

BUILDING CONDITION ASSESSMENT AND DEFECT
ANALYSIS AT A PRE-SCHOOL BUILDING IN KELANTAN

NORLILA BINTI MOHD YUSOFF

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DEDICATION

I would like to dedicate this to my lovely husband (Azhar bin Hassan), my beloved family (Legacy KMY), children, friends and lecturers
Thanks for everything

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ABSTRACT

This research is intended to investigate the main issue that commonly arise in relation to the school buildings Kelantan. This study focuses on the pre-school building that is typically designed as an additional building to accommodate the increasing number of students due to current the inadequacy space of the current building. The school management has to find ways to improve the condition of the building in order to meet Malaysia's Ministry of Education (MOE) requirements. Most of the affected schools use the existing buildings and renovate them to make another room or another preschool building. A large number of additional building structures or renovated buildings will contribute to damage of the building after operation. There are a number of building defects that are often found in renovated annex buildings. Building defects are, in reality, a common phenomenon in the construction industry which has a negative effect on schools in terms of performance building, health and safety aspects as well as the overall teaching and learning environment and process. Thus, a research was conducted to classify building defects frequently faced by pre-school buildings in Kelantan, Malaysia. This study aims to evaluate the conditions of the building and find a solution in the arrangement of suitable methods by prioritizing students' safety during the maintenance phase of existing buildings, in particular pre-school buildings selected. The Public Works Department of Malaysia 's Standard Guidelines for Building Condition Assessment (BCA) (JKR 21602-0004-13) will be used as a reference in this report, and improvements will be made to the list of building inspection standards in accordance with Kelantan and Malaysia's soil and weather requirements of Kelantan and Malaysia. A comprehensive inspection and investigation will be carried out and any defect and damage will be reported using a camera to take pictures of the building's condition. The result of the inspection as well as the interview session between the researcher and the individual responsible for the building will be determined by using Software BCA (Building Condition Assessment), established by University of Technology Malaysia. Additionally, suitable remedies will be proposed for building defects as well as key factors leading to building defects will be identified and evaluated. New design of the essential buildings or structures will be suggested using manual methods and Esteem Software to enable the school management to apply for government allocation to fix the building and preserve the value of a healthy environment.

ABSTRAK

Kajian ini merupakan mengkaji permasalahan yang sering berlaku di bangunan sekolah di Kelantan. Kajian ini memfokuskan pada bangunan prasekolah yang biasanya dibina sebagai bangunan tambahan setelah bangunan yang ada tidak mencukupi untuk menampung bilangan pelajar yang sebenarnya. Pihak pengurusan sekolah harus mencari jalan penyelesaian untuk membangun bangunan tersebut untuk memenuhi kehendak Kementerian Pendidikan Malaysia (KPM). Sebilangan besar menggunakan bangunan yang sediaada dan mengubahsuai untuk dijadikan bilik / bangunan prasekolah. Sebilangan besar struktur bangunan tambahan atau bangunan yang telah diubahsuai akan menyumbang kepada kerosakan dan kerosakan bangunan setelah beroperasi. Terdapat sejumlah kecacatan bangunan yang sering dijumpai di bangunan tambahan yang telah diubahsuai. Pada hakikatnya, kecacatan bangunan adalah fenomena biasa dalam industri pembinaan yang memberi kesan negatif kepada sekolah, dari segi prestasi bangunan, aspek kesihatan dan keselamatan serta keseluruhan persekitaran dan proses pengajaran dan pembelajaran. Oleh itu, satu kajian dibuat untuk mengenal pasti kecacatan bangunan yang biasa dihadapi oleh bangunan prasekolah di Kelantan, Malaysia. Kajian ini adalah untuk menilai keadaan bangunan bagi mencari penyelesaian dalam mengatur kaedah yang sesuai dengan mengutamakan keselamatan pelajar semasa proses penyelenggaraan bangunan yang sediaada terutama bangunan prasekolah yang dikaji. Garis panduan standard untuk Penilaian Keadaan Bangunan (BCA) (JKR 21602-0004-13) oleh Jabatan Kerja Raya Malaysia akan digunakan untuk rujukan dalam kajian ini dan pengubahsuaian akan dibuat pada senarai kriteria pemeriksaan bangunan sesuai dengan syarat-syarat struktur tanah dan cuaca Kelantan dan Malaysia. Pemeriksaan dan penyiasatan yang komprehensif akan dilakukan dan setiap kecacatan dan kerosakan direkod menggunakan kamera untuk penggambaran gambar mengenai keadaan bangunan. Hasil daripada pemeriksaan dan wawancara antara penyelidik dan orang yang bertanggungjawab terhadap bangunan tersebut akan dinilai menggunakan Software BCA (Building Condition Assessment) yang dibangunkan oleh pihak Universiti Teknologi Malaysia. Di samping itu, penyelesaian yang sesuai untuk kecacatan bangunan akan dicadangkan serta faktor utama menyumbang kepada kecacatan bangunan akan ditentukan dan dinilai. Rekabentuk baru bangunan atau struktur yang kritikal akan dicadangkan menggunakan kaedah manual dan Software Esteem supaya pihak pengurusan sekolah terbabit dapat memohon peruntukan kerajaan bagi membaikpulih bangunan serta mengekalkan kepentingan bangunan sekolah yang sihat dan selamat.

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LIST OF SYMBOLS

f_{cu}	-	Concrete cube strength
f_y	-	Steel Yield strength
ϵ_{cu}	-	Ultimate strain of concrete
E_c	-	Elastic Modulus of concrete
E_s	-	Elastic Modulus of steel
γ_c	-	Partial safety factor of material for concrete
γ_s	-	Partial safety factor of material for steel
C	-	Concrete cover
d	-	Effective depth
b	-	Width
v_{ss}	-	Shear stress
v_{tot}	-	Total Stress
v_{tu}	-	Maximum combined stress allowed

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CHAPTER 1

INTRODUCTION

1.0 Overview

Malaysia is a developing country and is aiming to become a developed country. The rapid development of technology and industry has played a major role in this goal. The construction and infrastructure industries also play an important role in making the goals of developed countries a reality. From year to year various types of construction have been built and designed to meet the customer's needs and the function of a building. According to Mokhtar (2006) in his writings, a structure designed and built must be appropriate and in good condition and safe to occupy. The construction of a structure needs to be built according to the specifications and can work within a certain time frame depending on the site conditions and the local environment.

However, there are some problems with building structure during the construction process after completion or during its service life. This may be due to failure in achieving its function or in other words unable to cope with the burden it exceeds the actual design limit. In addition, it may also be due to the deterioration of the material itself. This problem can be seen in many different structures not only in Malaysia but around the world.

Structures can be interpreted as interdependent members with appropriate and secure connections to create a framework that is capable of carrying the service load. This study is important in the process of constructing a building as it will determine the safety and durability of the structure. The loads varies from building to building due to different uses and this requires a comprehensive structural study of each building purpose.

Most of the damage to a structure occurs during the construction process. An example of the Sultan Mizan Zainal Abidin Stadium on June 2, 2009 was widely reported. The ruins involved an 80-meter-long roof over 134 meters covering the rooftop seating area including the Royal Stage. The ruins are believed to start in the middle section of the stadium where the guest rooms (VIPs) and main seating area including the royal stage was located. The incident was due to its unstable roof structure. According to the Investigation Committee report, materials and quality of work that did not meet specifications, inadequate design factors, poorly constructed roofs and poor quality control at the project site were factors contributing to the collapse of the stadium roof. (Bernama, 2010, April 6). Similarly, the incident on January 10, 2018, which was part of a building structure at the main refinery site (PMU) on Cochrane Road, Kuala Lumpur in an initial investigation found there was a failure in the concrete activity work system (Daily News, 2018, January 10).

In addition, many cases of building defects have been reported and formally reported by the mass media, involving school buildings, commercial buildings or even renovated buildings. These problems usually occur due to common defects in school building components such as roofs, walls, floors, ceilings, toilets, doors and. This defect can lead to unexpected accidents and even loss of life. For example, on, October 18, 2019, Sekolah Kebangsaan (SK) Siol Kanan in Taman Sukma, Sarawak, cafeteria workers were facing an anxious situation after the roof of the school building suddenly collapsed. According to an engineer involved in the investigation, the school management had reported earlier that the roof was found to be unsafe. In this regard, a similar case was reported on 2018, February 21 where students and teachers survived after the classroom ceiling of a primary school at Jerangau, Dungun collapsed, just after the teaching and learning session ended. Such incidents should not be underestimated and inspections should be made against other school buildings to prevent recurrence (Daily News, 2018, February 21). Also, in a separate case on September 12, 2005, a teacher fell and died afterwards due to a broken plywood floor in the two blocks of a school in SJK (C) Keat Hwa, Kedah. It is believed that the floor was damaged by the termite attack. From the cases reported, defects and damage to the building structure contributed greatly to the failure of the structure.

A study or investigation needs to be done to identify the causes, effects, and ways of resolving the damage. Assessments of damage levels as well as defects or building failure methods need to use more scientifically efficient methods and environmental complaints or hazards related to buildings using good physical evidence and scientific and mathematical methods, guided by a sufficiently broad scope of investigation - ensuring that key factors are not excluded.

1.1 Problem Statement

The Ministry of Education Malaysia began implementing annex preschool education program in 1992, as a pilot project based on the decision of the Cabinet on December 18, 1991, which had agreed to create 1,131 preschool classes. Meanwhile, the Council of Ministers on June 6, 2001 agreed that the MOE would continue the preschool expansion program from 2002. Since then, the expansion of the preschool has been conducted from time to time in accordance with existing policies, the National Key Result Areas (NKRA) and also the expansion plans in the 10th Malaysia Plan (10MP). To meet this need, management needs to ensure appropriate and quality physical facilities and equipment for the program. However, most school do not have special buildings to accommodate students in this category between 4 and 6 years old instead they used existing buildings or making major renovation onto the structure of the building. Renovations are made to the roof, wall and even the floor space irrespective of the additional load dependence. As a result, especially reinforced concrete structures will suffer damage that can lead to failure or collapse. Accordingly, the responsible party should take appropriate action in determining the condition of the building structure whether it is safe to use, repair or demolish so that no unforeseen events occur during the school session.

According to Azaman (2012), defects and damage to reinforced concrete Structural concrete structures require minimum maintenance although their strength is higher than that of other construction materials. This is because the concrete will suffer from defects such as cracks or damage due to excessive loads or environmental conditions. Each building material, component and appliance has different levels and

rates of damage that are affected by the quality, environment and frequency of use. Therefore, renovation techniques are used to ensure that every critical item is replaced when repairs cannot be made. Scheduled inspections should be performed on each recorded item to identify failure and damage. The renovation can avoid adverse effects on building performance and function. Among the things that should be noted are the building's environmental conditions, land conditions, and existing drainage.

The main problem with these buildings is that of concrete beams, columns and curves are corrosion, spalling and corroded reinforcing bars. According to Nurul and Azree (2014) in his writing, damage and defects can occur on all types of new or old buildings. Defect within new buildings is maybe of non-compliance with Building Code and published acceptable tolerances and standards. Meanwhile older buildings, or building out of warranty period, may not comply with these standards but must be judged against the standard at the time of construction or refurbishment.

1.2 Objectives

The aim of this study is to evaluate and identify the building defects on the selected case study building especially preschool buildings around Pasir Mas, Kelantan. While, the main objective of this study is to find the best solution for setting strategies in the maintenance of all government buildings such as school buildings especially preschool buildings in Kelantan which involve renovated buildings. The main focus is involving the most critical building in an effort to extend the life of the building with a minimal cost of repair. If the deteriorating building is left untreated, the damage levels can worsen and repair costs may increase.

The specific objectives of the study are:

- (a) Identify and analyze the types of building defects through visual inspection
- (b) To perform Building Condition Assessment (BCA) using standard BCA JKR 21602-0004-13 by the Public Works Department of Malaysia

(c) To perform Rebound Hammer test on reinforced concrete elements to determine the concrete strength

(d) To check the design of the element using Esteem (Version 9.2) software

1.3 Scope of Study

The study is focused on pre-school buildings around the state of Kelantan, which mostly use existing buildings that have been renovated as classrooms to meet the needs of pre-school education as required by the Ministry of Education Malaysia. Most of the buildings used are old buildings that have suffered damage and defects in major structures such as columns, beams, floors and other structures. This pre-school building is a pre-historic building constructed in the 1930s based on the interview with the management involved. Pasir Mas pre-school building was picked for investigation because it suffered a higher decline than the others. It needs to be repaired and renewed.

The assessment of the condition of this building will be based on the JKR 216602-004-13 Building Condition Assessment (BCA) standard and its modifications. It will only focus on the structure and architectural elements of the building. A visual inspection will also be conducted to the building as a preliminary examination of the condition of the building. Through the assessment made using BCA, the degree of deterioration and damage can be identified. If the structure of the building has deteriorated considerably, then it is imperative to test for reinforced concrete elements to determine the extent of the concrete deterioration. Although there are several methods that can be used to determine the extent to which concrete degradation in concrete reinforced concrete, this study will only focus on non-destructive tests such as evaluation methods to determine the deterioration rate of concrete samples and corrosion will be taken to conduct the compression strength test on concrete. Only school buildings located in Pasir Mas Kelantan will be examined for the purpose of this study.

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