SUPERVISOR DECLARATION

"I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Structure and Materials)"

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DECLARATION

"I declared that this project report entitled "Investigation on Vertical Excitation of the Structural Integrity in High-Rise Building" is the result of my own result except as cited in the references."

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INVESTIGATION ON VERTICAL EXCITATION OF THE STRUCTURAL INTEGRITY IN HIGH-RISE BUILDING

MUHAMAD ROSLAN BIN DARUL AMAN

This Report Is Submitted In Partial Fulfillment of Requirements For the Bachelor of Mechanical Engineering (Structure & Materials) with Honor

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DEDICATION

For my beloved father and mother,
Dearest family members,
Lecturers and friends

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Assalammualaikum and Salam Satu Malaysia,

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ABSTRACT

In describing the damage of buildings and structures from earthquakes, the term that we use is the types of building and structures, the degree of damage of buildings and the number of building damage during earthquake. The division of the buildings according to the types was made in consideration of the different stability of the buildings against seismic actions. The description of the effects of the earthquake is in three directions which is the perceptibility by human beings and surroundings; buildings of any type and also the effects in the underground and alterations of the groundwater and super terrestrial water systems. The separated description makes it possible to watch the increase of the effect, on the basis of one single sign, with the increase of the intensity of earthquake which is allows a better evaluation of an effect observed. The buildings are not homogeneous concerning their structural peculiarities, building material and in the state condition, which is the percentiles part of the damaged building can characterize the intensity of the earthquake.

ABSTRAK

Dalam menggambarkan kerosakan bangunan dan struktur dari gempa bumi, istilah yang kita gunakan adalah jenis bangunan dan struktur, tahap kerosakan bangunan dan jumlah kerosakan bangunan ketika gempa bumi. Pembahagian bangunan adalah berdasarkan kepada jenis yang dibuat dengan pertimbangan kestabilan yang berbeza dari bangunan terhadap tindakan seismik. Uraian tentang kesan gempa bumi dikategorikan dalam tiga bahagian iaitu anggapan oleh manusia dan sekitarnya, bangunan dari jenis apa pun dan juga kesan di bawah tanah dan juga perubahan dari tanah dan super sistem air terestrial. Penerangan yang telah dibahagikan membolehkan melihat peningkatan kesan, berdasarkan satu tanda tunggal, dengan peningkatan kekuatan gempa bumi yang membolehkan penilaian yang lebih baik terhadap sebuah kesan yang dinilai. Bangunan adalah tidak sama bergantung kepada keanehan struktur bangunan itu, bahan binaan bangunan dan dalam keadaan yang ditetapkan, yang mana ia merupakan sebahagian daripada peratus daripada kerosakan yang boleh mencirikan kekuatan gempa bumi tersebut.

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LIST OF SYMBOLS

SYMBOL	DESCRIPTION
α	Acceleration
F	Force
f	Frequency
k	Spring constant
m	Mass
w_n	Natural frequency
x	Displacement
C	Centroid
V	Velocity
ε	Strain
σ	Stress
T	Period
F	Frequency
W	Weight
M	External moments

LIST OF ABBREVIATION

ABBREVIATION	DESCRIPTION
HMD	Hybrid mass dampers
LRB	Lead rubber bearing
FVD	Fluid viscous dampers
MYD	Metallic yielding dampers
VED	Viscoelastic dampers
FD	Friction dampers
SDOF	Single Degree of Freedom
Al	Aluminium
CRES	Corrosion-resistant Steel
CAE	Computer-Aided Engineering
CFD	Computational Fluid Dynamics
B.C	Before Century
FEM	Finite Element Method
TMD	Tuned mass dampers
AMDA	Active mass dampers

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The experiences from the past strong earthquakes prove that the initial conceptual design of a building is extremely important for the behavior of the building during an earthquake. It was shown repeatedly that no static analysis can assure a good dissipation of energy and favorable distribution of damage in irregular buildings such as, for example, structures with large asymmetry or distinctively soft storey. Structural analysis and design is a very old art and is known to human beings since early civilizations. The Pyramids constructed by Egyptians around 2000 B.C. stands today as the testimony to the skills of master builders of that civilization. Many early civilizations produced great builders, skilled craftsmen who constructed magnificent buildings such as the Parthenon at Athens (2500 years old), the great Stupa at Sanchi (2000 years old), Taj Mahal (350 years old), and Eiffel Tower (120 years old) and many more buildings around the world. These monuments tell us about the great feats accomplished by these craftsmen in analysis, design and construction of large structures. Today we see around us countless houses, bridges, fly-over, high-rise buildings and spacious shopping malls. Planning, analysis and construction of these buildings is a science by itself.

The main purpose of any structure is to support the loads coming on it by properly transferring them to the foundation. Even animals and trees could be treated as structures. Indeed biomechanics is a branch of mechanics, which concerns with the working of skeleton and muscular structures.

In the early periods houses were constructed along the riverbanks using the locally available material. They were designed to withstand rain and moderate wind. Today structures are designed to withstand earthquakes, tsunamis, cyclones and blast loadings. Aircraft structures are designed for more complex aerodynamic loadings. These have been made possible with the advances in structural engineering and a revolution in electronic computation in the past 50 years. The construction material industry has also undergone a revolution in the last four decades resulting in new materials having more strength and stiffness than the traditional construction material.

Earthquakes have many other effects besides vibrating the structures in response to ground shaking at its foundation. These other effects may even exceed that due to vibration. Unfortunately, the procedure of their estimation and the required steps for the design are considered outside the scope of structural engineering. Different seismic resistant design codes have provisions to take into account the vibration of structures. But, these codes do not have any provision to take care of other effects. However, structural engineers should be aware of the intensity of the hazards with a view to taking precautionary measures either in the design of structures, advising clients in selecting proper sites in such zones or making them aware of the importance of proper maintenance of the structures and other considerations the clients should follow up while using the designed structures.

1.2 PROBLEM STATEMENTS

Nowadays, Earthquakes, Tsunamis, Landslides, Floods and Fires are natural calamity causing severe damage and sufferings to persons by collapsing the structures, cutting off transport systems, killing or trapping persons, animals etc. The natural disasters are challenges to the progress of development. Extensive damage and even structural failure are therefore common under seismic load. During the 1995 Hyogoken Nambu earthquake in Kobe, Japan, for instance, over 200,000 buildings were damaged or destroyed and 310,000 people had to be evacuated to temporary shelters. It is estimated that this 6.9 magnitude earthquake caused the loss of more than 5,500 human lives and damages of approximately US$110 billion.

Another example is the December 26, 2003 earthquake that occurred in Bam, Iran. It had a 6.6 magnitude on the Richter's scale, killed 31,000 people, injured 30,000 and left 75,600 homeless. This earthquake was responsible for the damage or destruction of 85% of the buildings, with damages being estimated at US$32.7 million (USGS 2004). In order to dissipate energy from earthquakes and reduce vibrations in structures, thereby reducing human and material losses, control devices have been developed and implemented in civil structures. They can be divided according to their energy consumption as passive, active and semi-active.

Passive control devices protect structures by reflecting or absorbing part of the input energy. They do not require power to function band are therefore very reliable systems. Examples include base isolation and tuned mass dampers. More effective than passive devices, active ones are able to adapt to different loading conditions since they use sensed structural responses to determine the control force exerted on the structure. Different vibration modes can therefore be controlled. Examples are active mass damper and active tendons. There are several criteria that must be review in this project which is:

1) Design a structural high-rise building to overcome earthquake.
2) Develop low-effect noise and vibration on high-rise building during earthquake.
3) Reduce earthquake effect on high-rise building.
4) Review all the earthquake effect on high-rise building.

1.3 OBJECTIVES

Objective is a mission, purpose, or standard that can be reasonably achieved within the expected time frame and with the available resources. In general, an objective is broader in scope than a goal, and may comprise of several different goals. The main objective for the study of this project is stated as follows:

1) To design the suitable high-rise building using numerical approach.
2) To develop an experimental rig on high-rise building.

1.4 SCOPES

The scopes of this study are to analyze all the effect of earthquake on high-rise building which can carry out low noise and vibration on the high-rise building during earthquake. Besides, the analytical study is necessary. Analytical study means that the study of the analysis which is the comparison between theoretical and experimental data. This is because some data are not in accurate value. In addition, the development of high-rise building is based on scale on actual building where the design must fit the actual building scale.

1.5 RESEARCH CONTRIBUTION

This research is being made in order to know the noise and vibration effect on high-rise building during earthquake. It is about the damping of the building to the ground motion which is shaking horizontally or vertically. The criteria that have been investigated in this research is to design a structural high-rise building to overcome earthquake, to develop low-effect noise and vibration on high-rise building during earthquake, to reduce earthquake effect on high-rise building and also review all the earthquake effect on high-rise building.