

CHAPTER I

INTRODUCTION

A. Background

Earthquake is one of natural phenomenon which can be devastating and overpowered the man-made infrastructure. Geographical location of Indonesia which located along the ring of fire contributed a lot to the frequent occurrence of earthquake. The geotechnical location also make Indonesia has a great risk of earthquake because located along the meeting point of three tectonics plate, Indo-Australia, Eurasia, and Pacific plate.

Tectonic plate is a hard part of the earth crust which floating above a hot liquid asthenosphere, so it is free to move and interact with each other. The plate movement often disturbed and locked with each other, resulting in a collection of energy until the tectonic plate could not resist its movement then a sudden release of energy occur which is called earthquake. (Irsyam, 2009)

Engineering solution has been developed for centuries to overcome the effect of earthquake. A numerous study has been conducted to obtain the suitable and most reliable method in designing an earthquake resistant structure. Force Based Design is one of the methods that has been used a lot in designing earthquake resistant structure. Although Force Based Design method has been widely used, it seems that several flaws make it not the best solution to numerous cases. Like it can produce an overly stiff structure in a certain scenario, especially in a poor soil performance.

Unlike Force Based Design, Direct Displacement Based Design focused on the displacement limit condition. Direct Displacement Based Design utilizing displacement as a preliminary input in structural designing (Priestley, 2007). Therefore, the structure is expected to be safe and efficient. (Priestley, et al., 2007)

In this modern and technological era, Universitas Muhammadiyah Surakarta as one of the leading universities in Central Java is pushing all its resources to conduct all kind of research. The rapidly growing scientific research activities comes with a growing need of a central research center building. So, this final project is to design the structure of UMS Research Center and comparing two design method, force-based design, and direct displacement-based design.

B. Problem Formulation

Based on the background, problem formulation that can be taken is comparison between force-based design and direct displacement-based design on UMS Research Center building design.

C. Objectives and Benefits

1. Objectives

- a) Design an earthquake resistant structure for UMS Research Center building using Force Based Design method
- b) Design an earthquake resistant structure for UMS Research Center building using Direct Displacement Based Design method
- c) Evaluate structure performance using non-linear Static Pushover Analysis
- d) Comparing the overall result of Direct Displacement Based Design and Force Based Design.

2. Benefits

- a) Obtain the effective structural design method for UMS Research Center.
- b) Increase Overall knowledge on Performance Based Design.
- c) Expected to be used as reference on earthquake resistant building design in Indonesia especially for academic purposes.

D. Problem Scope

In the preparation of this final project, A problem limitation is set to prevent a wider discussion. The limitations are listed as follow:

- 1) Building is in the form of multi storey open frame reinforced concrete structure.
- 2) Design load refers to SNI 1727:2013 and ASCE 7-10
- 3) Seismic design refers to SNI 1726:2019.
- 4) Design only covers the main structure.
- 5) Structural element detailing designed according to SNI 2847:2019.
- 6) Performance Evaluation conducted using non-linear Static Pushover Analysis and refers to FEMA 440, ASCE 41-13 and ATC-40.
- 7) Building performance will be compared in terms of structure drift.