CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Tierney R. Burke

Project Number
S0703

Project Title
Shear Wave Velocity Determined by Refraction Microtremor Surveys in the Oxnard Plain to Assess Earthquake Risk

Abstract

Objectives/Goals
Variation of geologic materials near the Earths surface can have a significant effect on ground motions from earthquakes. Shear-wave velocity (Vs) is an appropriate measure of rock or soil conditions for ground motion calculations because it directly affects ground motion amplification. Refraction microtremor (ReMi) method was used in this study to determine shear-wave velocity to evaluate ground motion hazard in the Oxnard Plain.

Methods/Materials
Refraction microtremor (ReMi) ambient noise recordings made on 140-m-long lines of standard refraction equipment were used to determine 30 meter (100 ft) average shear wave velocities and one-dimensional shear wave profiles down to depths of 100 meters. SeisOptReMi software allowed wavefield transformation data processing. ReMi processing involved: 1) velocity spectral analysis, 2) Rayleigh phase-velocity dispersion picking, 3) shearwave velocity modeling. Measurements were compared with UBC/IBC site classifications and downhole measurements by USGS. A shear wave velocity contour map of the site area was prepared to analyze area variation.

Results
43 field test measurements in this study produced shear-wave velocities between 180 and 360 m/sec which classified in the Uniform Building Code (UBC/IBC) class D group. Refraction microtremor method surveys throughout the Oxnard Plain showed shear velocity decrease as you move in a southwestward direction away from the mountains. A higher velocity zone was identified along the course of the Santa Clara River, and a lower velocity zone along the slow-moving Calleguas Creek on the eastern side of Camarillo.

Conclusions/Discussion
The dense population and active tectonics of southern California necessitate extensive seismic hazard evaluations that include precise earthquake location determinations, path, and site effect studies. Seismic refraction method is well suited for general site investigations for soil dynamics and earthquake engineering purposes. ReMi surveys performed in this study provided a more extensive assessment of shear-wave velocities in the Oxnard Plain than previously reported. Noninvasive refraction microtremor surveys of shear-wave velocities in the Oxnard Plain compared with downhole velocity measurements, and surface map predictions of ground motion hazard.

Summary Statement
Earthquake ground motion hazard risk characterized by shear wave velocity varies across the Oxnard Plain, and is influenced by the general geologic environment.

Help Received
Thomas Blake provided use of his refraction microtremor equipment, and instruction in performing ReMi surveys.