CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
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Project Number
J0712

Project Title
Soil and Structure Survival during Groundshaking

Abstract

Objectives/Goals
I examined four different soil "types" to assess soil & structural survivability to earthquake damage. A model for ground motion was built using an electric motor to generate the vibrations and results were recorded and analyzed. The experiment informed my understanding about structure suvivability in active earthquake zones.

Methods/Materials
A testbed using a small table and electric fan was built. Test cups were prepared with crushed rock strata and a fixed water-table at depth. Finally a topsoil strata of loam,alluvium,sand or bedrock was added. The earthquake was presented and performance latencies recorded. I repeated the following proceedure as necessary to collect the required data. 6 plastic cups were numbered and prepared with a layer of 3\4" crushed rock. Next each cup was layered with smaller 1\2" crushed rock and 500ml of water was added. The simulated water table remained below the prepared layers of rock. Next a 1" layer of experimental soil topped each test cup. Six cups were tested per table trial with all soil types represented at least once,perhaps twice with each test trial. The trial began with the simultaneous start of the timmer and vibration. When a building fell, the timmer and vibration were stopped and the elapsed time recorded. The trial was restarted and continued recording each building failure in turn,up to two minutes. Fresh cups were prepared, rotated & place matched on the table and a new trial begun.

Results
My findings show that alluvium and bedrock performed best while sand was poor. The four soil conditions performed differently. The shake table-model was not perfect but I planned & collected data that fairly represented the variables I could control. The epicenter of vibration had different effects at location on the table. The small structures were not perfectly the same in weight or shape. To characterize the soil types. My concept required many trials to test each variable.

Conclusions/Discussion
I prepared my data for analysis by considering the soil type performance and my experimental design. As expected the data showed experimental bias by individual building and again by shake-table position. The place-matching and multiple tests proved necessary & interesting. My shaketable model performed well. My main finding was that soils consist of both large and small particles and that in the presence of water and earthquake hazards, the earth's is dynamic.

Summary Statement
My project tests what is the best soil to build a structure on during groundshaking.

Help Received
Dad helped me build the shake table. My mom helped me with stay organized and helped with glueing the board. . Bryant Falk a student at SDSU explained to me in detail what happens when groundshaking occurs.