CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
J1815

Project Title
What Kind of Foundation Is the Best for an Earthquake?

Abstract

Objectives/Goals

In many places around the world there have been very powerful earthquakes, but the damage repair costs varied a lot. In Prince William Sound, Alaska the damage repair cost was about $311M with a 9.2 magnitude earthquake in 1964, but in Kamchatka, Russia the cost was only $2M with only a slight difference in the magnitude, 9.0, in 1952.

In this project, I am trying to figure out what foundation for a building is the best (shakes the least) during different sized earthquakes. I am going to use three foundations, a fixed foundation, a hinged foundation on rollers, and a free on roller foundation. Two hypotheses were made: 1) a building will move the least on a fixed foundation but 2) objects in the building are going to move the least on a free foundation.

Methods/Materials

An earthquake simulator has been constructed using a toy car, wooden balls for rollers, and springs, etc. to measure building movements and object movements in the building on three different support methods (fixed, hinged on rollers and free on rollers). Each of the support methods was measured four times at three different strengths of earthquakes.

After all measurements were collected, they were averaged for each support type at each quake strength. Then a shake ratio between the number of grids and the length of each line of the building and the in-building object was calculated to figure out how violent the building or the in-building object was.

Graphs were drawn for the average length of the farthest point, average number of grid counts the line went through, and the average shake ratio. Then the comparison was made for the three graphs of the building foundation and for the three graphs of the in-building object to see which supporting method was the best.

Results

The object movement is least and safest with the free-on-rollers supported building. However, the building movement is the greatest with the free-on-rollers support. The object movement in the hinged supported building is the safest because it responds with a marginal movement and the building itself does not move a lot or violently.

Conclusions/Discussion

My hypothesis about the building was wrong, but the second hypothesis about the object movement in the building was correct. The further experiment can be done to determine how to secure in-building objects to the building and how to construct a building in order to minimize the earthquake damage.

Summary Statement

The project is about determining the best building support method to minimize the earthquake damage of a building and objects in the building.

Help Received

I would like to thank my teacher, Mr. Lenker, the science fair coordinator from my school, Ms. Francis, my mother for buying materials for me, and my father and brother for helping me build an earthquake simulator.