CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

S0801

Project Title

Let's Get Ready to Rumble! A Comparative Study of Three Ground Materials' Stability/Safety During an Earthquake Scenario

Abstract

Objectives/Goals

This experimental procedure demonstrates how 3 common ground materials [sand, soil, and cement] will behave during a simulated earthquake on a fault line. By using a shake table, it is possible to mimic the movements and vibrations of an earthquake. Using this shake table and models of buildings; this project will simulate how a building would react during an earthquake on each ground material.

Methods/Materials

The main parts of the project included: a shake table, two miniature building models (small A and large B), and ground materials. Important experiment materials included: rope, staples, staple gun, rulers, hot glue, a hot glue gun, wood, racket balls, bungee cord, a scroll saw, a nail gun, nails, a concrete slab, sand, dirt, stones, and a drill. First, the ground material was placed in the shake table. A model was placed over the middle of the space between the quadrants. The legs of the building model dug into the ground material. The starting point of the model was recorded by a ruler that marked on the wooden border. For transverse fault line tests, the quadrants were pulled vertically or back-and-forth 30 times for 4 tests. For the convergent/divergent fault line tests, the quadrants were pulled horizontally apart and back together 30 times for 4 trials. The cement trials were tested 3 times each. The model was measured for movement and was inspected for damage. The greater the damage or movement, the less safe the ground material was deemed.

Results

The movement model A had on sand averaged 1.47cm; model B moved on sand an average of 2.04cm. On soil, model A moved an average 1.27cm; model B had 1.89cm of average movement. During cement trials, model A had an average movement of .03cm. Model B had no movement at all during the same trials. The trials with cement yielded the most damage of all tests; the transverse tests for model A weakened the right legs the first two trials and pulled both left legs off.

Conclusions/Discussion

The soil group had the least movement and damage; therefore, it was deemed the safest. But there is no direct way of knowing which material would be safest during an earthquake; the world's geological diversity and the new earthquake prevention systems will affect the safety of the ground material. Needless to say, because of the constant movement of the Earth's crust, testing needs to be carried on to help prevent such devastations witnessed by the world this past year.

Summary Statement

This project observes the behavior of three different ground materials under two building types during a simulated earthquake to judge which tested ground material is safest.

Help Received

Father helped construct earthquake simulator table