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**FACULTAD DE INGENIERÍA**

Escuela Académico Profesional de Ingeniería Civil

Tesis

# Structural Behavior of Building with First Level Height Variation Controlled by Viscous Fluid Damper

Joshy Nichelson Castillo Curasma
Esthefany Araceli Curo Tovar
Jimmy Nick Stevens Garcia Joija
Manuel Ismael Laurencio Luna

Para optar el Título Profesional de
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**Autores:**
1. Joshy Nichelson Castillo Curasma – EAP. Ingeniería Civil
2. Esthefany Araceli Curo Tovar – EAP. Ingeniería Civil
3. Jimmy Nick Stevens Garcia Joija – EAP. Ingeniería Civil
4. Manuel Ismael Laurencio Luna – EAP. Ingeniería Civil

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**Joshy Nichelson Castillo Curasma, Esthefany Araceli Curo Tovar, Jimmy Nick Stevens Garcia Joija, Manuel Ismael Laurencio Luna***

Faculty of Civil Engineering, Continental University, Peru

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**Abstract** The variation of height from one floor to another is associated with the decrease of stiffness. Such variations in the world, have claimed countless lives and have led to the collapse of structures throughout history, such as the earthquakes occurred in Loma Prieta 1989, Taiwan 1999, Northridge 1994, Ica 2007, several buildings products of the seismic event failed by the change of stiffness at the first level of the structure. The present research work analyses the structural behaviour of buildings in the first level height variation controlled by viscous fluid dissipators. Based on the analyzed investigations, we have noticed that the buildings of 3, 6, 9, 12, 15, 18, 21 floors, are structures that have collapsed in the described earthquakes, so on this basis we have analyzed the structuring of models with 900 m$^2$ with the variation of the height of the first level in 3, 5, 7 m in the models of 3, 6, 9, 12, 15, 18, 21 floors correspondingly, in which we analysed the 21 models with a linear time-history analysis with 3 pairs of seismic records which were treated and scaled by using the SeismoSignal software, SeismoMatch, being the 1966 lima case 2 earthquake the predominant one to analyse the behaviour of the structure, in which we added the viscous fluid dissipators based on Fema 274 and the Hazus methodology, in which we could appreciate the parameters of drifts, accelerations, energy dissipation, hysteretic graph, which were obtained through the use of the ETABS 20 software. We conclude that the addition of viscous fluid dissipators improves the structural behaviour, optimally reducing the stresses in the building, controlling the height variation of the first level, which is ideal for existing structures that require structural reinforcement, being the maximum tolerable drift of 0.009249 to ensure the proper functioning of this device, and it was also obtained that increasing the height in a new building is not appropriate because it increases the drifts and reduces the accelerations correspondingly.

**Keywords** Soft Floor, Energy Dissipation, Floor Drifts, Viscous Fluid Dissipator

## 1. Introduction

According to the Geophysical Institute of Peru (IGP), areas prone to large earthquakes are located along the western edge of Peru [1]. This risk was analysed using statistical methods, determining the probability of earthquake occurrence in the period from 1960 to 2012. In this analysis, asperities were identified in the areas of Lima, Ancash and Moquegua, associated with the accumulation of energy that could be released in an 8.8 Mw earthquake [2]. On the other hand, Villegas and Lanza evaluated the period from 2008 to 2014 and determined that the central coast of Peru, over a length of 470 km, could release the accumulated energy generating an earthquake of 8.6 to 8.8 Mw [3]. To contextualise the potential damage, this earthquake is comparable to the one that occurred on 28 October 1746 in Lima, with a magnitude of 8.8 Mw, where 10% of the population lost