CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34236

Project Title

Soften the Wave: The Minimization of a Tsunami

Abstract

Objectives/Goals

If an object placed in the path of an oncoming wave can change the velocity of the water and thus decrease its momentum, could a structure be placed in a tsunami#s path, to lessen the waves# impact?

Methods/Materials

Various wood structures were mounted on a continental shelf in a wave tank. A wavemaker generated consistent waves, and the changes caused by the structures were measured. To measure the force of the waves after the structure, a ballistic pendulum was suspended from a supporting beam. Cameras captured the wave height, the pendulum swing, the wave velocity, and the distance the wave run up. The pendulum swing was measured in degrees of swing from static position. The wave velocity was calculated by measuring the distance the wave traveled from one frame to another and then multiplied by the number of frames per second of the recording speed. The run up was measured using lines placed along the width of the shelf. Five test runs were conducted for each test condition. Calculations were made from the measurements to obtain wave energy and force transferred to the pendulum.

Results

Comparing results to the control of no structure: all structures regardless of formation reduced the wave height. The wave velocity was slowed in all formations for the large circle, the L-sharp increased wave velocity in all formations, and all other structures had mixed results. The pendulum swing was less in all formations for the medium circle, large circle, medium diamond, large square, and large diamond. The L-sharp had a greater swing in all formations, and the medium square and L-catch had mixed results. The run up was less in all formations for the large circle, medium diamond, large square, and large diamond. All other structures had mixed results.

Conclusions/Discussion

The reduction of force and velocity were rated higher than wave height and run in for reducing the impact of a wave. The top structures were the medium circle, large circle, medium diamond, and medium square. In looking at formations, the best formation was the wide formation as it had the least force and wave velocity even though it had the greatest run up and a moderate wave height. Based on these results, structure shape can lessen the impact of a wave. Engineers would need to determine which of these factors is most desirable for each location and then apply this research.

Summary Statement

This project was to test if a passive structure can reduce the effects of a large water wave on a shoreline.

Help Received

Consulted engineer on calculations; parents helped prepare test setup and record data.