Final Project Summary — PEER Lifelines Program

Project Title—**ID Number**	*Statistical Methods for Attenuation Modeling*—**1L07a**		
Start/End Dates	10/1/03 – 6/30/04	Budget/ Funding Source	$56,470 / PG&E/CEC
Project Leader (boldface) and Other Team Members	**Youngs (Geomatrix)**		

1. Project goals and objectives

The primary objective of the project was to develop statistical methods to be used to address the issues of data truncation and data uncertainty in developing ground motion attenuation models from the empirical PEER NGA ground motion data base.

A separate task funded under the same project ID (1L07a) provided additional information on recording site conditions as part of the development of the PEER NGA strong motion data base.

2. Benefits of the results of this project to develop technologies and protocols to mitigate the vulnerability of electric systems and other lifelines to damage directly and indirectly caused by earthquakes. Also, benefits to develop assessment techniques to evaluate damage to electric systems caused by earthquakes and to assess fiscal impacts due to the loss of electric service to the community.

The benefit of the primary results of the project is improved statistical estimates of strong ground motions based on the analysis of empirical strong motion data. The benefit of the separate task is improvements in the PEER NGA strong motion data base. Both tasks lead towards the goal of improving the prediction of strong ground motion amplitudes.

3. Brief description of the accomplishments of the project

To date, the statistical methods task has identified techniques to deal with data truncation and data uncertainty and implemented initial versions of these algorithms in R. Demonstrations of these techniques have been presented at project workshops.

The data base improvement task involved a review of information on recording stations contained in the PEER NGA data set, including information on the station structure and information on the geologic conditions at the station sites. The data reviewed included the classification of the recording station structure type using the Geomatrix structure classification system; and classifications and parameters for the geologic conditions at the recording station sites, including classification according to different systems (Geomatrix, NEHRP, Campbell-Bozorgnia, and surface geology) and average shear wave velocity to depth of 30 meters (V_{S30}). The data were reviewed yo identify missing and incorrect entries, and conflicts between preferred assignments for data set classifications and parameters and assignments provided by different contributors to the data set. Because several data sets were identified that had not been incorporated into the station data base, a significant effort was made to update the station structure classification and geological classifications using the additional data sets. Several of the larger data sets that were incorporated into the data base included soil boring data from U.S. Geological Survey Open-File Reports and the ROSRINE project for California stations, and structural classifications and geological classifications for Taiwan stations from station site plans and geological maps of Taiwan.

4. Describe any instances where you are aware that your results have been used in industry

None to date.

5. Methodology employed

A verity of statistical methods will be adapted from the statistical literature for application to the NGA empirical ground motion assessments. These will likely be implemented in the statistical language R or possibly FORTRAN.

6. Other related work conducted within and/or outside PEER

N/A.

7. Recommendations for the future work: what do you think should be done next?
N/A.

8. Author(s), Title, and Date for the final report for this project
The statistical methods will be described in a report by:
Robert Youngs, Brian Chiou, Norm Abrahamson, and David Brillinger
Statistical Methods for Improved Estimation of Strong Ground Motion Using Empirical Data
June 2005

No report is being prepared for the data base task.