Final Project Summary — PEER Lifelines Program

Project Title—ID Number	*Checking and Augmentation of NGA Database—*1L09		
Start/End Dates	5/1/03 – 6/30/04	Budget/ Funding Source	$54,498 / PG&E/CEC
Project Leader (boldface) and Other Team Members	**Collins,** Graves, Somerville, Thio, Willis (URS Corporation)		

1. Project goals and objectives

Review the NGA empirical database including earthquake source parameters, station distance and directivity parameters, orientation of recorded components, and station locations and other items as may be deemed pertinent. Add to the database depth to Vs isosurfaces; basin outlines at the ground surface; other basin parameters that more fully describe the geometric relation of source, basin, and site; and a flag indicating shallow vs deep asperities of fault models. Calculate residuals of 3D basin simulations with respect to the Abrahamson and Silva (1997) model. Add data from USGS processed data to the database including PGA and sampling interval from Volume 1 files and PGA, PGV, PGD, and filter information from Volume 2 files. Create summary tables of simulations results from the three modeling groups.

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.

This projects supports the development of NGA attenuation relations which will be used widely in engineering practice to develop seismic design criteria

3. Brief description of the accomplishments of the project

We have reviewed the magnitudes and source parameters of major earthquakes in the database and documented references used. Finite fault models have been checked in detail for 13 earthquakes including four earthquakes with multiple segments (Landers, Kocaeli, Hector Mine (Fig 1), and Denali). Fault models and source parameters for an additional six earthquakes have been reviewed by literature search. Results have been documented by updating Excel spreadsheets created by the original researchers and providing notes with references.

The formula used for calculation of closest distances has been checked. Component orientations entered in the database were checked against those in the COSMOS database and any discrepancies noted on the appropriate Excel spreadsheets. We have added basin depth information to the "flat file" that had been created by Brian Chiou to summarize a number of tables developed by Pacific Engineering and Analysis (PEA).

The "flat file" was updated with data from 333 three-component Volume 1 time histories representing 40 earthquakes and 354 three-component Volume 2 time histories representing 41 earthquakes.

A table of results of simulations done by the three modeling groups (Pacific Engineering and Analysis, University of Nevada Reno and URS Corporation) was created.

For all work, reports were written and suggestions for additional tasks that need to be addressed were made.

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

When completed, the NGA ground motion models will be used widely in industry.

5. Methodology employed

See Section 3.

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

This work relates to the development of a database of empirical records and one of simulation results that will be used by the Developers in preparing a new ground motion attenuation model.

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

As these databases have great value, not only within the NGA project, but also for the earthquake engineering and seismological community, quality checks on both the empirical and synthetic databases should continue. In addition, the empirical database should be kept up to date by adding new data as it is available.

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

Somerville, Paul, Nancy F. Collins, Robert Graves, Hong Kie Thio. "NGA Data Base Review, Final Report," April 12, 2004.

Somerville, Paul and Nancy F. Collins. "Add USGS Data to NGA Database, Final Report," April 16, 2004.

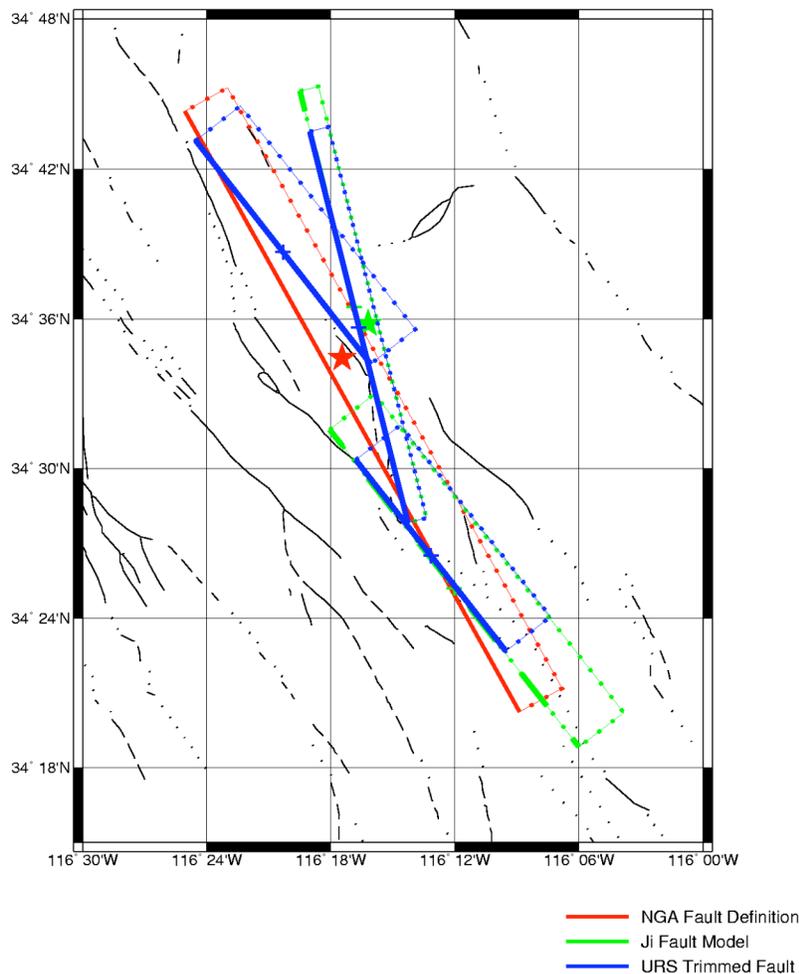## (0158) Hector Mine, 1999 1016 ; Mw =7.13

Figure 1. Map of Hector Mine fault projection showing the original NGA fault definition, the preferred model chosen (Ji Model), and the trimmed Ji model as entered into the revised database.