THE EARTHQUAKE EFFECT OF MULTI-STOREY BUILDING DUE TO SURROUNDING EARTHQUAKE IN MALAYSIA

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JUNE 2016

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LIST OF ABBREVIATIONS

MMD	Malaysian Meteorology Department

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ABSTRACT

Most structures in Malaysia were designed without considering for seismic factor during its service lifetime. However, in recent years Malaysia has experienced the effects of earthquake such as at Ranau, Sabah and was impacted from Tsunami on 2004. Besides that, earthquake originated mainly from epicenters in the western zones arising from the Sumatra and Philippines. The aim of this study is to study the behaviour reinforced concrete of Multi-storey building that subjected to earthquake excitation. Thus, this research present comparative analysis using SAP2000 and Esteem 8 software (shear forces and moment resistances). During this phase, all the information, data, studies and facts that are related to study, should be known. The information to be collected is useful for model and analyze our structure. The information and data that required are architectural drawing of the building and the earthquake data. Raw data of earthquake originated from Tsunami in Aceh which recorded in Malaysia seismic stations will be collected from Malaysian Meteorological Department (MMD). Based on architecture drawing of multi-storey building, the structural drawing should be design using Esteem 8 and SAP2000 software as a planned. There the multi-storey reinforced concrete building which were design 5th floor level of building. The designed for both software were considering earthquake factor and data. The best result will be compare to select the best software for considering earthquake design for multi-storey building. Other than that, this study are to determine the best mode shape of free vibration analysis. There have 12 mode shape with different natural period and frequencies. Results such as the natural frequencies, vibration modes of the structure, bending moment and shear force etc. are collected and analyzed. Generally, the multi-storey structure with consideration of seismic ground motion is still within members capacity desirable range.

ABSTRAK

Kebanyakan struktur di Malaysia telah direka tanpa mengambil kira faktor seismik semasa hayat perkhidmatan. Walau bagaimanapun, pada tahun-tahun kebelakangan ini Malaysia telah mengalami kesan gempa bumi seperti di Ranau, Sabah dan menerima kesan dari Tsunami pada tahun 2004. Selain itu, gempa bumi berasal daripada pusat gempa di zon barat yang timbul daripada Sumatera dan Filipina yang merupakan negara di sekeliling Malaysia. Tujuan kajian ini adalah untuk mengkaji tindak balas bangunan tinggi konkrit bertetulang yang dikenakan pengujaan gempa bumi. Oleh itu, penyelidikan ini adalah untuk menganalisis perbandingan menggunakan SAP2000 dan Esteem 8 (daya ricih dan rintangan masa). Semasa fasa ini, semua maklumat, data, kajian dan data-data berkaitan untuk kajian, perlu diketahui. Maklumat yang akan dikumpul berguna untuk model dan menganalisis struktur kami. Maklumat dan data yang diperlukan adalah lukisan seni bina bangunan dan data gempa bumi. Data gempa bumi daripada Tsunami di Aceh yang direkodkan di Malaysia stesen seismik telah diambil dari Jabatan Meteorologi Malaysia (JMM). Berdasarkan lukisan seni bina bangunan bertingkat tinggi, lukisan struktur harus direkabentuk menggunakan Esteem 8 dan perisian SAP2000 seperti mengikut perancangan asal. Bangunan tersebut merupakan bangunan 8 tingkat namun diubahsuai menjadi 5 tingkat Keputusan terbaik dari kedua-dua perbandingan perisisan akan dibandingkan untuk memilih perisian yang terbaik untuk mempertimbangkan reka bentuk gempa bumi bangunan bertingkat. Selain daripada itu, kajian ini adalah untuk menentukan mod bentuk yang terbaik dalam analisis getaran bebas. Terdapat 12 bentuk mod dengan tempoh semula jadi dan frekuensi yang berbeza. Keputusan seperti frekuensi semula jadi, mod getaran struktur, momen lentur dan daya ricih dan lain-lain yang dikumpul dan dianalisis. Secara umumnya, struktur berbilang tingkat dengan pertimbangan pergerakan tanah seismik masih dalam kapasiti ahli pelbagai wajar.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Earthquakes are vibrations that occur in the Earth's surface caused by the release of energy from a sudden that makes seismic waves. It often affected by movement of the Earth's layer. Geologists have found that Malaysia is outside the Pacific Ring of Fire. Therefore, Malaysia is also prone to earthquakes due to friction between the two blocks of the crust in fault zones are caused by stresses. However, this statement only can be used five to ten years ago and now in 2015 Malaysia was among the countries at risk in the earthquakes.

There some countries have experienced a severe earthquake that occurred severe damage and cost many lives. Among countries that have experienced a severe earthquake were India, Indonesia, Japan and more. Malaysia is only 350 km away from the closet active fault line in Sumatera, Indonesia. On December 26, 2004 our country was hammered by shaking with natural disasters such as the tsunami that occurred due to the earthquake that occurred in the Indian Ocean off the west coast of Aceh, causing tsunami. Kedah and Penang states, which also had a concussion and tsunami. That area was the worst affected areas in Malaysia where 68 individuals had been death and more than 100 people were injured.

Other than that, the 6.0-magnitude earthquake Sabah around Ranau roughly at 7.15 am on Friday, June 5, 2015 and it has been referred to by Bernama as the most grounded to hit the state subsequent to 1991. The US Geological Survey said the earthquake hit at a profundity of 10 kilometers, with its epicenter found 19 kilometers (12

miles) from the town of Ranau. Furthermore, 54 kilometers from Kota Kinabalu. Malaysia experiences earthquakes, however is outside the Ring of Fire, a touch of seismic action circling the basin of the Pacific Ocean that incorporates neighbors Indonesia and the Philippines.

Therefore, the study is covering the earthquake design on building in Malaysia since Malaysia has also got the impact of the tsunami in Aceh and the earthquake that occurred in Sabah in June this year.

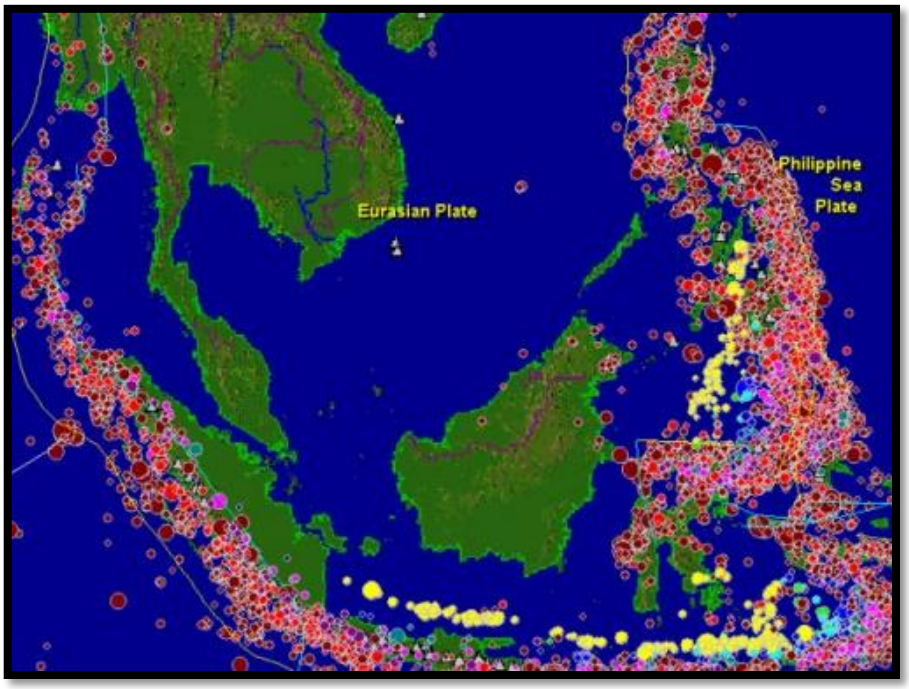

Figure 1.1: Map of seismic surrounding Malaysia

Source: (Seismic Analysis And Design Of Residential Building Based On Indonesian Code Samsul Bin Syahrum, 2007)

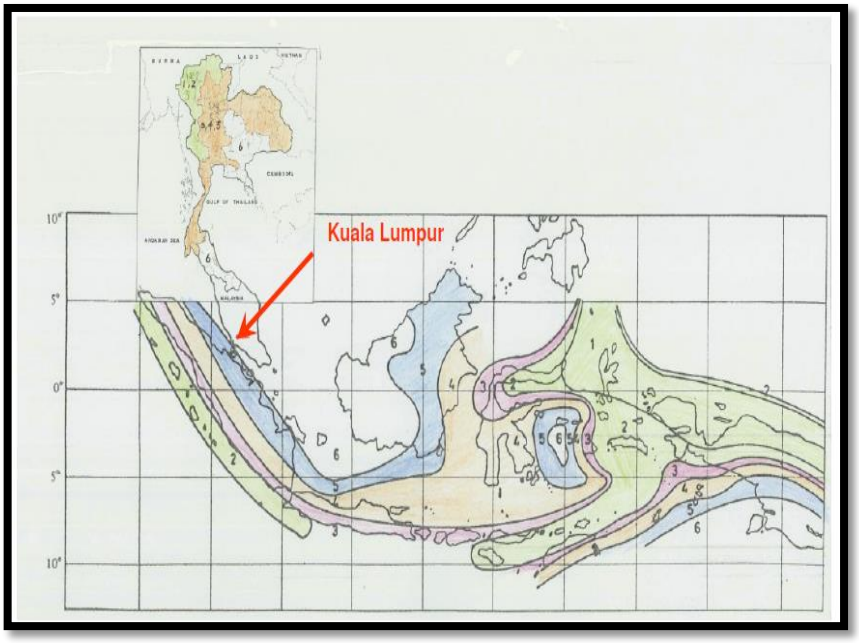

Figure 1.2: Earthquake Risk Map of Indonesia & Thailand

Source: *(Date : May 2005 Ref : WEB/INFORMATIONDOC.04, n.d.)*

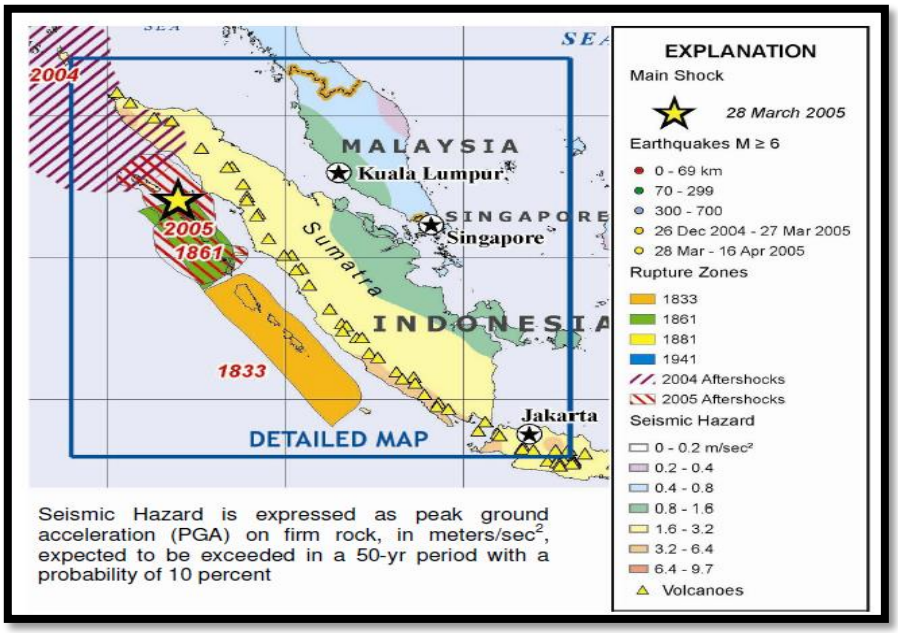

Figure 1.3: Seismic hazard map of 28March northern Sumatra earthquake by USGS

Source: (Date : May 2005 Ref : WEB/INFORMATIONDOC.04, n.d.)

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