CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J0314

Project Title
Wave Bye Bye: Would a Different Jetty Design Reduce Tsunami Wave Amplitude in the Santa Cruz Harbor?

Abstract

Objectives/Goals
The objective was to determine if an alternate jetty design would reduce tsunami wave amplitude in the Santa Cruz Harbor from a tsunami wave similar to the one that resulted from the Japan 2011 earthquake.

Methods/Materials
An open-ended wave flume was constructed to replicate the design of the current Santa Cruz Harbor and jetty. It measured 72 inches long by 20 inches wide by 12 inches deep. A wave generator was constructed to create a scale size tsunami similar to the tsunami in the Santa Cruz Harbor that was a result of the Japan 2011 earthquake. A scale model Santa Cruz Harbor jetty was built and placed in the end of the flume opposite to the wave generator. An alternate jetty design, the Marina Del Rey Harbor in southern California, was built to scale and compared. Wave amplitude on the inner side of the jetty was compared to wave amplitude outside the jetty for both designs. 10 trials were conducted for each jetty design.

Results
The alternate jetty design indicates a 68% wave reduction inside of the harbor, while the current jetty design indicates a 38% wave reduction. The results of the experiment suggest that both jetty/breakwater designs reduce inner-harbor tsunami wave amplitude, but the alternate breakwater design reduced inner-wave amplitude almost 2 times more that the current jetty design.

Conclusions/Discussion
The results support the hypothesis, that an alternate jetty design would better protect the Santa Cruz Harbor from tsunami waves.
After the tsunami wave resulting from the Japan 2011 earthquake hit the United States west coast, it caused substantial damage to boats and infrastructure in the Santa Cruz Harbor. Said Santa Cruz Harbor Port Commission member Jeff Martin, "Could they have designed it [the Santa Cruz Harbor jetty] better? I think so." Martin is a civil engineer. This supports my project, which determined that an alternate jetty design would better protect the Santa Cruz Harbor.

Summary Statement
An alternative breakwater design to the existing jetty design would reduce tsunami wave amplitude within the Santa Cruz Harbor.

Help Received
Dad helped cut wood for flume; Mom videoed experiment so I could go back and look at the videos to get accurate measurement of wave amplitude.