CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
J0215

Project Title
Building Buildings Better. Which Design Does Better in an Earthquake: Tuned Mass Damper or Base Isolator?

Abstract

Objectives/Goals
The purpose of this project was to determine which type of earthquake resistant design for a building would create less sway. The hypothesis is that a building with a base isolator would create less sway than a building with a tuned mass damper.

Methods/Materials
A model building made of flexible metal wires and wood squares was constructed. A shake table was constructed with wood, pvc pipe, wire, rubber bands and a drill to create consistent shaking. A tuned mass damper was built out of washers, nuts and a bolt, then attached to the top of the building with wire. A base isolator was made by placing marbles in a shallow cardboard box, and secured to the shake table top with large rubber bands. A small hole was drilled at the top of the building to place a stick with an arrow on it. This was the guide for recording the numbers seen on the paper taped on the wall behind the building. Data was gathered by videotaping ten, ten second trials for each condition tested on the shake table: control, tuned mass damper, base isolator, and a combination of the tuned mass damper and base isolator. Videotape was viewed in slow motion to record where the arrow moved from left to right. Numbers were recorded and amount of movement was calculated . Bar graphs were made.

Results
Results were consistent for all four conditions. The base isolator had the least amount of sway with an average of 3.63 centimeters. The tuned mass damper and base isolator combination had an average sway of 5.82 centimeters. The tuned mass damper alone averaged 10.84 centimeters. The control had the most amount of sway with an average of 24.55 centimeters.

Conclusions/Discussion
The base isolator was better than all other earthquake resistors tested in this experiment. The base isolator was even better than a combination of base isolator and tuned mass damper. In this particular test, I observed that the sway of the weighted tuned mass damper began to sway the building on a base isolator. More testing could be done on how much weight to use in a tuned mass damper in proportion to the size of the building. Tuned mass dampers and base isolators alone can reduce the amount of sway and result in less damage to the contents of a building.

Summary Statement
The purpose of the project was to determine whether a base isolator, tuned mass damper or a combination of the two would create the least amount of sway on a model building exposed to simulated earthquake activity created by a shake table.

Help Received
Mother helped with construction of shake table; turning on and off drill when data was being collected; typing and layout of display board.