THE EARTHQUAKE EFFECT OF SINGLE STOREY RC BUILDING STRUCTURE DUE TO SURROUNDING EARTHQUAKE IN MALAYSIA

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Thesis submitted in fulfillment of the requirements for the award of the degree of Bachelor (Hons.) of Civil Engineering

Faculty of Civil Engineering and Earth Resource
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%	Percentage
km/sec	Kilometer per second
MPA	Mega Pascal
/sec	Per second
sec	Second
kN	Kilo Newton
kNm	Kilo Newton meter
mm	Millimeter
mm^2	Millimeter square
T	Torsion
V	Shear
b	Section Width
d	Effective depth
A	Area
u	Beam perimeter

t	Thickness of box section
Ak	Area within centerline
uk	Perimeter of centerline
z	Inner Lever Arm
vss	Shear Stress due to Loading,
N/mm²	Newton per millimeter square
v	Strength Reduction Factor for Torsion and Shear
Fck	Strength classes of concrete
fcd	Concrete stress-strain
θ	Angle
TRd,max	Maximum Torsion Moment Resistance
kNm/m	Kilo Newton meter per meter
VRd,max	Maximum Shear Resistance
TEd	Torsion force
VEd	Shear force
vRd,max	Maximum Shear Stress Allowed

LIST OF ABBREVIATIONS

RC	Reinforced Concrete
EC2	EuroCode 2
3D	Three Dimension
2D	Two Dimension
R	Rebar
C	Concrete

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ABSTRACT

Nowadays, earthquake had happened in Malaysia. So, a study of earthquake was carrying out for Malaysia which is for single storey concrete building. For this study, there are two software being used to get data of effect of single storey building due to surrounding earthquake and not surrounding earthquake which are ESTEEM software and SAP 2000 software. ESTEEM software and SAP 2000 software have differences step to use it and advantage of using the software to the engineer or users. ESTEEM software and SAP 2000 software produce differences of result and this research is carry out to know why there are difference between this two software. This is to determine comparative analysis using ESTEEM software and SAP 2000 software. By using SAP 2000, the best mode shape of three vibration analysis can be determined. ESTEEM software and SAP 2000 software can insert of earthquake data but there are still differences of this each software. SAP 2000 using Acheh's data of earthquake but for ESTEEM software insert for angle of earthquake or waves which will come to the building.

ABSTRAK

Pada masa kini, gempa bumi yang berlaku di Malaysia. Jadi, satu kajian gempa bumi dijalankan untuk Malaysia iaitu bangunan konkrit satu tingkat telah dipilih. Untuk kajian ini, terdapat dua perisian yang digunakan untuk mendapatkan data kesan kepada bangunan satu tingkat yang berada di sekitar gempa bumi dan tidak berada di sekitar gempa bumi iaitu perisian ESTEEM dan perisian SAP 2000. Perisian ESTEEM dan perisian SAP 2000 mempunyai perbezaan cara-cara untuk menggunakannya dan kelebihan menggunakan perisian tersebut kepada jurutera atau pengguna. Perisian ESTEEM dan SAP 2000 mempunyai perbezaan hasil keputusan dan kajian ini dijalankan untuk tahu mengapa terdapat perbezaan di antara perisian ini dua. Ini adalah untuk menentukan analisis perbandingan menggunakan perisian ESTEEM dan perisian SAP 2000. Dengan menggunakan SAP 2000, bentuk mod terbaik daripada tiga analisis getaran boleh ditentukan. perisian ESTEEM dan perisian SAP 2000 boleh memasukkan data gempa bumi tetapi masih terdapat perbezaan pada setiap perisian. SAP 2000 menggunakan data Acheh gempa bumi tetapi untuk memasukkan perisian ESTEEM untuk sudut gempa bumi atau gelombang yang akan datang kepada bangunan.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

In Malaysia, mostly 90% of the building that made up is designed without considering of the earthquake effects. Earthquake can occurs everywhere throughout the world at any time. Nowadays, earthquake happened in Malaysia, for example of earthquake in Malaysia at Tasik Kenyir,Terengganu (2010), Bukit Tinggi,Pahang (2007), Lahad Datu,Sabah (2012) and Ranau,Sabah (2015). Earthquakes can cause devastating effects in terms of loss of life and livelihood (Amr S. Elnashai, Luigi Di Sarno, 2008). Just only a few minutes, homes, goods and relatives can be lost. Extensive structural damage is suffered by buildings, bridges, highways and other lifelines during earthquakes. So that building must be design with considering of the earthquake effects.

For the last 39 years ago, Malaysia having earthquake reported at Lahad Datu which is in 1976 and the earthquake measuring is 5.8 on Richter scale which is the strongest earthquake record. This is causing heavy damage to the property and crack to the building. Supposed to the engineer should have acted earlier which is designed the building with considering the earthquake effects. But engineer still design the building without considering the earthquake effects. The latest one at Ranau,Sabah, has earthquake measuring at 5.9 magnitude which is the strongest earthquake hit Malaysia. The effect of this earthquake are damaged of road and building which are a hospital and schools on Sabah's west coast. Moreover, the twin rock formation on the mountain known as the "Donkey's Ears" are broke (Eileen Ng Associated Press,2015). Now engineer need to learn on with design the building with considering earthquake effects.

The possibility Malaysia of being hit by a strong earthquake remains slim. As Dr Mohd Rosaidi Che Abas,54, a seismology expert who has a Doctorate in earthquake studies at Universiti Teknologi Malaysia and a Master degree in seismology from Jaoan's International of Seismology and Earthquake Engineering, who has been with the meteorological department for the last 30 years, said that the threat of an earthquake in Malaysia cannot be ignored. Malaysia very close area which have experienced with the strong earthquakes along with Sumatra and the Andaman Sea, meanwhile Sarawak and Sabah are placed close to the earthquake zone of South Philippines and North Sulawesi. Thus, the chance of an earthquake remarkable cannot be taboo. (said Dr Mohd Rosaidi Che Abas to Bernama at the Meteorological Department's headquarters).

Inside of the Earth is where the seismic movements are developed. The movements are developed by the convection currents produced in the viscous mantle hence to the prevailing high pressure and high temperature gradient between the core and the crust. This convection currents result in an Earth circulation masses, the hot molten lava come out and the cold rock mass goes down into the Earth.

Figure 1.1: Convection current into the Earth (Source: USGS,nd)

Short-term and long-term effects should be known in quantify social and economic consequences. The built environment will be damage because of the earthquake effect and additionally to straightforward shaking effects, earthquakes may direct to various forms of ground failure which produce damage to the built environment.

1.2 PROBLEM STATEMENT/MOTIVATON

Earthquakes are commonly caused when rock underground unexpectedly breaks along with defect. This unexpectedly liberate of energy generates the seismic waves that make the ground shake. Ground shaking is by far the most important hazard resulting from earthquakes, with some exceptions. The Asian tsunami of 26 December 2004 with about 280,000 people killed (Amr S. Elnashai, Luigi Di Sarno, 2008). On 5 June 2015 a moderate 5.9 magnitude shake hit Ranau and killing 18 people.

Earthquakes are the effect of more than 1.5 million deaths worldwide during the 20th Century. Earthquakes do not kill people but the building collapse because of earthquake effect can kill people. It is unbelievable situation which is, after a century of research works, each earthquake brings new surprises and creates the situation that new lessons have to be learned (Luis Esteva, 2005).

From the Earthquake Track, northernmost tip of Sabah have mostly 13 earthquakes which between 4.0 until 6.0 magnitude. So structural building must be design with considering earthquake effect so at least the building will be not damaged due to the earthquake.

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