

Seismic Microzonation for Las Vegas: Shallow Soils Effects

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Progress Report: August 2, 2004

Project overview/scope:

The Las Vegas basin exhibits anomalous responses to ground shaking. Amplitude and duration of shaking are lower on the valley margins and higher in the mid-basin. The anomalous response appears to be correlated to the structural geometry of the basin. Another important factor is the constitution of the shallow sediments. In general, sediments grade from coarse on the basin margins to fine in its center. We propose to enhance understanding of the potential for anomalous shaking in the Las Vegas valley by characterizing the shear stiffness of key sites. We will use this information to (1) develop geographical and geological correlations to enhance microzonation of seismic response and (2) perform one-dimensional equivalent-linear ground response analyses to determine the extent to which shallow sediments contribute to anomalous response. This project will have broader impact due to complementary funding by Lawrence Livermore National Laboratory.

Work Plan summary:

We will generate shear wave velocity profiles at several sites in Las Vegas valley using SASW and ReMi methods. Test locations will be selected to best support delineation and characterization of earthquake microzones. Wanda Taylor (UNLV Geoscience) will assist in correlating results with sediment types to enhance microzonation. John Louie (UNR Seismological Laboratory) will assist in interpreting datasets collected by the ReMi method. We will perform one-dimensional equivalent-linear seismic response analyses using the measured soil profiles and measured earthquake ground motions modified using appropriate scaling and attenuation relationships to project acceleration response spectra and illustrate amplitude of local variation attributable to the shallow sediments.

Justification/Benefit:

The project will improve our understanding of causes as well as magnitude of variability of earthquake ground motions across the Las Vegas valley. This is important because of the tremendous seismic risk in our heavily populated valley, and because the seismic hazard is poorly understood. This project is particularly timely as we re-evaluate our building codes. In some conditions and locales, we might find that requirements must be increased to ensure public safety.

Progress to Date:

The funds were made available to the investigators in April, 2004. The project is on track for its late summer schedule timeslot. This timing is best because it allows us to take full advantage of our previous, complementary research on the seismic response of the Las Vegas basin in response to underground nuclear testing. We plan to characterize six new sites with this project. The lead investigators have met to discuss best siting for the tests. Priorities are given to sites that fill gaps in

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existing datasets, in terms of geometric distribution, lithology, and basin depth, and sites with companion boring logs that can be used to feed the database for lithological correlations. We will also target existing or planned ANSS sites, as needed. The next step is identifying accessible property close to the optimum site locations.

Key personnel on the grant, in addition to the Principal Investigators, are Mr. Ying Liu, graduate research assistant, and Mr. Bagathbabu Dumpala, summer research assistant.

The researchers are well skilled and experienced in collecting, processing, and interpreting the field data. Adequate equipment is available to conduct the work. Barring any unexpected equipment or personnel problems, field data will be collected and interpreted in August. We anticipate that the analyses will be completed in September. We are already working to examine correlations of velocities with lithology and basin depth, so these new datasets will supplement existing work. We are well skilled and experienced in performing the one-dimensional site response analyses. Our biggest challenge will be developing appropriate earthquake ground motions to serve as input for the analyses. We anticipate that the final report will be submitted on time at the end of the project year.

We encourage feedback from interested parties.