Final Project Summary — PEER Lifelines Program

Project Title—**ID Number**	*Attenuation Relations for Velocity and Displacement*—**1E02**		
Start/End Dates	06/1/00 – 11/30/01	Budget/ Funding Source	$30,000/ PG&E-CEC
Project Leader (boldface) and Other Team Members	**Walter Silva (PEA)**		

1. Project goals and objectives

Based on newly added data from recent large earthquakes as well as existing data in the PEER strong motion database, attenuation relations were developed for several intensity measures: peak acceleration, peak particle velocity, and peak displacement. To properly characterize peak particle velocities and peak displacements, special effort was made to preserve static displacements at close distances (< 20 km) to large (**M** > 7.4) earthquakes.

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.

These intensity measures are used to characterize seismic loads on engineered structures such as lifelines. Lifelines are particularly distressed by static displacements, particularly bridges and pipelines.

3. Brief description of the accomplishments of the project

Magnitude, distance, and site dependencies of these peak intensity measured were captured along with their uncertainties. Figures 1 and 2 show resulting attenuation relations for data processed to retain static displacements and relations developed (which filters out any static displacements) with traditional processing, respectively.

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

Not aware of any usage as yet.

5. Methodology employed

Nonlinear regression analyses was used to determine values for the coefficients in the regression equation. Independent variable were magnitude and rupture distance. Site conditions were soft rock and deep firm soil.

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

Results of this project will be updated with the PEER NGA project.

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

The effects of spatial correlation in strong ground motion should be included in defining seismic loads on lifelines. Spatial correlation models need to be developed with the same data used in developing attenuation relations.

8. Author(s), Title, and Date for the final report for this project

Nick Gregor, Walter Silva, Bob Darragh.

Attenuation Relations for Velocity and Displacement. June 12, 2002.

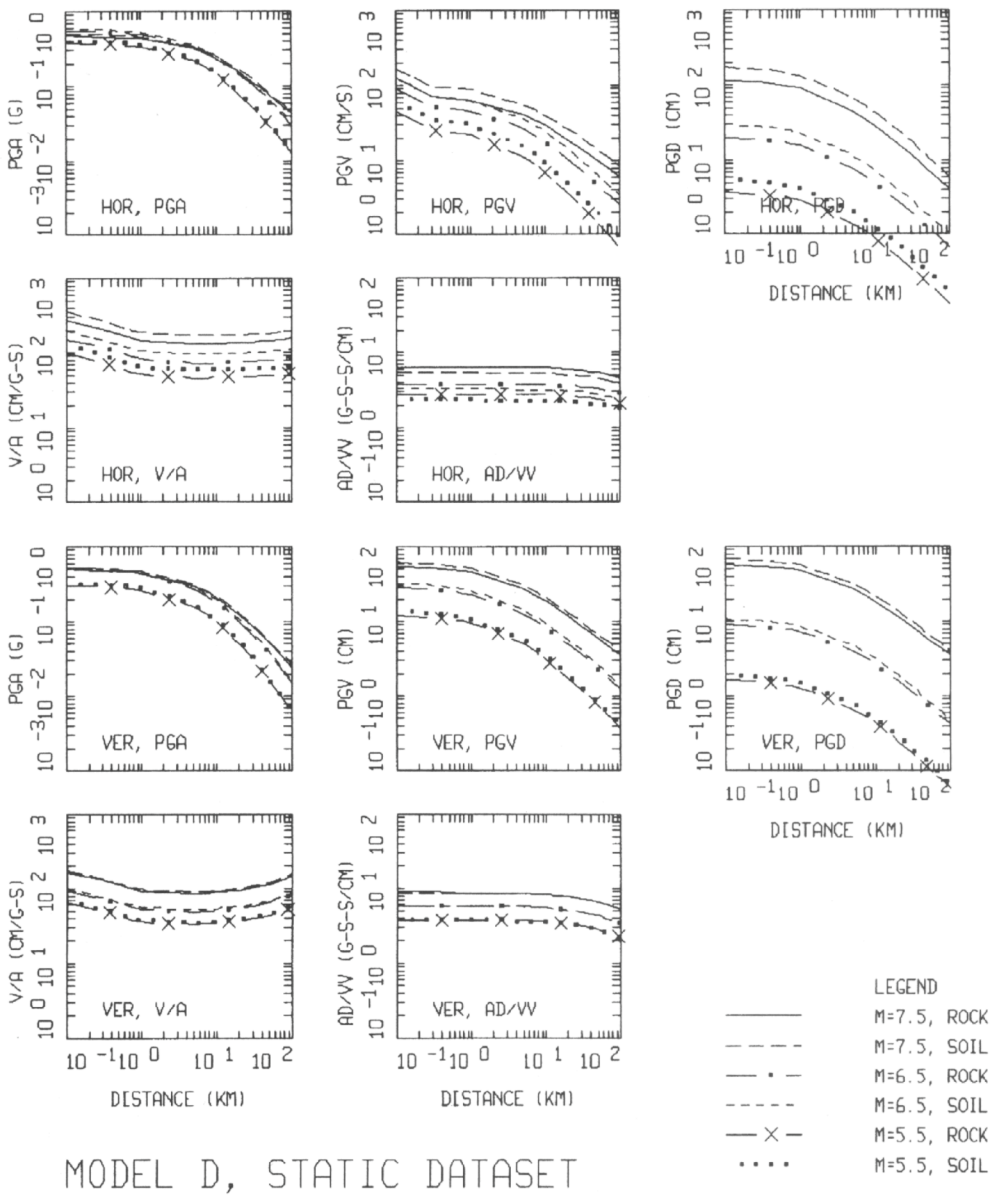

Figure 1. Peak ground motion estimates for **M** = 5.5, 6.5, and 7.5 based on the functional Model D form and the static dataset assuming a strike-slip mechanism.

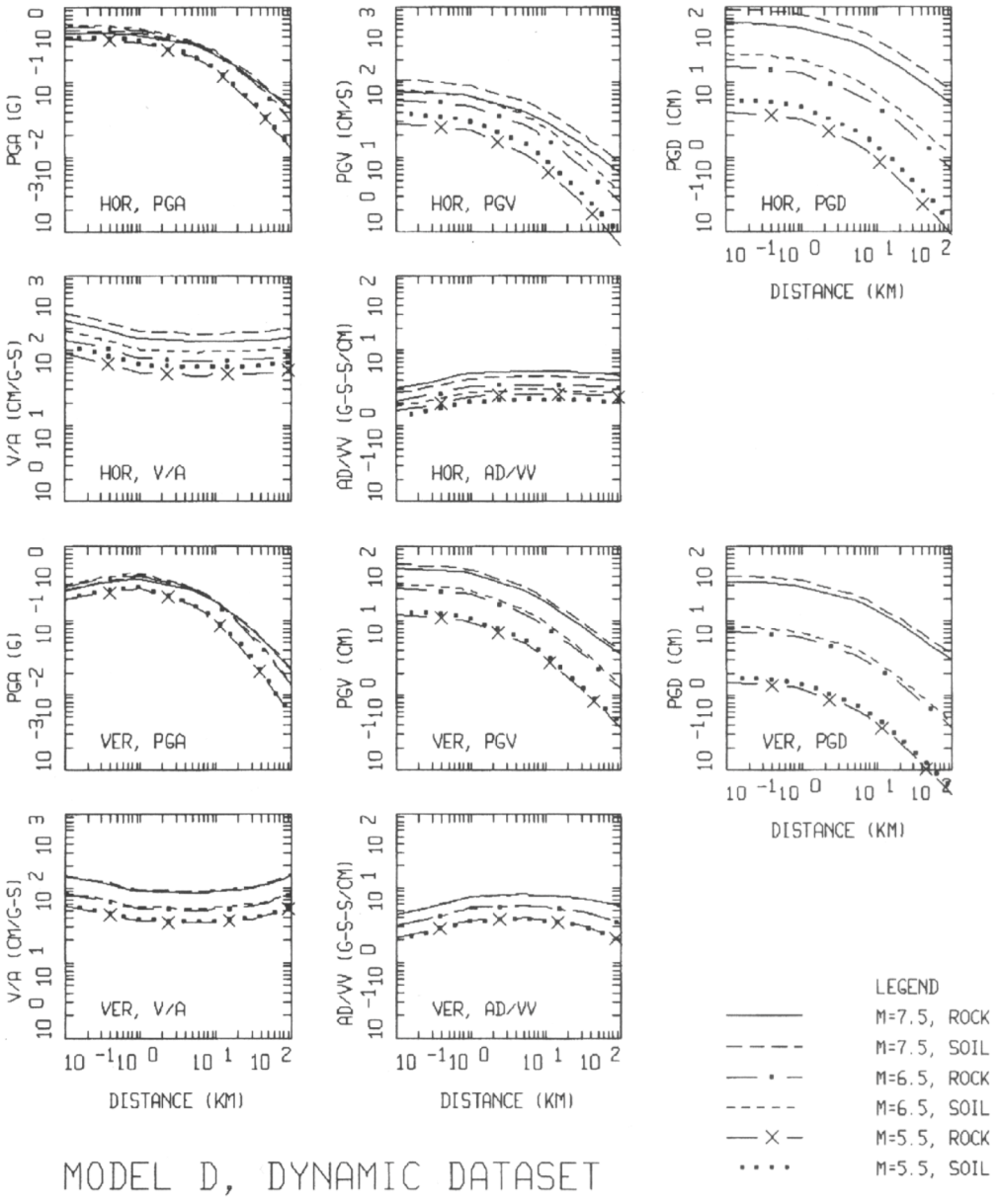

Figure 2. Peak ground motion estimates for **M** = 5.5, 6.5, and 7.5 based on the functional Model D form and the dynamic dataset assuming a strike-slip mechanism.