Ground motions for PEER Transportation Systems Research Program

October 16th, 2009 Draft results

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with thanks to Nirmal Jayaram, Ting Lin, Shrey Shahi

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Online data:

http://www.stanford.edu/~bakerjw/PEER_gms.html

Background

http://www.stanford.edu/~bakerjw/PEER_gms.html

The goal of this project is to select a standardized set of ground motions for the TSRP that

- Can be used to analyze a variety of bridge and geotechnical systems
- Are appropriate for a variety of locations in California

Because these are not structure-specific and site-specific goals, ground motion selection techniques developed in previous PEER projects are not directly applicable here

Today I will present our "first draft" proposed ground motions, based on feedback from our August 2009 meeting

We intend to make (minor?) modifications and finalize these ground motion sets shortly after this meeting

Proposed ground motion sets

http://www.stanford.edu/~bakerjw/PEER_gms.html

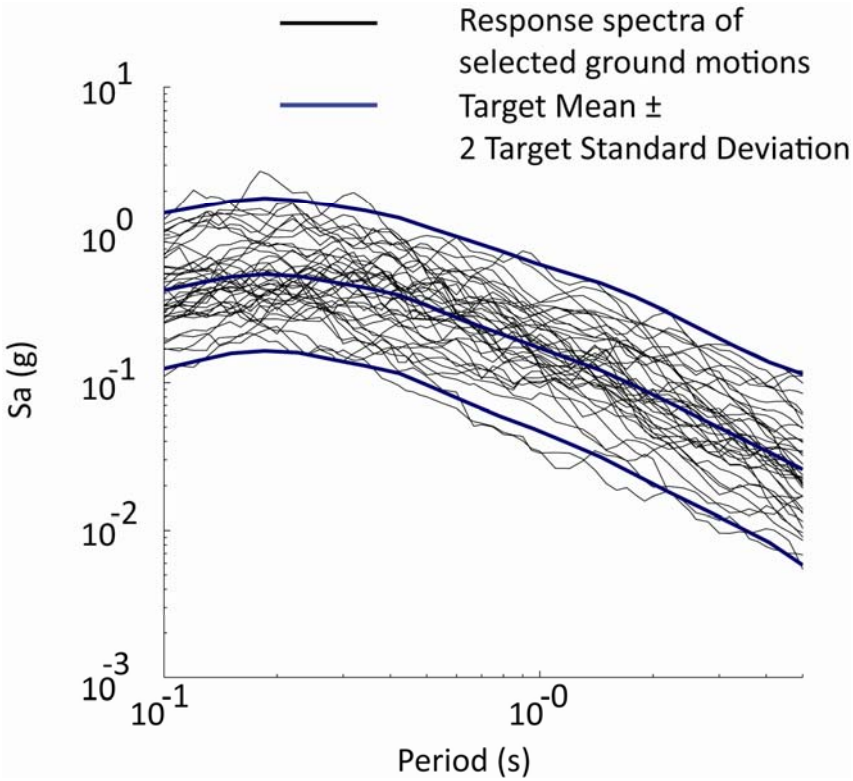
- Group 1: "Broad-band ground motions"

- Group 2: "Pulse-like ground motions"

- All ground motions are unscaled, three-component (SN/SP/Vertical), …

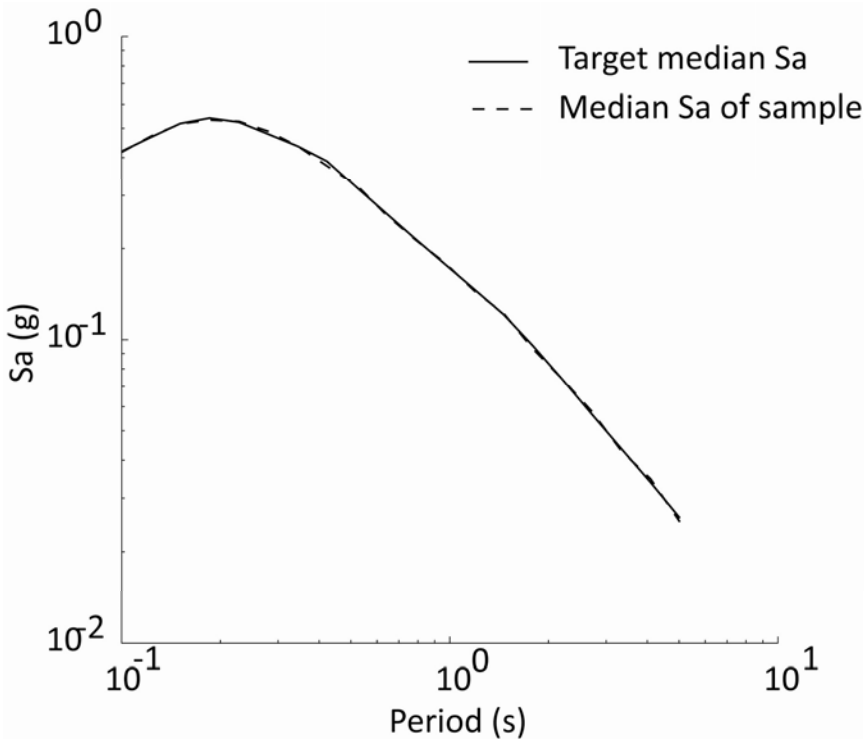
Group 1: Broad-band ground motions

- 40 unscaled ground motions
- Varying magnitudes and distances
- Response spectra have means and standard deviations equivalent to that predicted (per Boore and Atkinson, 2008) for a
  - Magnitude = 7
  - Distance = 10 km
  - Strike slip event
  - V_{s30} = 250 ms

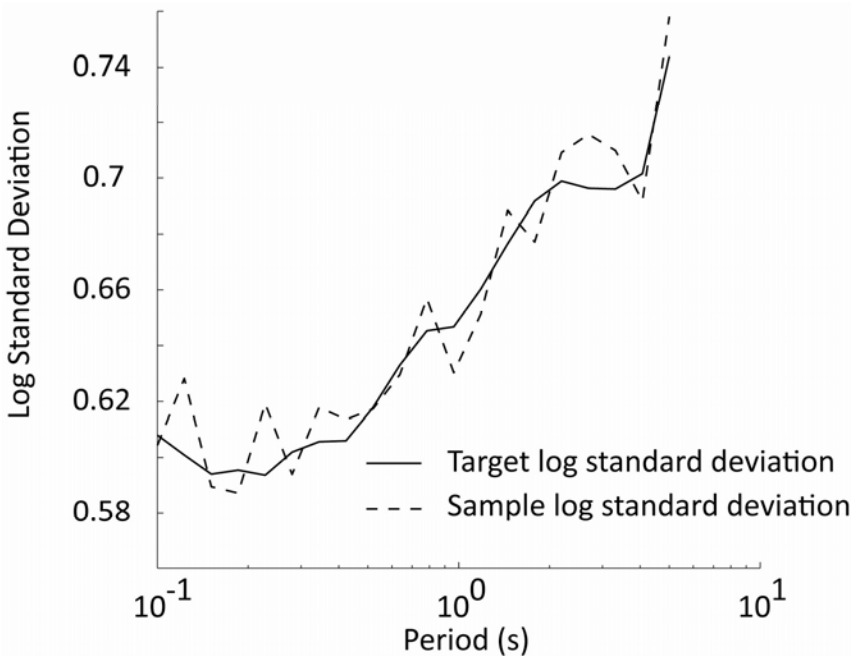


Group 1: Broad-band ground motions

Record set mean lnSa versus predicted mean for M=7, R=10km

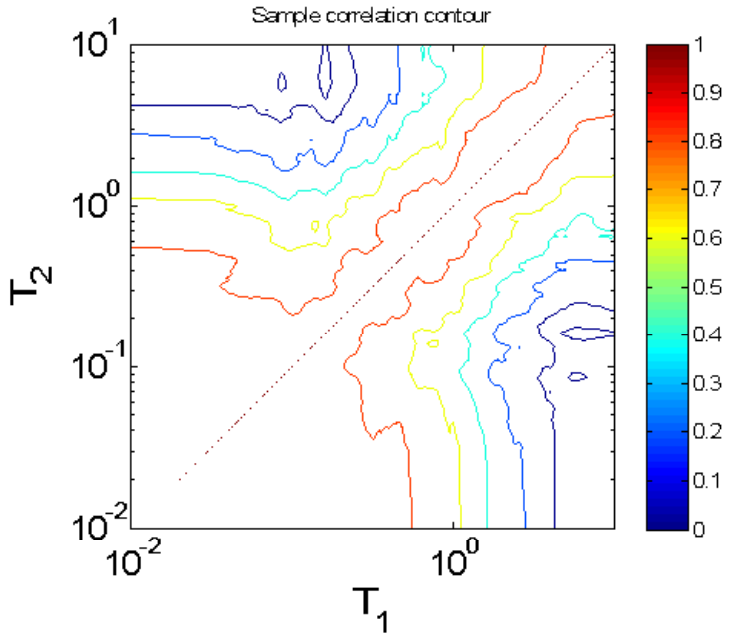


Record set standard deviation of lnSa versus predicted standard deviation

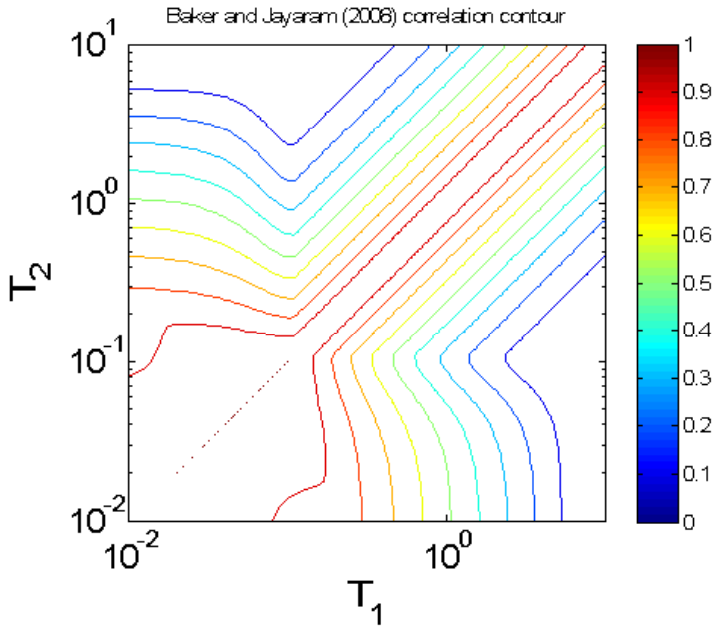


Group 1: Broad-band ground motions

Record set correlations at pairs of spectral values

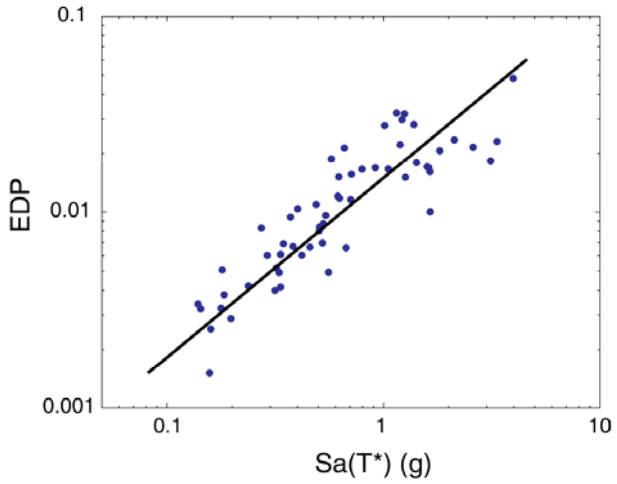


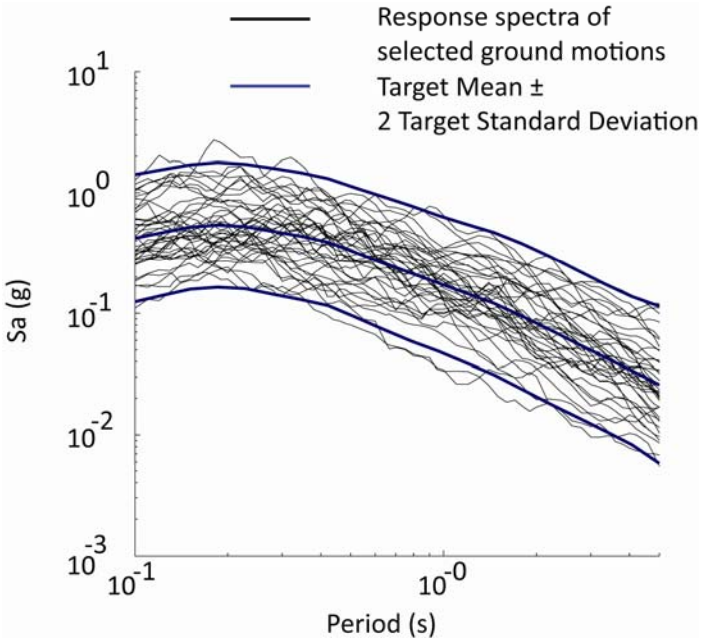
Predicted correlations at pairs of spectral values

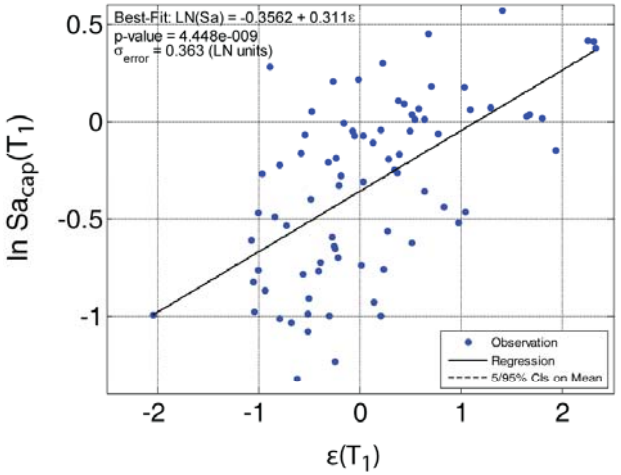


Coming soon: suggested analysis techniques

We will prepare a (short?) report describing how EDP results can be post-processed to choose effective intensity measures for a given system, integrate with hazard curves, etc.





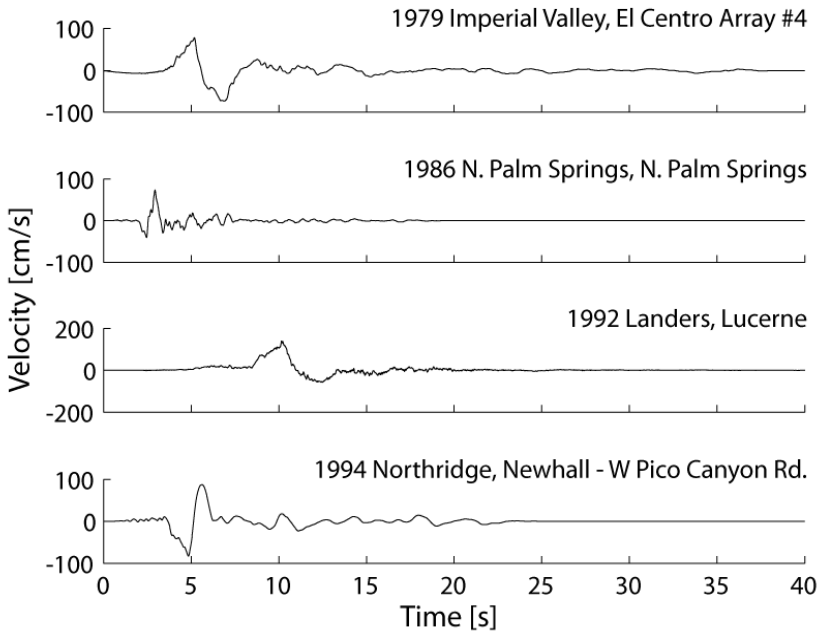


(figure adopted from Curt Haselton)

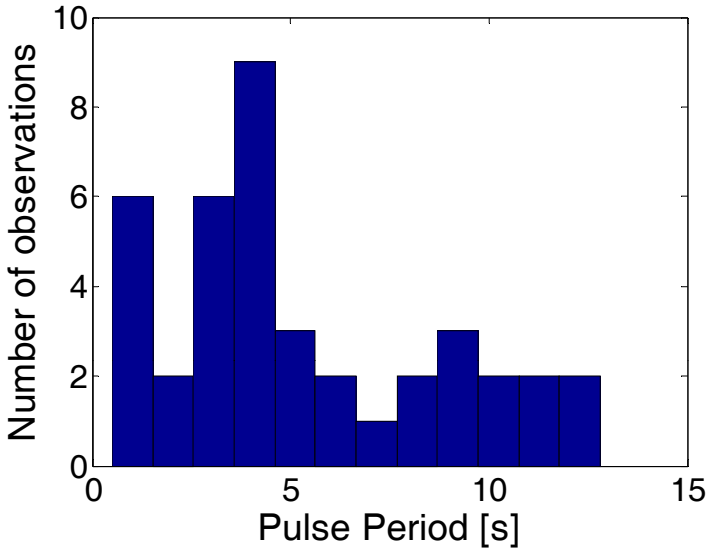
Group 2: Pulse-like ground motions

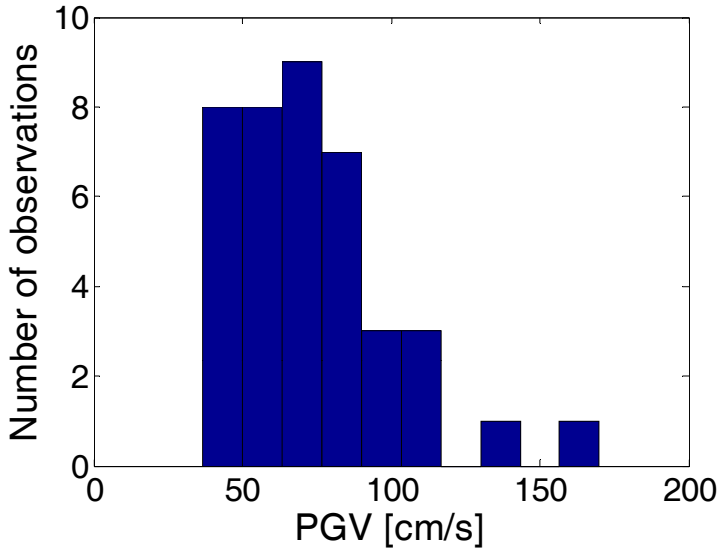
These are strong ground motions, with distinct velocity pulses of varying periods

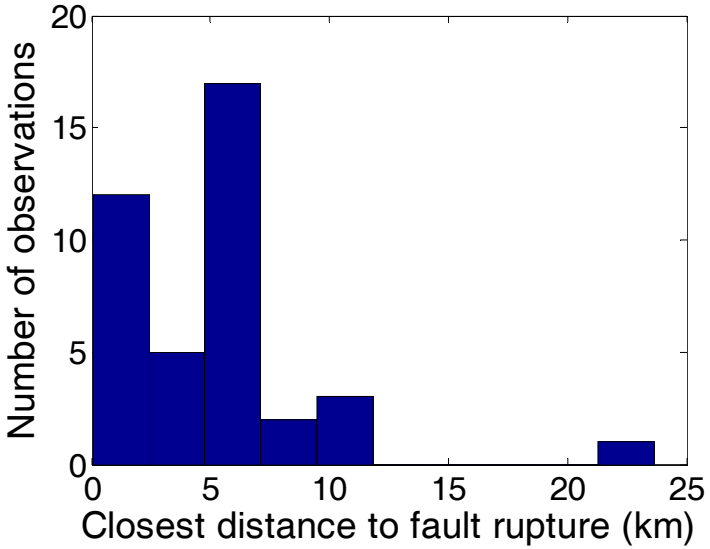
Original orientation will be strike-normal and strike-parallel, and I will provide information about the range of angles over which a strong pulse is present



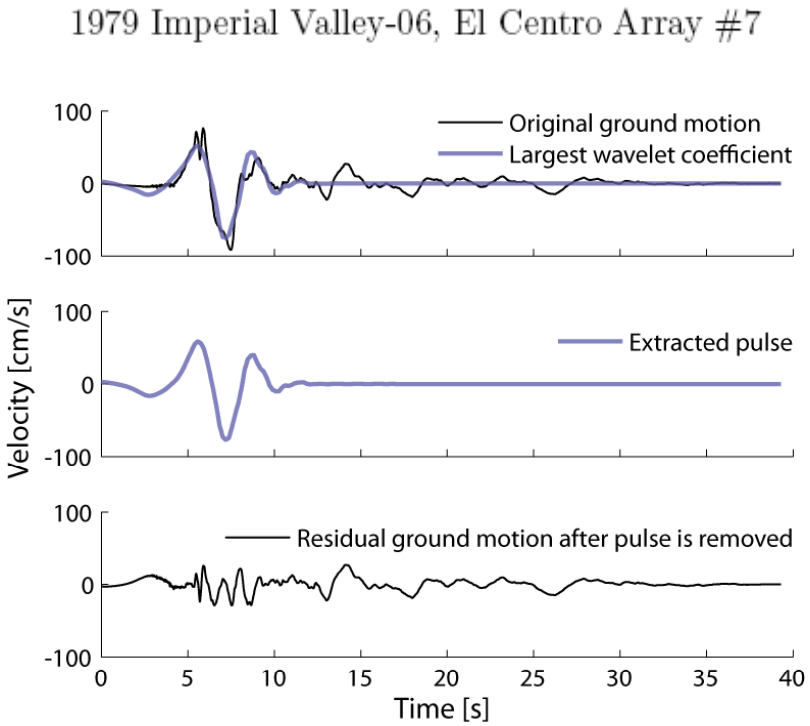
Group 2: Pulse-like ground motions







Additional documentation for Pulse-Like Ground Motions



All three “parts” of the ground motions will be available as plots and raw data files

Our next steps

- Review the candidate records individually
- Get all documentation in order, file formats standardized, etc.

Our requests for you:

- Let me know if you have analysis needs that won't be met by these ground motions
- Let me know if you have concerns regarding data formats, documentation, etc.
- Let me know if you have any concerns about specific ground motions in these draft sets (of lesser importance at the moment)