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Investigation on Earthquake Resistance System Design Based on EC8 for Low Rise Building in Malaysia

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ABSTRACT

The purpose of this research is to investigate or study the behavior of the earthquake resistance system design based on Euro Code specifically for base isolator and used on low rise building in Malaysia. Recently, the amounts of public infrastructure are continuously be damaged from earthquake problems and by doing this research it may help in engineering field to reduce the damage happened. Base isolator is installing between column and foundation which act as isolator for the earthquake force. The base isolator in this research is going to be tested with compression and shear test to analyze the behavior of the bearing that applied by a certain load. However, a comparison between theoretical and experimental data needs to be done to get a percentage different and compare both compression and shear stiffness behavior of the material. Another comparison of the deflection that need to be done are between finite element analysis using COMSOL Multiphysics 3.5 with lab result. Lastly, using the Euro code 8 to categories the base isolator which is fulfills the criteria that require.

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CHAPTER 1

INTRODUCTION

1.1 General Introduction

An earthquake is created a vibration or seismic waves which result of sudden energy release in the earth crust. Earthquake can be caused by natural fracture of geological fault and other human activity such as mine blasts or nuclear test. It is happened that earthquake can trigger several of natural disasters for example tsunami, landslides, and volcanic activity.

The earthquakes have been studied by many centuries. Today, hundreds of millions people around the world live with serious risk to their property and lives from earthquakes. The amounts of public infrastructure are continuously be damaged from earthquake problems. These problems are not infrequently happened in some countries such as United States, Japan, Indonesia , Taiwan , Hong Kong or any other country. In 2004 an earthquake was occur in Penang island, Malaysia. The tsunami that happened in Aceh, Indonesia generating by the earthquake with the magnitude of 9.0 spread to surrounding area including Penang island with approximately 572.67 km from Banda Aceh. It is reported that 52 persons were death and houses in fishing villages along coastal areas were damaged in the incident.

Earthquake has happened for million years ago and will continually occur throughout the entire world. It is no way to prevent earthquakes from occur, but it is possible to reduce the effect of the seismic to avoid death , injuries and damaged that might be occur.

1.2 Problem Statement

This study purpose meant for investigating on earthquake resistance system that design based on EC8 for low rise building in Malaysia. Earthquake rarely happens in Malaysia but when the earthquake occur, low rise buildings might collapse or badly damage and if it happens in residential area people might be killed and injured with the collapsed building, most the times building fails because the foundation faults cause column to lose their stability to support the load acting on it , causing the whole structure collapse. So, by doing this study about the resistance system design through EC8 it overcomes the collapse or minimize the damage of the low rise building if it struck by an earthquake.

1.3 Objective

-Investigate the behavior of the base isolator due to lateral earthquake forces for low rise building in Malaysia.

-Study the design of the base isolator for taking the vertical earthquake forces that transfer from low rise building in Malaysia.

1.4 Thesis Organization

Chapter 1 is an introduction of the studies which basically is conducting the research, the background of this topic and the objectives is the main outcome for the studies.

Chapter 2 is show the literature review which is scholarly text paper that includes the recent knowledge for both theoretical and methodological contributions to a particular topic and need to be combining together to support the research of the topic.

Chapter 3, methodology is the analysis of the theoretical method in a field of study and the purpose of the research in more detail and structured.

Chapter 4 is the result and analysis of the studies which take a several time for doing the research of the required material such as lab experiment , design , workshop result which are all compile in this chapter.

Chapter 5 the conclusion and recommendation of all the summary of the research that also included references and appendix.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Earthquake is a sudden shaking or essentially vibration of the soil or earth surface move in all directions. The most destruction effects for the building structures especially high rise building that required a good foundation to carry the structure load. In fact that normal building structures are designed for vertical gravity loads where there are no resistant for structures to take the horizontal forces that occur in the earth surface, this will caused structural hazards when the earthquake happen. In 12 May 2008, an earthquake struck China's south-western region with a magnitude of 8.0. It was the strongest earthquake that happen in China since the founding of the People's Republic, not only property loss and causing heavy human casualties but also makes a serious damage to the ecological environment which led to the loss of ecosystem services, ecological safety is threatened and evaluation of the loss of the ecosystem services was vital for post-disaster reconstruction. (Y.KWang. et al. 2012). Earthquake is caused by sudden release of stress in the earth crusts that build a point of weakness and led to large sections of the movement. Earthquake is not happened in every area of the earth surface, perhaps there are certain area that earthquake are frequently occur where it called zone of high probability.

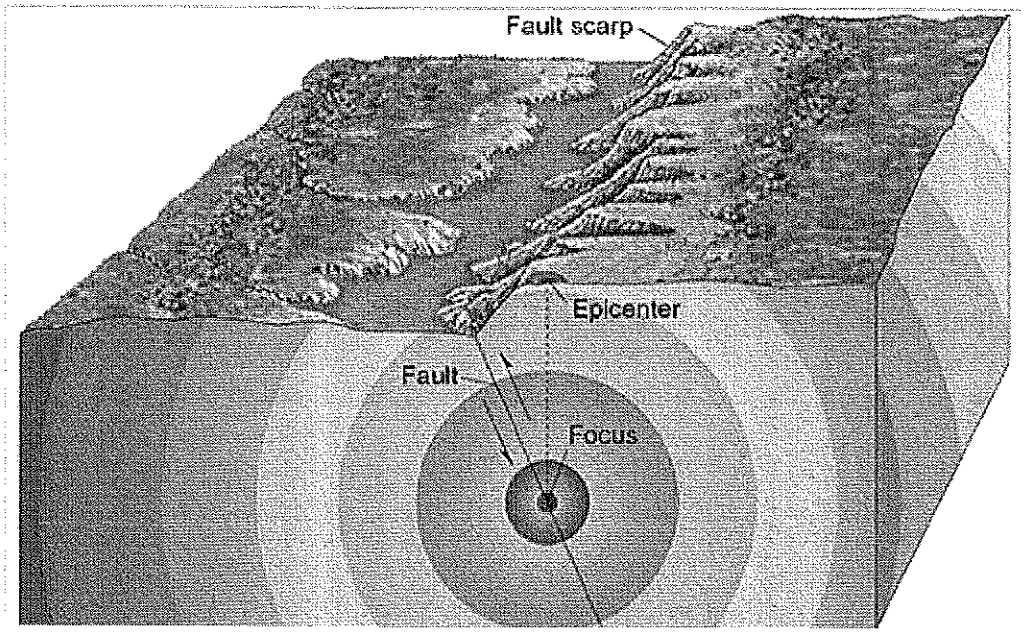

Figure 2.1.1 Earthquake waves spread out

In the figure 2.1.1 shows the Earthquake waves spread out from the inner surface of the earth to the outer surface which can classified into few points:

- **Focus**- The location where the earthquake begins. The seismic waves spread outward in all directions.
- **Fault**- the surface where when two blocks of the earth suddenly slip past one another.
- **Epicenter**- the location on the surface of the earth directly or perpendicularly above the focus of a earthquakes.

2.2 Characteristic of Earthquake

2.2.1 Earthquake Magnitude

2.2.1.1 Richter scale

In 1935, The Richter Scale was developed by Charles Richter of the California Institute of Technology in Pasadena. He used a Wood-Anderson seismometer to define a magnitude scale of shallow, local earthquakes in southern California. (Richter 1935). Richter constructed a similar diagram as a Japanese seismologist named Kiyoo Wadati in 1931. The diagram shows the peak amplitude versus distance which he used it to create the first earthquake magnitude scale. He based his scale similar for both the stellar brightness scale commonly used in astronomy and also the pH scale that used to measure acidity.

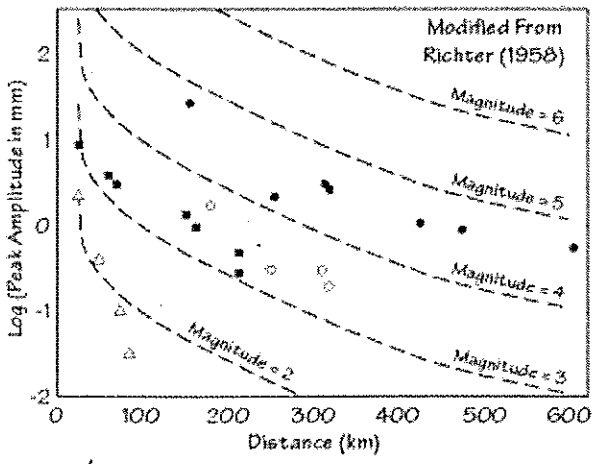

Figure 2.1 Graph of Peak Amplitude versus Distance (Richter 1958)

In a process to complete the construction of the magnitude scale, he identified the rate at which the peak amplitudes will be decrease with distance from an earthquake. Richter was pragmatic in his definition, and chose a value for a magnitude zero that insured that most of the earthquakes