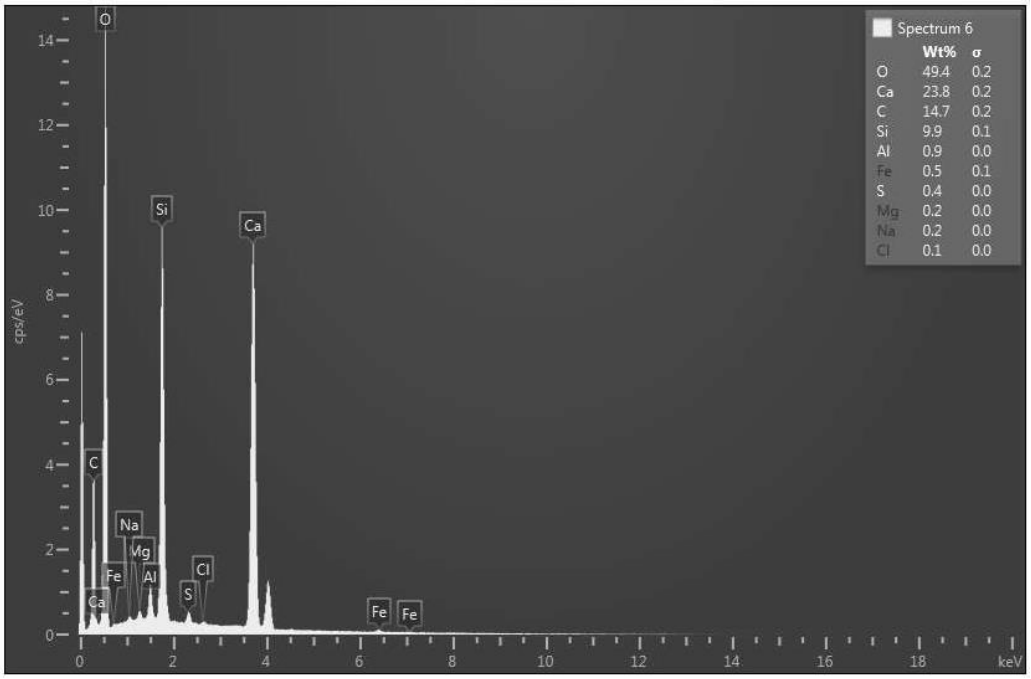

Figure 4.24 Chemical composition of the sample of surface 3

Figure 4.25 and figure 4.26 comprised of the image of the sample's surface 3-1. Figure 4.25 show the image of the sample of the surface 3-1 under microscopic view while figure 4.26 shows the chemical composition of the sample surface 3-1. Thus, based on figure 4.26 it is seen that the highest chemical compound found was oxides. Next, some other compound found were calcium, silica, carbon and aluminium.

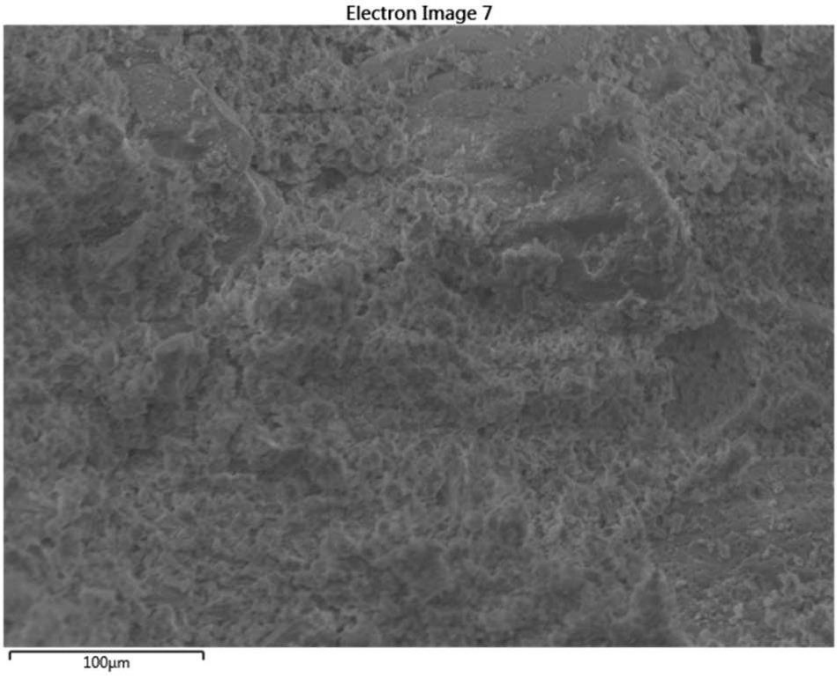

Figure 4.25 Image of the sample of surface 3-1under microscopic view

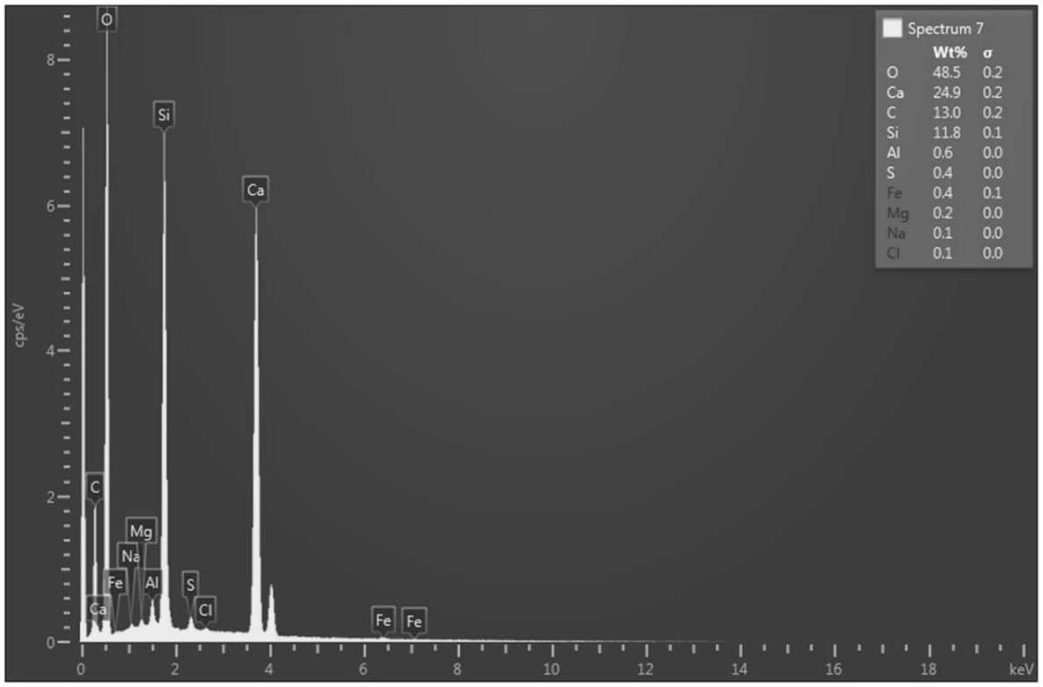

Figure 4.26 Chemical composition of the sample of surface 3-1

Figure 4.27 shows the image of the sample of surface 3-2 under microscopic view and figure 4.28 shows the chemical composition of sample of surface 3-2. In this sample we can see in figure 4.28 that the highest chemical compound found was calcium. Oxides has the second highest percentage in the material. In addition to that, silica and carbon were also very abundant in the material.

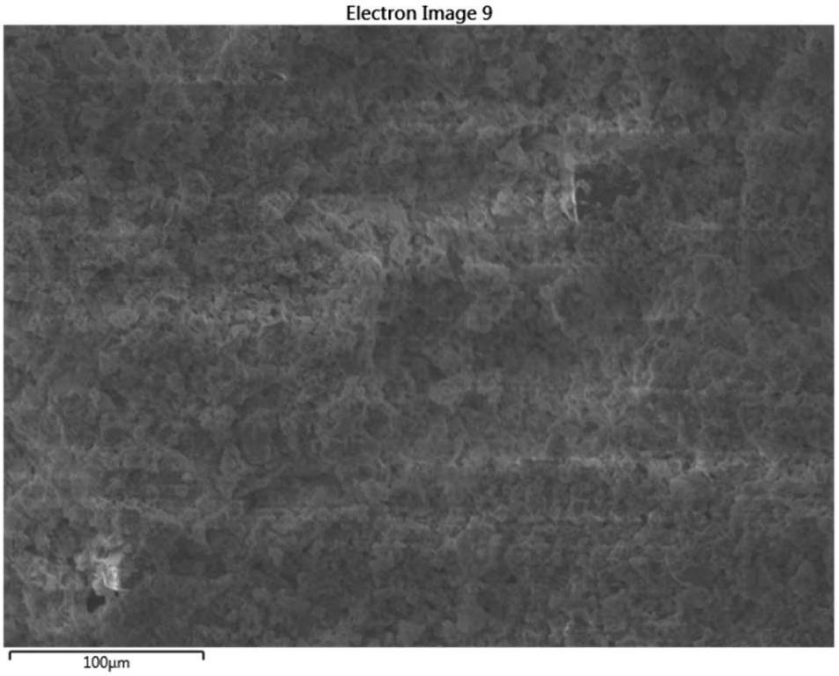

Figure 4.27 Image of the sample of surface 3-2 under microscopic view

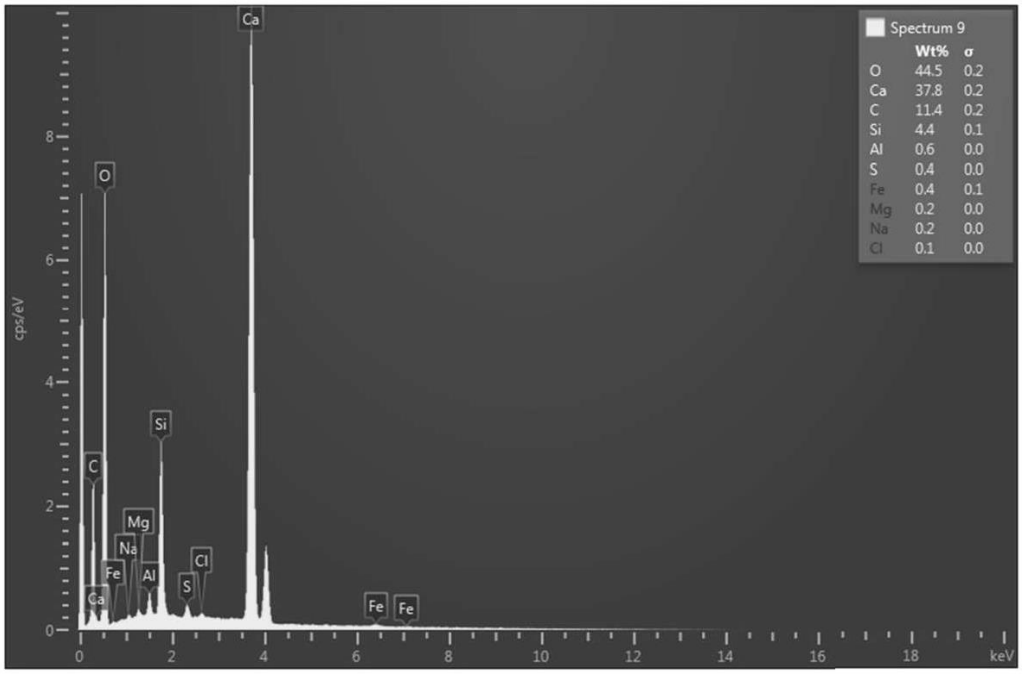

Figure 4.28 Chemical composition of the sample of surface 3-2

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The conclusions that are made in this chapter are based from the analysis made on the data and results obtained in chapter 4. The conclusions made have input on all the discussions and findings that had been discovered during the course of the study. Furthermore, this chapter also include recommendations for future researchers that will be doing similar topic as this study to ensure that their study can run smoothly to obtain better quality results.

This chapter will conclude the data obtained from the visual inspection done on the Dato' Abdullah Jaafar building in Jalan Petrie, Johor Bharu. The data include the inspection that were made on the ground floor of the building, first floor and the external part of the building. In this chapter, it will be known whether the objectives of this study is achieved or not.

5.2 Research Findings

Based on the visual inspection that had been done using the existing building condition assessment (BCA) manual provided by Jabatan Kerja Raya Malaysia (JKR), it can be said that the existing BCA can be applied in inspecting heritage buildings. Because of that, the data on the deterioration of Dato' Abdullah Jaafar building managed to be collected and analyzed using the existing BCA standard. Even more, the rating for Dato' Abdullah Jaafar building was obtained. The building was rated with the overall rating of 3 which translated into having major defect, but investigations will be done first before repair work start. This is to make sure that the

repair work that will be done on the building will properly fix the defect from furthering cause failure to the structures of the building.

To add more, the rating obtained is tallied with the visual inspection done on the building. This can be said as the data obtained for the rating also had been compared with data collected for other study that are doing similar research on the Dato' Abdullah Jaafar building to make sure that it is accurate. Lastly, the material samples that had been collected at the Dato' Abdullah Jaafar building was tested, and the chemical composition of the materials were found. This will help in the finding of the exact same materials or at least similar materials with the existing ones. It is very important while doing refurbishment process of a heritage building that the exact or similar materials to be used. This will preserve the identity of the building that had become a landmark on a certain place for a very long time. Other than that, the materials used before might not be the same as the materials that we are using now. Hence, to avoid structural damage to the building, it is necessary to use the exact materials or at least a similar composition.

5.3 Problems Occurred during the Inspection

During the visual inspection, there was a number of problems that occurred which may affect the BCA process. The problems are:

i. During the first visit to the building, we could not start doing the BCA process right away as the building was fully abandoned thus the inside of the building has no proper lighting. This has caused setback to the study.

ii. There are some defects that cannot be identified right away as we were not familiar with it. This also made the process of doing the BCA slow as we need to do a quick research on the defect.

iii. We needed to go to the Dato' Abdullah Jaafar a couple of times after the BCA process was done as we did not know that there were several parts of the building that did not being considered as part of the heritage building.

5.4 Recommendations

This study is done by conducting BCA process on the Dato' Abdullah Jaafar building. The inspection only took place at one building where the BCA process was done on the entire part of the building. This process only takes into account the structural and architectural part of the building. Several problems also had occurred during the study that could be avoided during the next project. Some of the recommendations that can be introduced are:

i. Make sure to study and really know part of the chosen building as there might be several constructions done to it by adding new feature. This is to avoid getting part of the original building being mixed up with the new feature as it needs to focus on heritage building.

ii. After chosen the building, it is best to visit the site several times to make a proper preparation before entering the building. This is to avoid unnecessary setbacks when you come unprepared.

iii. The visual inspection part needs a professional opinion as some of the defect identified cannot be compared using the standard provided. If not, the inspector need to have a couple of experience in doing BCA to familiarize themselves.

iv. The BCA process can be done on more than one building where one of the building can be a well-maintained building just to use the data obtained as a comparison on how the BCA process really works.

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