CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
J0809

Project Title
How Do Different Ground Materials Affect Seismic Wave Propagation?

Abstract

Objectives/Goals
This experiment was designed to determine which ground material (loose sand, packed sand, gravel, asphalt, or concrete) would make a seismic wave decrease most rapidly as it travels from a seismic source to a detector.

Methods/Materials
A shot put ball was dropped from a fixed height onto a steel plate. The resulting seismic wave was recorded by a seismograph placed at 10 different distances from the impact on 5 different ground materials: loose sand, packed sand, gravel, asphalt, or concrete. The loose sand, packed sand, and gravel represented the broken-up rocks of the West Coast, while the asphalt and concrete represented the more solid rocks of the Eastern US. The median peak ground acceleration was taken across the 10 drops at each distance for each ground material.

Results
When traveling through the unconsolidated materials (loose sand, packed sand, and gravel), the median peak ground motion decreased by a factor of 2 when the seismic wave traveled 80 cm from the source. Traveling through more solid asphalt, the seismic wave went 160 cm before the median peak ground motion decreased by a factor of 2--a significant difference. Traveling through the even more solid concrete, the median peak ground motion decreased by a factor of 2 after going 360 cm from the source--an even greater difference.

Conclusions/Discussion
The hypothesis was supported by the data. In the experiment, seismic waves decayed more quickly in unconsolidated materials than in more solid materials. This experiment agrees with the observation that seismic waves travel farther on the East Coast (through hard, solid rock) than the West Coast (through soft, broken up rock).This information is important to architects and engineers all over the US. In the eastern US, even though the earthquake are rare, they are felt over a much larger area. On the west coast, the earthquakes are much more frequent even if they are not felt over as large an area. Thus, buildings all across the US must built to withstand earthquakes.

Summary Statement
My project investigates how different ground materials cause seismic waves to decay at different rates as they propagate through the earth.

Help Received
Corrie Neighbors and Kayla Kroll at UC Riverside loaned me the seismic sensor, and Gareth Funning at UC Riverside loaned me the steel plate. My parents assisted me with running the experiment and the spreadsheet software, and helped proofread the poster.