CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

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Project Number

J0616

Project Title

A Ground-Breaking Revelation: Testing Compression Waves in Various Circumstances

Abstract

Objectives/Goals

Our objective was to learn if types of soil or sand decreased the magnitude of compression waves to a larger extent. In addition, we aspired to learn if placing a wooden box over a low-g accelerometer decreased the acceleration with which the accelerometer was hit. We hypothesized that the sand would decrease the waves to a greater extent, as it has a higher semi fluidity content than does soil. We hypothesized that the box would also lower the acceleration of the waves.

Methods/Materials

In order to test our hypothesis, a wave tank for solids was constructed. A loudspeaker was mounted at the base of the tank and a sound generator and amplifier were connected to the loudspeaker to create vibrations similar to that of an earthquake. An accelerometer connected to computer probeware was used to measure wave amplitude. Variations of both sand and soil were tested, separately, and a wooden box was placed over the accelerometer in half of the 105 tests. LoggerPro and FreqGenie softwares were also initialized. LoggerPro was primarily used to collect and graph the data, while FreqGenie was used to initiate the waves and control the amplitude of the speaker. The accelerometer was placed in three separate positions to ensure that conclusions would prove accurate.

Results

When each high crest count and low trough count was averaged, it was evident that the sand did decrease the acceleration of the waveds in a larger way. In addition, the box actually increased the acceleration of the waves in all cases other than those in position B, at 12.03 centimeters from the epicenter. These results pertained to our research in that they proved, with no doubt, our hypothesis right of wrong.

Conclusions/Discussion

Our results did support our hypotheses in one sense. The result that the sand did decrease the acceleration of the compression waves did prove our hypothesis accurate. However, finding that the box increased the acceleration of the waves in all but one-third of the tests did prove our second hypothesis far from true. The results of this experiment are highly relevent to our category subject in that they are vital for improving the seismic constant, or arbitrarily set acceleration value that a building must withstand during seismic activity. This research also improved our knowledge of this category in that it proves that sand is a better resister to compression waves than soil is.

Summary Statement

This project is focused on whether or not sand or soil decreases the acceleration of compression waves to a larger extent and if placing a wooden box over a low-g accelerometer decreases the force with which the accelerometer is hit.

Help Received

Mr. Louis Garcia helped with software usage, overall suggestions, and lab equiptment usage; Professor John Claerbout assisted by increasing our knowledge of seismology and by giving suggestions; Mrs. Cathy Pherson purchases materials and aided by setting up the tank.