

## CHAPTER I

### INTRODUCTION

#### 1.1 Background

The last few years have seen many earthquake natural disasters in Indonesia. One of the effects of an earthquake is causing excessive vibrations in the structure of the building. The adverse effects that can be seen in the 2018 earthquake that occurred in Southeast Sulawesi (Palu). The 2018 earthquake caused many multi-story buildings to be damaged and destroyed.

The collapse of a building can be caused by a low structural resistance to dynamic loads. To prevent it, a solution is needed that can increase the resistance of the structure to dynamic loads. One way that can be used to increase the resistance of structures to dynamic loads is to add damping to the structure. Damping is one of the most important parameters that limits the response of a structure during that dynamic event. With the attenuation of the building structure's resistance to dynamic loads, it can increase and minimize the collapse of building structures due to dynamic loads.

Tuned Liquid Damper is a rigid liquid filled tank and is positioned on one of the fl floors of a building with the aim of reducing the dynamic response of the structure to external excitation. The basic idea behind the use of tuned liquid dampers is that the natural frequency of spilled liquid is tuned to the fundamental natural frequency of the building so that the dynamic response decreases.

Since the 1950s liquid dampers have been used to stabilize ships or control the movement of satellite motion. In the late 1970s tuned liquid dampers began to be used in civil engineering to reduce structural motion; Vandiver and Mitome (1979) used a tuned liquid damper to reduce wind vibrations from a platform. Also, May (1978) and Yamamoto et al. (1982) investigated the interaction of structural waves using numerical methods. In the early 1980s important parameters such as fluid height, mass, frequency, and attenuation for tuned liquid dampers attached to offshore platforms. Lee and Reddy (1982). Bauer (1984) introduced a full two-liquid rectangular tank that could not mix into a structural building. Kareem and Sun (1987), Sato (1987), Toshiyuki and Tanaka, and Modi and Welt (1987) were among the first researchers to suggest using tuned liquid dampers in Civil structures.

Tuned liquid dampers (TLDs) can be implemented as active or passive devices and are divided into two main categories: tuned sloshing dampers (TSD) and tuned liquid column holders (TLCD).

### **1.1.1. Formulation of Problem**

From the background that has been described, the problem in this thesis can be formulated:

1. Does Tuned Liquid Damper is able to reduce the amplitude response of structure subject to earthquake?
2. How to obtain the optimum parameters of the liquid and tank?
3. How to verify the numerical results with the experimental study?

### **1.1.2. Scope of problem**

In writing this proposal there are several limitations to the problem given. The problem limits in this proposal are:

1. Structurally reviewed:

- a. The simulation model used is a one-story.
- b. Laboratory testing model in the form of shaking table utilizes sinusoidal load

### **1.1.3. Authenticity of Research**

Based on observations made by the author, the thesis title " VERIFICATION OF TUNED LIQUID DAMPER DESIGN FOR REDUCING RESPONSE OF STRUCTURES DUE TO EARTHQUAKE EFFECTS " which basically has never been done before.

### **1.1.4. Benefits of Research**

Through writing this scientific paper, the benefits obtained from this research are:

1. Contributing to the science of civil engineering Structures especially in the designing of Tuned Liquid Dampers.
2. As one of the sciences to add insight and can be used as an additional reference in preparing Thesis and additional lecturing materials related to the design of tuned liquid dampers to reduce the response of earthquakes effects.

3. For researchers, this research is also useful as an application of knowledge that has been obtained during my study at the Civil Engineering Master's Program, Postgraduate Program, Atma Jaya University, Yogyakarta.

## **1.2 Research Objectives**

1. To find out the TLD (Tuned Liquid Damper) design in reducing the response of earthquakes effects to buildings.
2. To verify numerical with experimental study.

