CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

J0303

Project Title

Minimizing Earthquake Damage for Buildings

Abstract

Objectives

The purpose of this project is to determine which variable (the mass, length of the damper and the amount of damping) causes the tuned mass damper to be the most efficient in minimizing damage caused by earthquakes.

I became interested in this idea when I was learning about the earthquake that hit Mexico on Sept. 19, 2017, I was wondering why there was so much destruction. I thought buildings were supposed to be stable but the buildings destroyed by the earthquake proved otherwise. I decided to do some research on how earthquake damage could be minimized. My science fair project provided me an opportunity and motivation to study up more on this.

In this experiment I found the most effective variables, in order to maximize the efficiency of Tuned Mass Dampers. This project will help decrease the damage done by earthquakes in the future. I had hypothesized that the bigger, and heavier the tuned mass damper the more it resists against the shaking; the less smaller, and lighter, it would resist less against the shaking.

I tested five different scenarios. In one scenario I had a plain building with no tune dampers, the second scenario was with a building that had a 12 inch tuned mass damper with 10 washers as the mass. For my third scenario I had a building with 12 inch tuned mass damper with 5 washers, for my fourth scenario I had a building with an 8 inch tuned mass damper with 10 washers. For my final scenario I had a building with an 8 inch tuned mass damper with 5 washers. I tested each scenario 10 times. I graphed each scenario and found the average for each one. I used the average to figure out the most effective Tuned Mass Damper. After the experiment I learned that my first hypothesis was wrong. The most effective Tuned Mass Damper was the 8 inch with 5 washers.

Based on my results, I concluded that too much mass overcompensates the effect of the tuned mass damper, and once you increase it beyond the optimal mass you will start seeing the benefits decrease in terms of minimizing the shaking. Also if the weight is too much the structure could get weakened which can cause it to collapse. My second hypothesis was correct, the building with no tuned mass damper was the most vulnerable.

Summary Statement

I showed that the damage to buildings when the ground shakes during an earthquake can be minimized by an efficiently designed tuned mass damper.

Help Received

My adviser guided me and my parents helped me buy the material needed for the model