Ground motions for the PEER Transportation Systems Research Program

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Motivation

- 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 (i.e., mid- to large-magnitude shallow crustal earthquakes at near to moderate distances)
- The systems of interest may be sensitive to excitation at a wide range of periods
- Some sites of interest may have the potential to experience near-fault directivity pulses
- Because these are not structure-specific and site-specific goals, ground motion selection techniques developed in previous PEER projects are not directly applicable here

The product: several standardized ground motion sets

http://peer.berkeley.edu/transportation/projects/

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Ground Motion Studies for Transportation Systems

Sample Project Title

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Ground Transportation Systems

Project # NCTRJB

Research Team

- Jack Baker, Professor of Structural Engineering, Stanford University (PI)
- Nirmal Jayaram, Graduate Student, Stanford University
- Shrey Shahi, Graduate Student, Stanford University

Research Abstract

This project contains three subsets of objectives related to ground motion selection and scaling for transportation projects.

Objective 1, Ground Motion Selection, will consist of selecting a versatile set of ground motions for the TSRP program, to enable researchers to perform a variety of studies while still using a standardized set of ground motions.

To maximize the value of the ground motions selected, Objective 2, Guidance for Use of Ground Motions, will be conducted. These activities focus on enabling users to perform useful analyses with this ground motion set, which contains several new features that researchers will not be experienced in utilizing. The techniques will be demonstrated using example analyses of simple bilinear SDOF's, to transparently illustrate the procedures in a situation where the audience can intuitively predict resulting responses.

Incremental Dynamic Analysis (IDA) has become a popular tool for use in Performance Based Earthquake Engineering (PBEE), to quantify the relationship between ground motion intensity measure (IM) and structural response. A notable shortcoming of this approach, however, is that the input ground motions are considered to be identical at all IM levels, while probabilistic seismic hazard analysis (PSHA) clearly show that ground motion properties (such as causal magnitude and spectral shape) change as the IM changes. Objective 3 of this project, Demonstration of Adaptive Incremental Dynamic Analysis, will improve current IDA methods, to account for the fact that these grounmotion properties change with the IM.

Research Outcomes

The following files document selected ground motions for use in the PEER transportation systems research program.

Data format and documentation

- All ground motions are three-component
- All ground motions come from the PEER NGA database, and are indexed by "NGA number" for easy cross referencing with the NGA Flatfile
- Additional information not in the current NGA Flatfile is included in supplemental spreadsheets
  - Directivity pulse periods
  - Scale factors (if applicable)
  - Component response spectra of scaled motions
  - ε values

Broadband ground motions

- Selected to match the median *and variability* in response spectra associated with an M = 7, R = 10 km strike slip earthquake

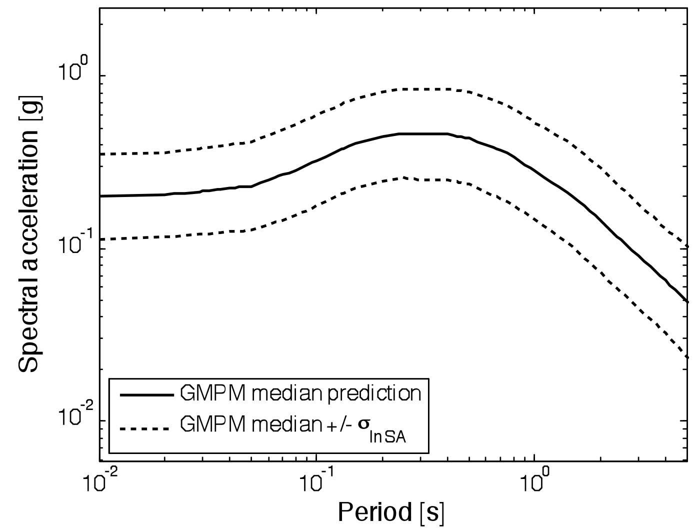
- Separate sets are provided for soil and rock conditions (V_{s30} = 250m/s and 760m/s)
  - Recordings from appropriate sites
  - Target spectra account for site conditions

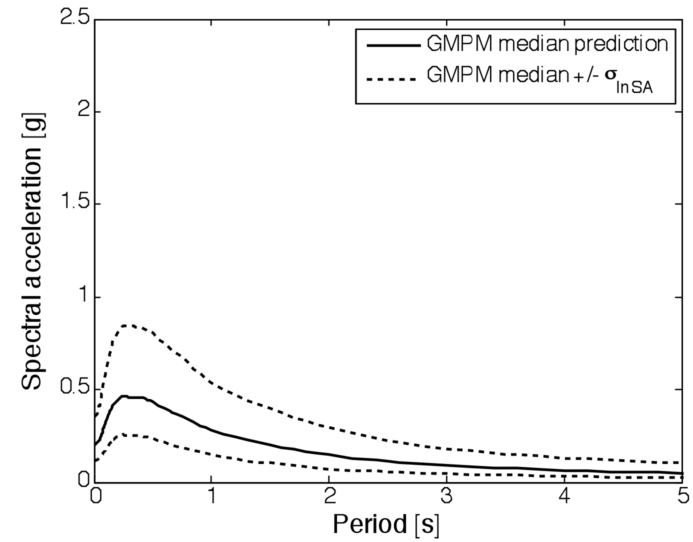
- A set is provided for lower-amplitude shaking (M = 6, R = 25 km V_{s30} = 250m/s)

- This required development of a new ground motion selection algorithm:

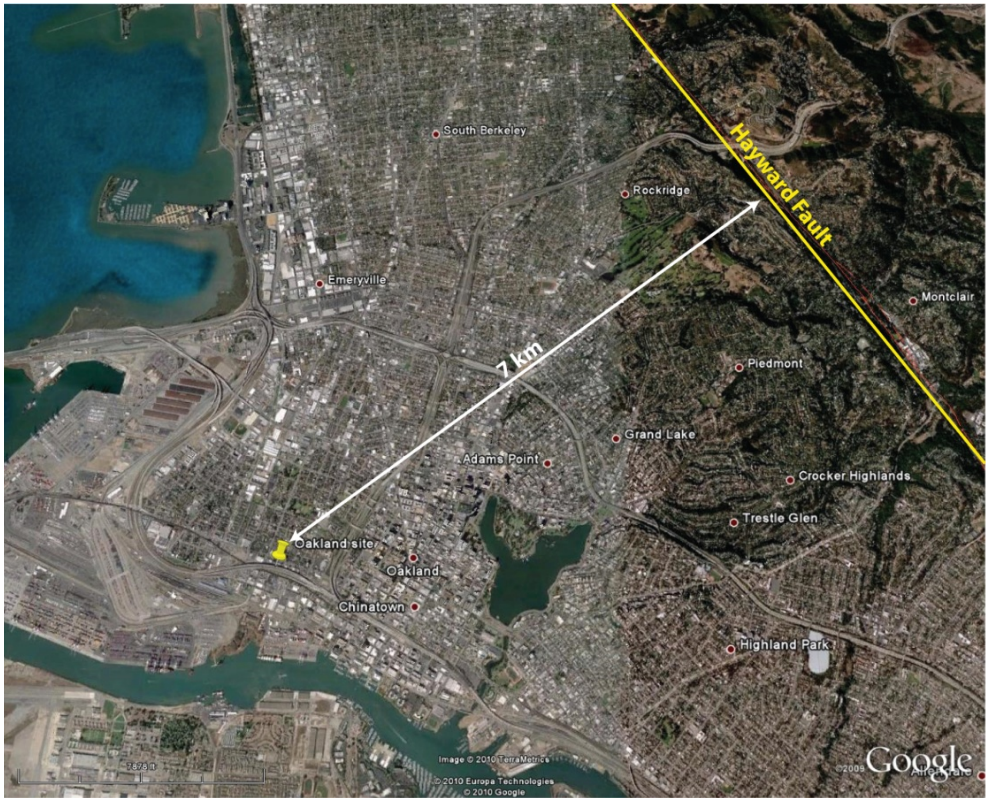
Jayaram, N., Lin, T., and Baker, J. W. (2011). "A computationally efficient ground-motion selection algorithm for matching a target response spectrum mean and variance." *Earthquake Spectra*, (in press).

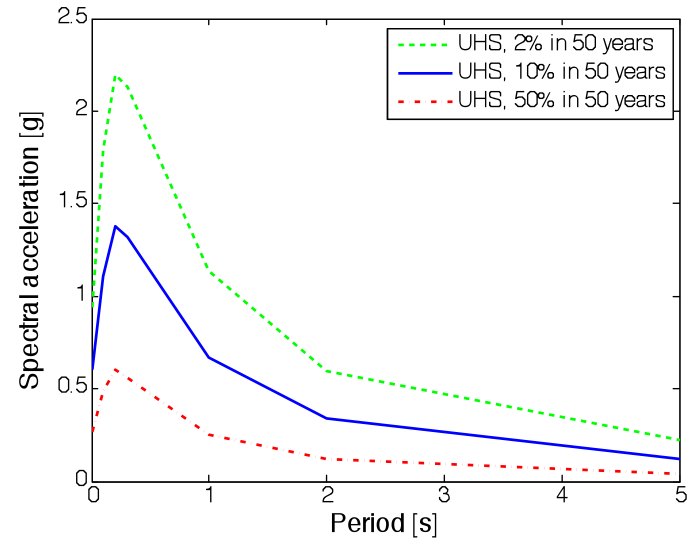
Target spectrum:

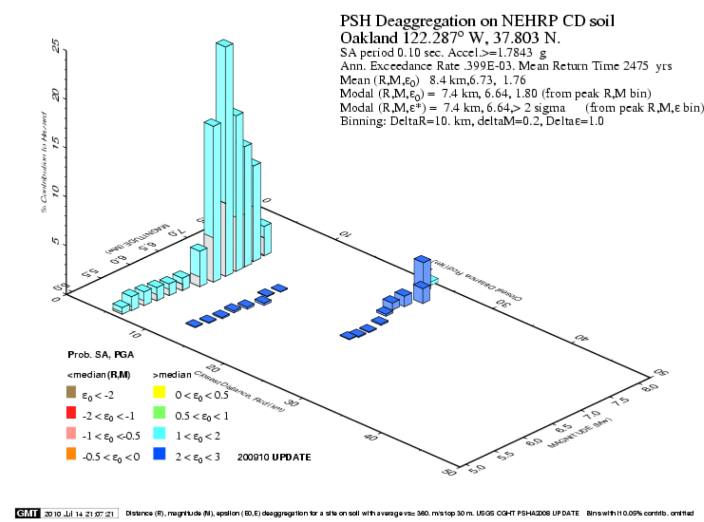




Site-specific ground motions for Oakland I-880 Viaduct



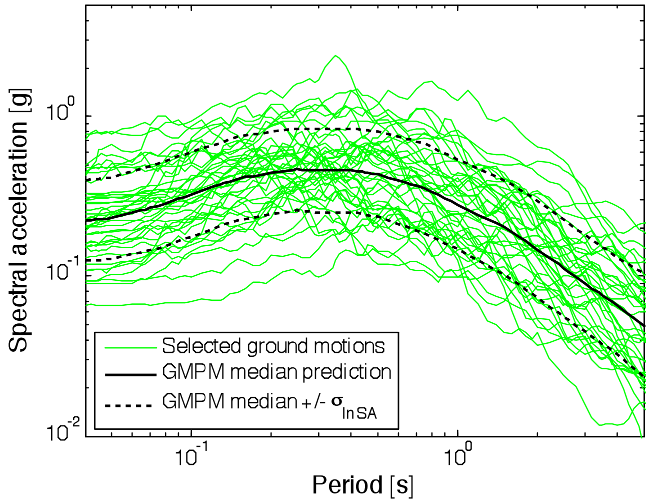


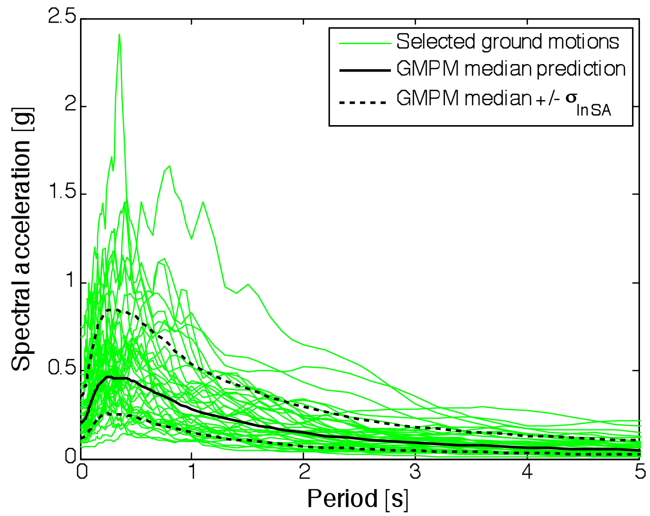


- Same location as the PEER I880 testbed
- Ground motions selected to *closely* match USGS Uniform Hazard Spectra and Deaggregations

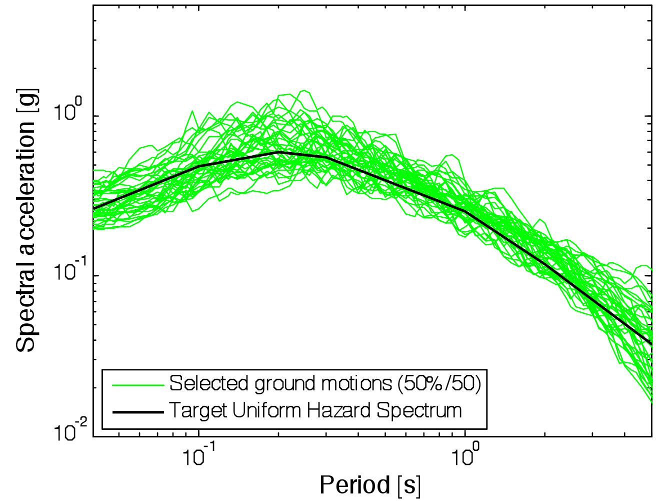
Comparison of ground motions

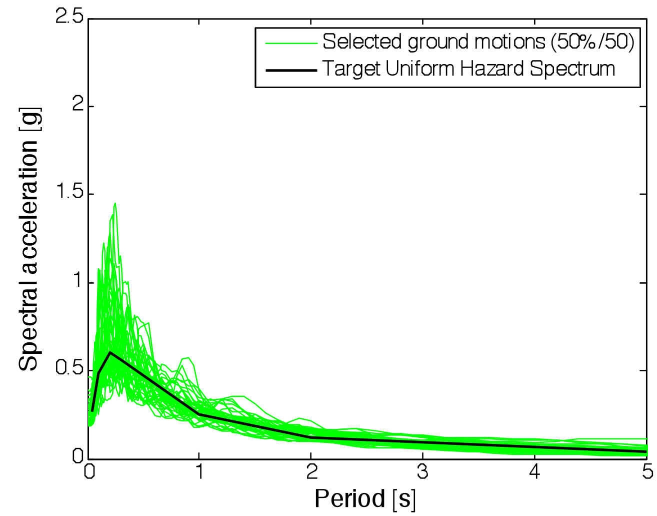
Broadband soil ground motions





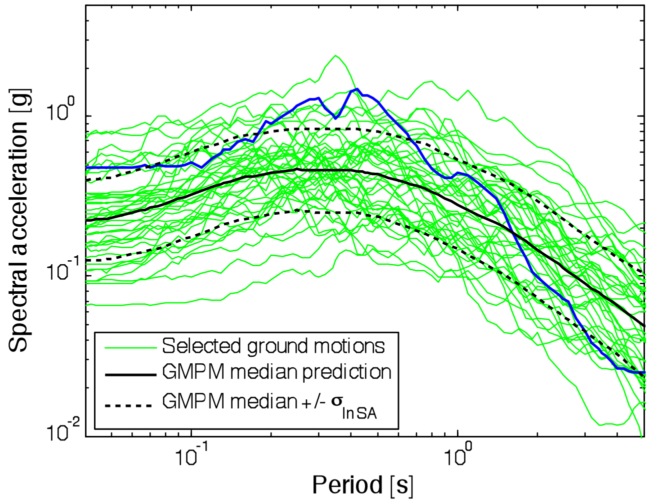
50%/50 yrs site-specific ground motions

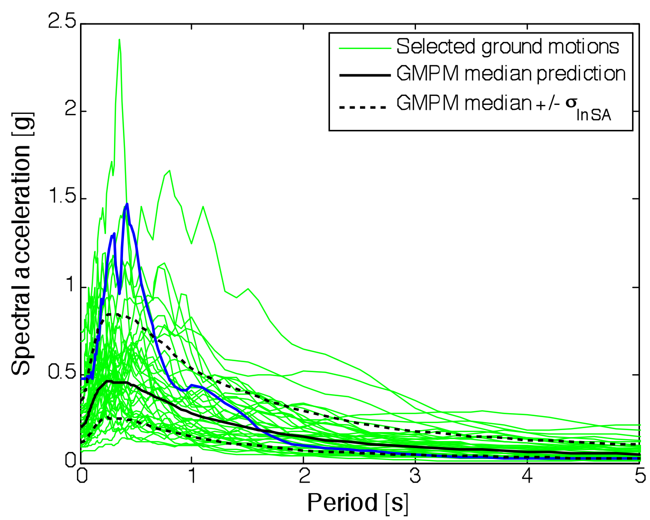




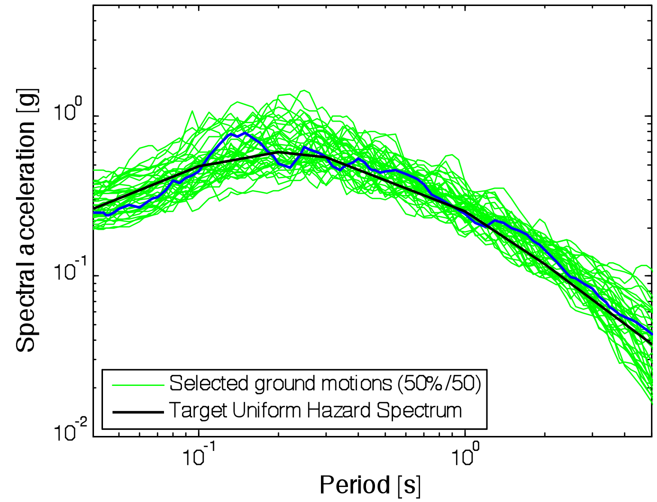
Comparison of ground motion spectra

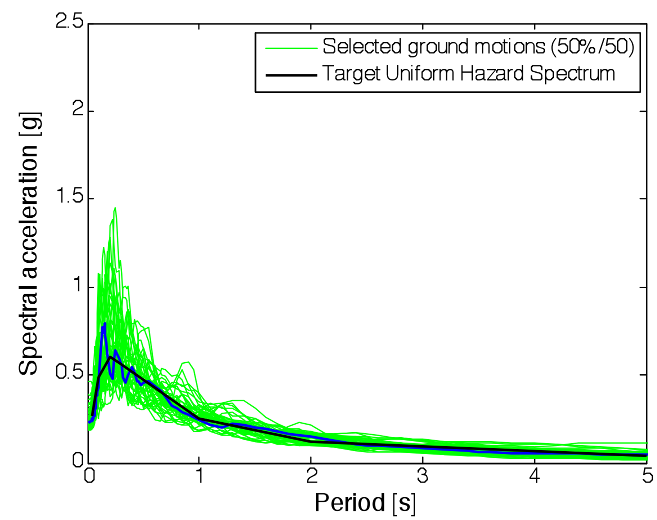
Broadband soil ground motions





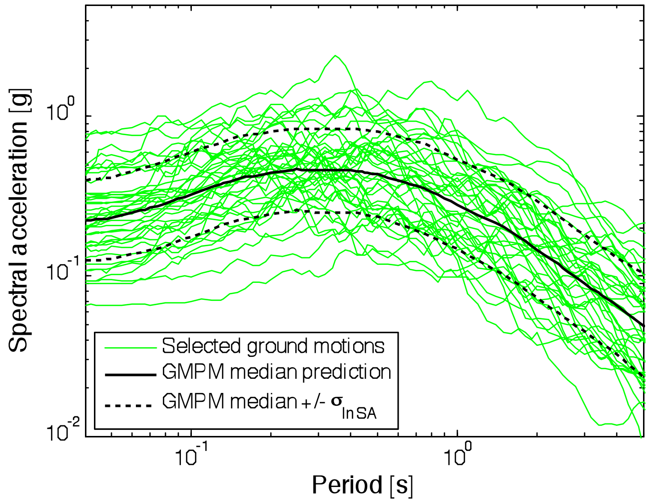
50%/50 yrs site-specific ground motions



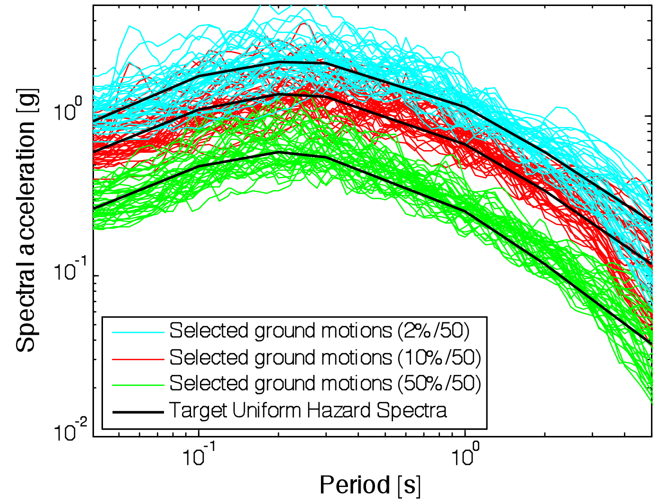


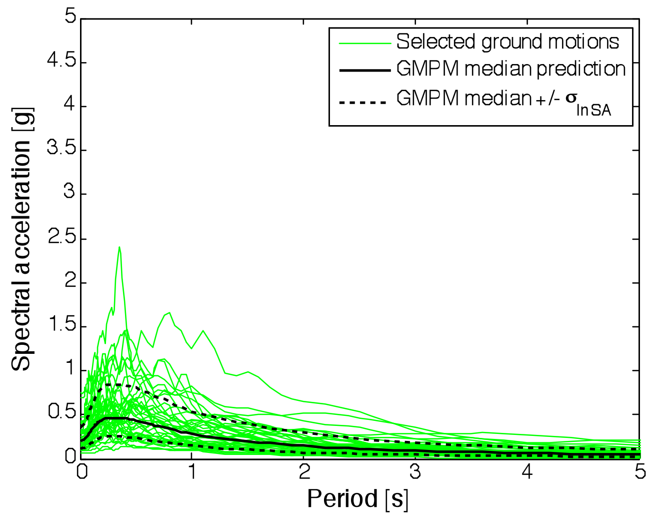
Comparison of ground motion spectra

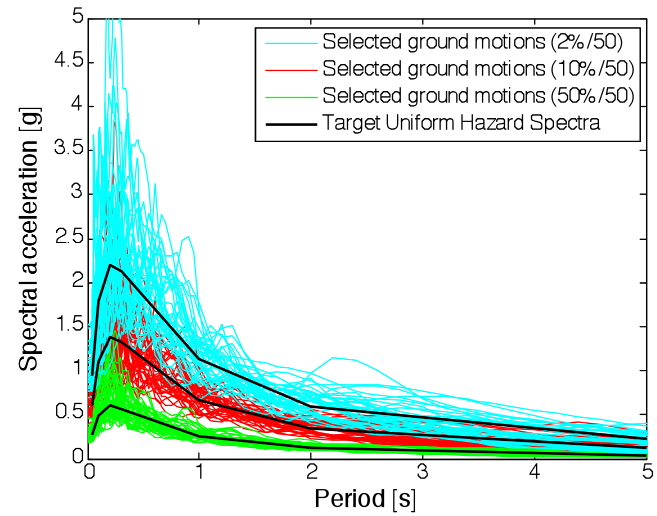
Broadband soil ground motions



Site-specific ground motions

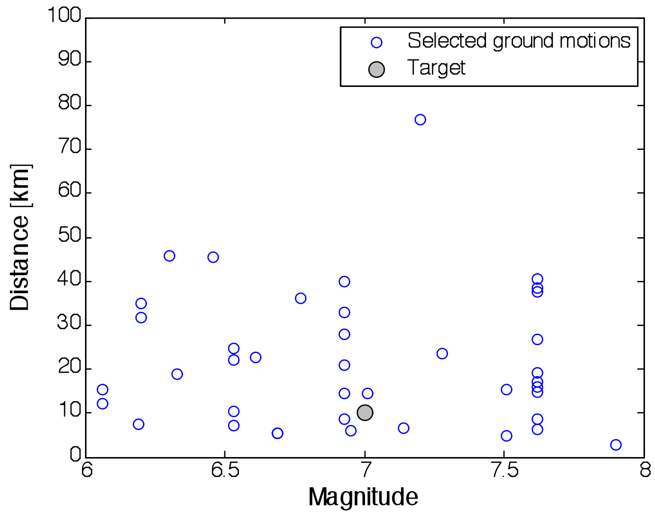






Comparison of other ground motion properties

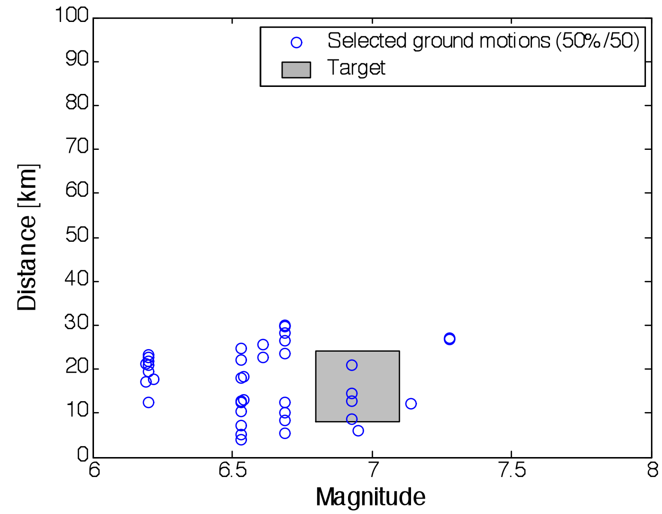
Broadband soil ground motions



Other properties

- Variability included
- No scaling
- Velocity pulses not specifically included or excluded

50%/50 yrs site-specific ground motions



Other properties

- No variability desired in spectra or other properties
- Scaled to match targets
- Velocity pulses included in proportion to expected occurrence at the site of interest

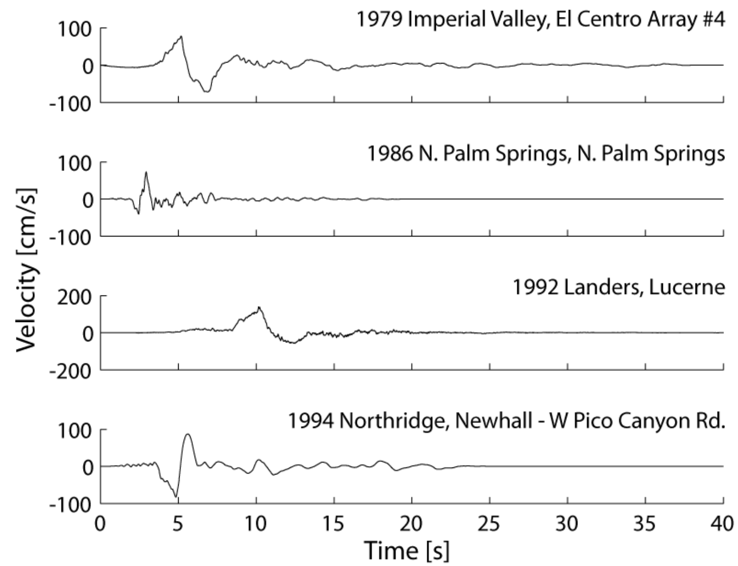
Another set of ground motions: near-fault motions with pulses

Set #3: Pulse-like ground motions

See the report above for background regarding the selection of these ground motions. Further information on the technique used to identify these ground motions is available here.

- Spreadsheet documenting the properties of the selected pulse-like ground motions. (Excel file – 1.75 MB)
- Zip file containing acceleration and velocity time histories for the 40 selected pulse-like ground motions. Strike-normal, strike-parallel and vertical components are included. Separate sets of these time histories are provided for the original ground motions, extracted pulses, and residual ground motions. (Zip file – 16.2 MB)
- Link to web page listing selected pulse-like ground motions, and providing plots of pulse indicators and peak ground velocities for arbitrary horizontal orientations.

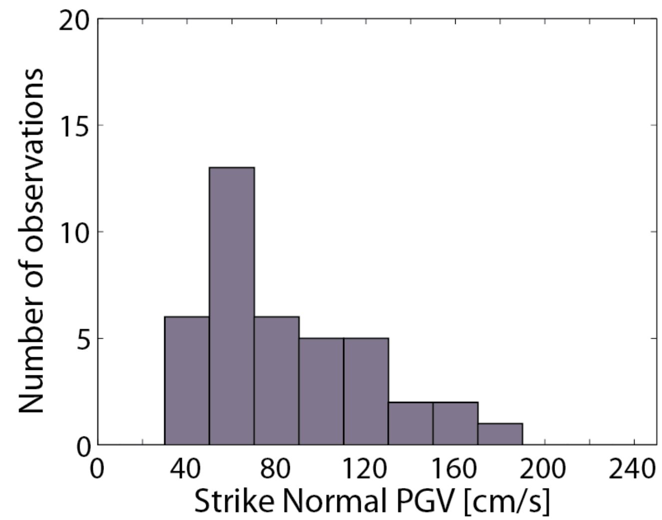
- Forty ground motions with strong velocity pulses in the fault-normal component are provided
- Pulse periods vary
- The ground motions are unscaled

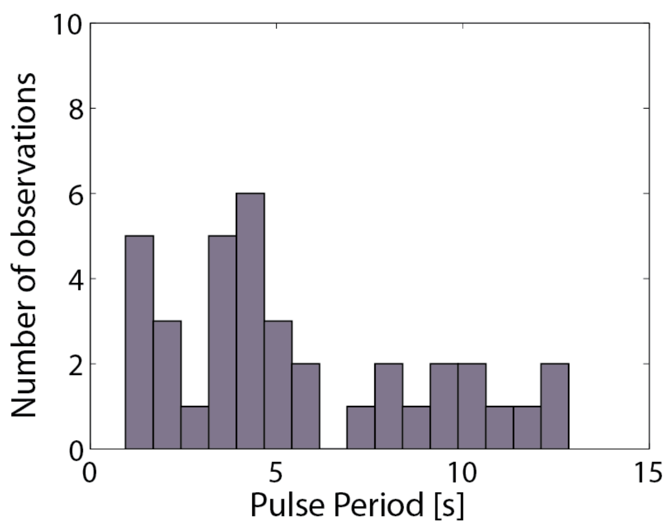


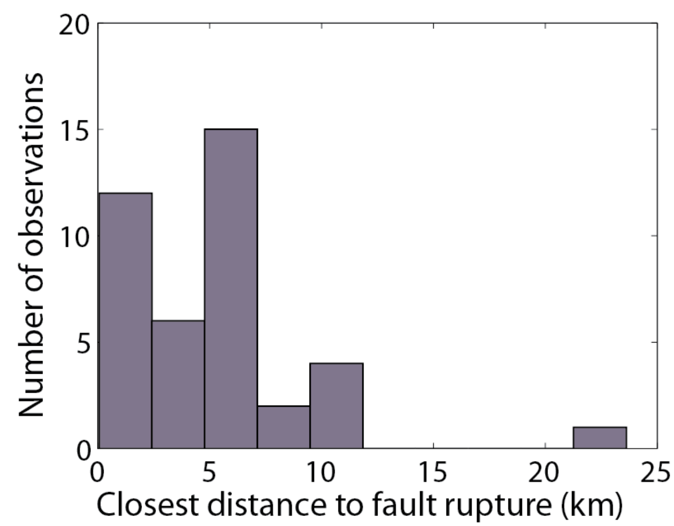
Near-fault motions with pulses

- These motions are all high intensity and recorded close to faults

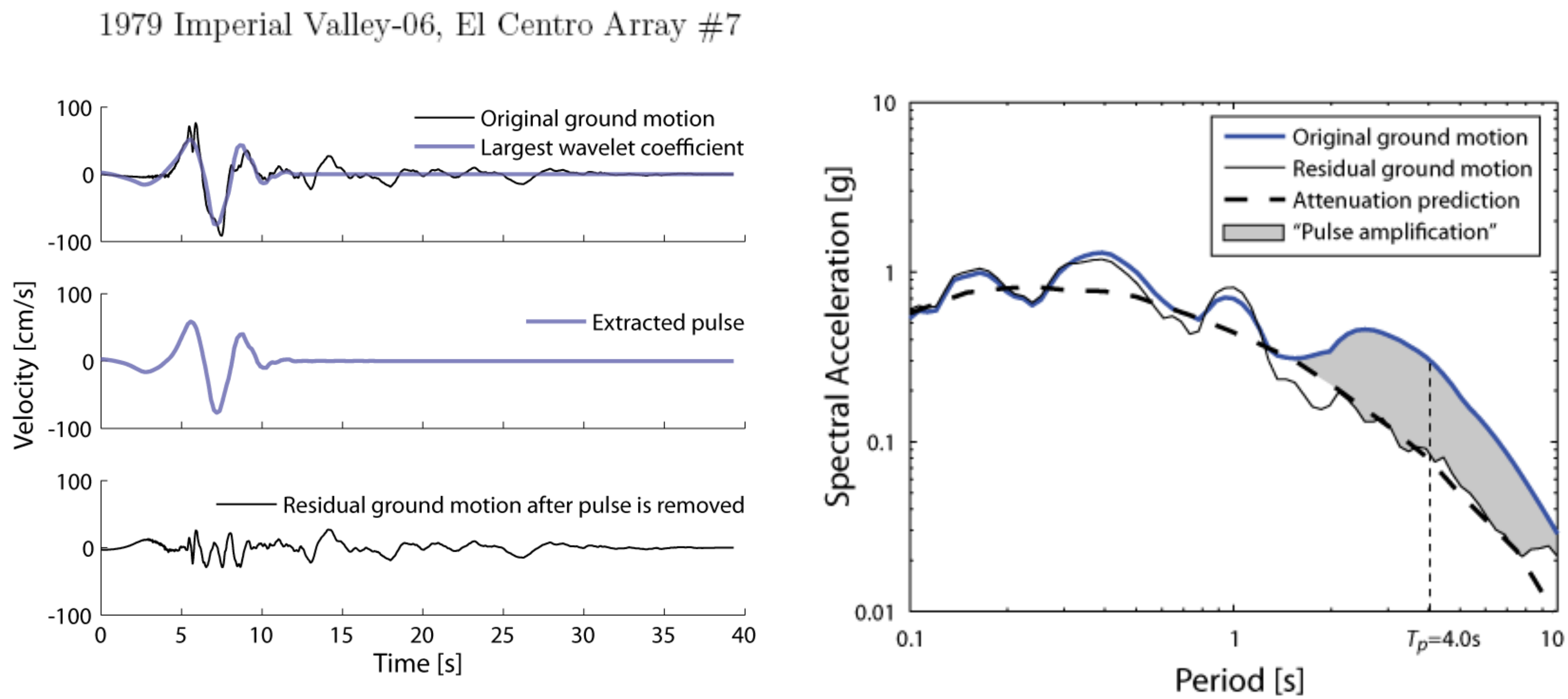
- They have a variety of pulse periods, in recognition of the variety of structures that they might be used to analyze







Additional data for the near-fault motions with pulses



Time histories and response spectra for all three "parts" of the ground motions are available

Baker, J.W. (2007). "Quantitative Classification of Near-Fault Ground Motions Using Wavelet Analysis." *Bulletin of the Seismological Society of America*, 97(5), 1486-1501.

Provided data: summary metadata from NGA Flatfile

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Record number**	**NGA Record Sequence Number**	**Earthquake Name**	**Year**	**Station**	**Magnitude**	**Hypocentral Distance**	**Closest Distance**	**Preferred Vs30 (m/s)**	**Assumed Fault Normal Orientation**	**Filename_Vertical**	**Filename_FN**
2	1	231	'Mammoth Lakes-01'	1980	'Long Valley Dam (Upr L Abut)'	6.06	15.52	15.46	345.4	282	'M7_soil_UP_1.acc'	'M7_soil_FN_1.
3	2	1203	'Chi-Chi, Taiwan'	1999	'CHY036'	7.62	44.74	16.06	233.1	292	'M7_soil_UP_2.acc'	'M7_soil_FN_2.
4	3	829	'Cape Mendocino'	1992	'Rio Dell Overpass - FF'	7.01	24.55	14.33	311.8	260	'M7_soil_UP_3.acc'	'M7_soil_FN_3.
5	4	169	'Imperial Valley-06'	1979	'Delta'	6.53	35.17	22.03	274.5	233	'M7_soil_UP_4.acc'	'M7_soil_FN_4.
6	5	1176	'Kocaeli, Turkey'	1999	'Yarimca'	7.51	25.07	4.83	297	180	'M7_soil_UP_5.acc'	'M7_soil_FN_5.
7	6	163	'Imperial Valley-06'	1979	'Calipatria Fire Station'	6.53	58	24.6	205.8	233	'M7_soil_UP_6.acc'	'M7_soil_FN_6.
8	7	1201	'Chi-Chi, Taiwan'	1999	'CHY034'	7.62	46.82	14.82	378.8	292	'M7_soil_UP_7.acc'	'M7_soil_FN_7.
9	8	1402	'Chi-Chi, Taiwan'	1999	'NST'	7.62	89.2	38.43	375.3	306	'M7_soil_UP_8.acc'	'M7_soil_FN_8.
10	9	1158	'Kocaeli, Turkey'	1999	'Duzce'	7.51	99.52	15.37	276	163	'M7_soil_UP_9.acc'	'M7_soil_FN_9.
11	10	281	'Trinidad'	1980	'Rio Dell Overpass, E Ground'	7.2	78.22	-	311.8	319	'M7_soil_UP_10.acc'	'M7_soil_FN_10
12	11	730	'Spitak, Armenia'	1988	'Gukasian'	6.77	36.68	-	274.5	212	'M7_soil_UP_11.acc'	'M7_soil_FN_11
13	12	768	'Loma Prieta'	1989	'Gilroy Array #4'	6.93	36.79	14.34	221.8	38	'M7_soil_UP_12.acc'	'M7_soil_FN_12
14	13	1499	'Chi-Chi, Taiwan'	1999	'TCU060'	7.62	46.07	8.53	272.6	278	'M7_soil_UP_13.acc'	'M7_soil_FN_13
15	14	266	'Victoria, Mexico'	1980	'Chihuahua'	6.33	38.29	18.96	274.5	228	'M7_soil_UP_14.acc'	'M7_soil_FN_14
16	15	761	'Loma Prieta'	1989	'Fremont - Emerson Court'	6.93	57.86	39.85	284.8	38	'M7_soil_UP_15.acc'	'M7_soil_FN_15
17	16	558	'Chalfant Valley-02'	1986	'Zack Brothers Ranch'	6.19	17.47	7.58	271.4	58	'M7_soil_UP_16.acc'	'M7_soil_FN_16
18	17	1543	'Chi-Chi, Taiwan'	1999	'TCU118'	7.62	44.49	26.84	215	271	'M7_soil_UP_17.acc'	'M7_soil_FN_17
19	18	2114	'Denali, Alaska'	2002	'TAPS Pump Station #10'	7.9	84.89	2.74	329.4	199	'M7_soil_UP_18.acc'	'M7_soil_FN_18
20	19	179	'Imperial Valley-06'	1979	'El Centro Array #4'	6.53	28.9	7.05	208.9	233	'M7_soil_UP_19.acc'	'M7_soil_FN_19

Provided data: documentation of metadata

	A	B
1	**PEER broadband ground motions for soil sites**	
2	**Prepared by Nirmal Jayaram and Jack Baker, Stanford University**	
3	**November 15, 2009**	
4		
5	This spreadsheet provides documentation for the PEER "soil broadband" ground motions. A brief description of the includ	
6		
7	These ground motions were selected so that their response spectra match the median and log standard deviations predict	
8	Magnitude = 7 earthquake	
9	Source-to-site distance = 10 km	
10	Site Vs30 = 250 m/s	
11	Earthquake mechanism = strike slip	
12	Response spectra predictions from the Boore and Atkinson (2008) ground motion model	
13		
14		
15	**"Records" Worksheet**	
16	This worksheet provides basic summary data regarding the selected ground motions. Columns are defined as follows:	
17		
18	Record number	Numbering for the selected ground motions. This matches the numbering of the ti
19	NGA Record Sequence Number	The corresponding record sequence number from the NGA Flatfile at http://peer.b
20	Earthquake Name	Earthquake name, from NGA Flatfile
21	Year	Year of earthquake
22	Station	Name of station where ground motion was recorded, from NGA Flatfile
23	Magnitude	Moment magnitude of earthquake
24	Hypocentral Distance	Distance from the recording site to hypocenter.
25	Closest Distance	Closest distance from the recording site to the ruptured area (if available)
26	Preferred Vs30 (m/s)	Preferred Vs30 from NGA Flatfile
27	Assumed Fault Normal Orientation	Assumed fault-normal orientation, used for rotating ground motions to fault-norm
28	Filename_Vertical	Filename for the vertical component of the ground motion
29	Filename_FN	Filename for the fault normal component of the ground motion
30	Filename_FP	Filename for the fault parallel component of the ground motion
31		
32	**"Response spectra" worksheet**	
33	Tabulated response spectra (in units of g) are provided here for the 40 selected ground motions	

Provided data: response spectra

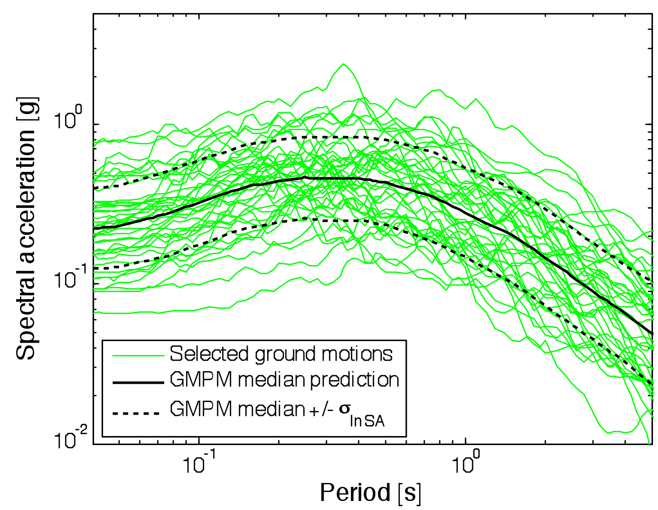
Target spectra, and response spectra for each horizontal component of each ground motion, geometric mean spectra, GMRotI50 spectra

Predictions from the Boore and Atkinson (2008) ground-motion prediction model

	Period (s) →																
	0.01	**0.02**	**0.022**	**0.025**	**0.029**	**0.03**	**0.032**	**0.035**	**0.036**	**0.04**	**0.042**	**0.044**	**0.045**	**0.046**	**0.048**	**0.05**	**0.055**
Median	0.199915	0.204768	0.207176	0.210451	0.214319	0.215212	0.217075	0.219688	0.220516	0.223641	0.225103	0.226506	0.227186	0.227854	0.229153	0.230406	0.240183
Log Standard deviation	0.566	0.566	0.568351	0.571503	0.575164	0.576	0.577642	0.579923	0.58064	0.583321	0.584563	0.585747	0.586319	0.586878	0.587961	0.589	0.592996

Geometric mean of FN/FP components

		Period (s) →																
		0.01	**0.02**	**0.022**	**0.025**	**0.029**	**0.03**	**0.032**	**0.035**	**0.036**	**0.04**	**0.042**	**0.044**	**0.045**	**0.046**	**0.048**	**0.05**	**0.055**
Record #	**1**	0.332808	0.329604	0.331231	0.334937	0.340809	0.348155	0.369678	0.413019	0.431402	0.495294	0.521013	0.555085	0.564498	0.58352	0.566915	0.573794	0.555106
↓	**2**	0.256526	0.256173	0.256273	0.256437	0.25674	0.256956	0.257665	0.258145	0.259775	0.259704	0.259835	0.263563	0.266454	0.267079	0.266536	0.275127	0.275386
	3	0.481281	0.481281	0.481281	0.481281	0.481281	0.481281	0.481281	0.481281	0.481281	0.481281	0.474968	0.475651	0.476949	0.47649	0.477132	0.480902	0.478264
	4	0.281412	0.281412	0.280105	0.281004	0.281889	0.28137	0.289974	0.283872	0.280184	0.283723	0.28386	0.285557	0.285505	0.285977	0.28879	0.29038	0.28836
	5	0.295792	0.295518	0.295512	0.296031	0.297932	0.299059	0.298639	0.297522	0.296478	0.302845	0.312576	0.312762	0.312444	0.309484	0.313117	0.31425	0.312129
	6	0.10198	0.101568	0.101592	0.101748	0.102378	0.102424	0.103898	0.104895	0.106341	0.10							
	7	0.312625	0.312752	0.312953	0.313301	0.314632	0.315376	0.31569	0.317871	0.316723	0.32							
	8	0.40282	0.40062	0.400505	0.402488	0.404821	0.404732	0.407654	0.406782	0.413368	0.42							
	9	0.326152	0.325907	0.325925	0.326134	0.326391	0.326497	0.326706	0.326755	0.327022	0.32							
	10	0.14715	0.146179	0.146584	0.146941	0.147305	0.147133	0.148214	0.148941	0.150435	0.15							
	11	0.205186	0.205186	0.20483	0.205468	0.205993	0.205888	0.205485	0.20472	0.204091	0.20							
	12	0.299604	0.299372	0.299289	0.299407	0.299624	0.299554	0.300031	0.300601	0.300656	0.30							
	13	0.151939	0.151822	0.151776	0.151871	0.152045	0.152109	0.152499	0.153633	0.153479	0.15							
	14	0.118765	0.118765	0.118423	0.118549	0.118938	0.119183	0.121213	0.119359	0.118646	0.11							
	15	0.158686	0.158104	0.158171	0.158369	0.158746	0.158986	0.159429	0.160018	0.159231	0.16							
	16	0.399877	0.398091	0.398842	0.399692	0.399569	0.401318	0.404694	0.405034	0.407835	0.45							
	17	0.102779	0.102581	0.102605	0.102873	0.103298	0.103264	0.104023	0.106262	0.105074	0.10							
	18	0.308684	0.308181	0.308157	0.308372	0.3089	0.309091	0.309621	0.310047	0.310337	0.31							
	19	0.413965	0.412511	0.412305	0.412837	0.414479	0.417201	0.418358	0.417732	0.430748	0.43							
	20	0.090349	0.090349	0.089683	0.089686	0.090747	0.090496	0.09033	0.089722	0.089974	0.08							
	21	0.223681	0.223681	0.223681	0.223681	0.223681	0.223681	0.223681	0.223681	0.223681	0.22							
	22	0.688884	0.688777	0.688107	0.689434	0.692428	0.693569	0.69601	0.700731	0.702941	0.71							
	23	0.199549	0.199549	0.193579	0.199424	0.193373	0.19307	0.208143	0.205781	0.208109	0.2							
	24	0.222839	0.223079	0.222843	0.222863	0.226173	0.22696	0.227089	0.229339	0.237154	0.22							
	25	0.285636	0.285621	0.285689	0.286095	0.286166	0.286026	0.286304	0.286196	0.286553	0.28[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



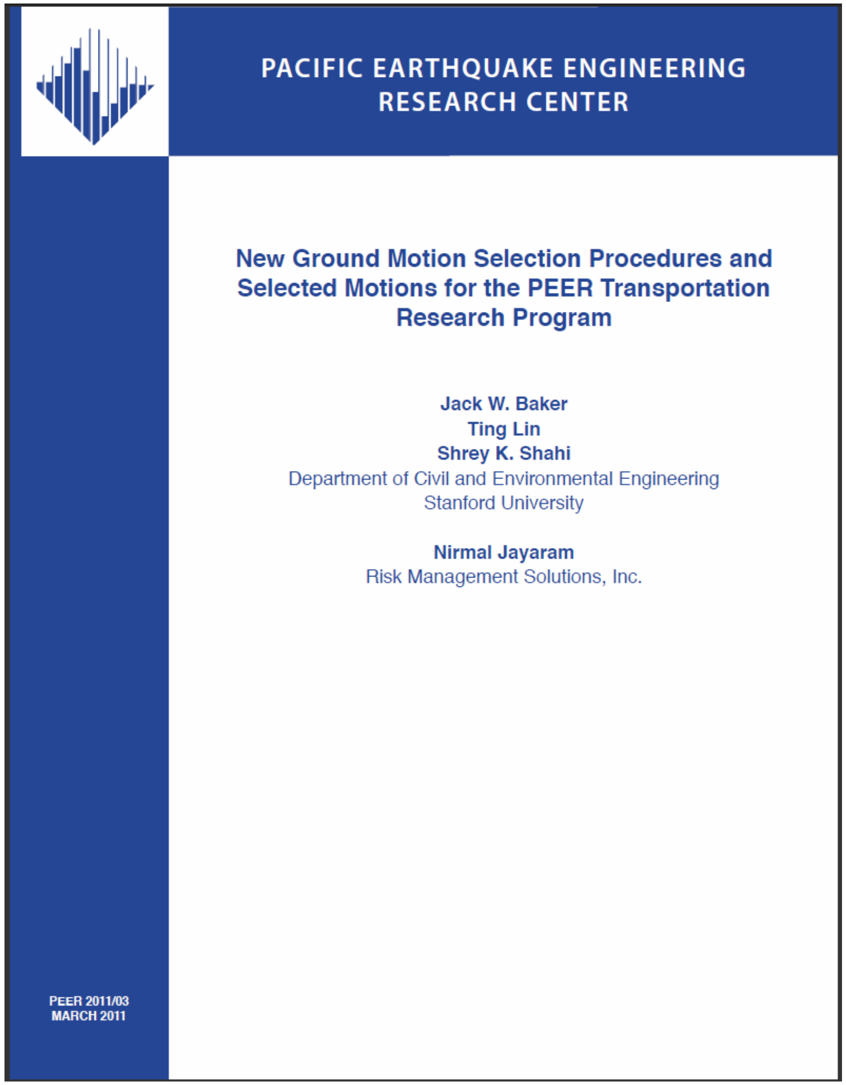
Provided data: prediction residuals (ε ’s)

Prediction residuals for spectra of each horizontal component of each ground motion, geometric mean spectra and GMRotI50 spectra

GMRotI50 residuals																			
		Period (s) →																	
		0.01	0.02	0.022	0.025	0.029	0.03	0.032	0.035	0.036	0.04	0.042	0.044	0.045	0.046	0.048	0.05	0.055	
Record # ↓	1	1.97599	2.070995	2.107328	2.133792	2.268485	2.264258	2.290807	2.375892	2.384202	2.44911	2.433508	2.440995	2.418731	2.363295	2.319344	2.302782	2.0566	2
	2	0.486193	0.451764	0.431063	0.403145	0.368597	0.363014	0.363094	0.358379	0.356964	0.354741	0.366257	0.368917	0.35803	0.346177	0.329944	0.334088	0.29143	0
	3	0.735945	0.681398	0.644476	0.612724	0.578367	0.572789	0.550655	0.519224	0.502694	0.479805	0.464017	0.457296	0.453384	0.439635	0.453737	0.492788	0.555183	0
	4	1.300931	1.237977	1.225957	1.219205	1.23871	1.225673	1.159056	1.098496	1.118901	1.289841	1.273631	1.267167	1.288469	1.316971	1.369583	1.378079	1.367975	1
	5	-0.78333	-0.84425	-0.85348	-0.87534	-0.92296	-0.92686	-0.95437	-0.95518	-0.95802	-1.00704	-1.05128	-1.05249	-1.06071	-1.07274	-1.09393	-1.11783	-1.18837	-
	6	-0.14199	-0.12651	-0.15622	-0.13928	-0.1176	-0.10238	-0.09282	-0.1063	-0.11006	-0.23877	-0.21774	-0.19206	-0.19826	-0.21574	-0.26199	-0.23943	-0.13662	-
	7	0.233761	0.183758	0.165135	0.146196	0.122239	0.114758	0.107052	0.110913	0.108094	0.085341	0.037483	0.029745	0.043959	0.049853	0.056213	0.079002	0.008242	-
	8	1.510041	1.494026	1.48228	1.443004	1.424093	1.413672	1.397859	1.678843	1.729997	1.797458	1.945948	1.951417	1.971431	2.018063	2.017882	2.067098	1.88636	1
	9	0.522818	0.47122	0.447837	0.417461	0.38338	0.375982	0.358788	0.338627	0.335666	0.299286	0.286664	0.288526	0.290181	0.289967	0.280358	0.265415	0.195892	0
	10	-2.27889	-2.33414	-2.34227	-2.35612	-2.40135	-2.38173	-2.34788	-2.37924	-2.41711	-2.40393	-2.40016	-2.40641	-2.40926	-2.42579	-2.49936	-2.49599	-2.42422	-
	11	-1.32024	-1.38842	-1.41169	-1.43918	-1.45526	-1.46258	-1.50497	-1.47041	-1.45366	-1.50384	-1.47603	-1.40943	-1.38615	-1.35779	-1.33381	-1.38298	-1.51601	-
	12	1.187741	1.163378	1.142551	1.113136	1.083127	1.077495	1.063882	1.058017	1.053659	1.042713	1.030986	1.018672	1.01514	1.030052	1.031116	1.021673	0.918118	0
	13	-1.07112	-1.12879	-1.14174	-1.17062	-1.18895	-1.19568	-1.19722	-1.20885	-1.22394	-1.23503	-1.23672	-1.2589	-1.27386	-1.27667	-1.27273	-1.25109	-1.19657	-
	14	-0.21494	-0.26644	-0.2849	-0.30823	-0.32812	-0.32738	-0.34619	-0.3875	-0.40363	-0.37953	-0.35543	-0.32506	-0.31727	-0.30186	-0.28078	-0.30671	-0.27293	-
	15	0.514009	0.495334	0.485394	0.475418	0.457539	0.452002	0.438012	0.446635	0.454069	0.440093	0.409785	0.378085	0.367021	0.375302	0.403693	0.45424	0.46368	0
	16	1.395846	1.340358	1.300194	1.27672	1.237066	1.220102	1.20273	1.230885	1.230001	1.159907	1.170015	1.176666	1.206106	1.232247	1.283432	1.280826	1.244816	
	17	-0.91818	-0.92369	-0.93212	-0.9212	-0.95125	-0.92991	-0.92706	-0.88071	-0.87041	-0.87116	-0.86617	-0.86042	-0.8579	-0.85925	-0.83398	-0.82675	-0.70842	-
	18	-0.92945	-0.99266	-1.02075	-1.0581	-1.09576	-1.10417	-1.12432	-1.15438	-1.16318	-1.18921	-1.19694	-1.21032	-1.22159	-1.23207	-1.25234	-1.25186	-1.31028	-
	19	1.469576	1.456961	1.443438	1.368229	1.373531	1.360512	1.30844	1.40758	1.434034	1.455144	1.468871	1.488405	1.46694	1.493776	1.51584	1.509781	1.331671	
	20	-2.62177	-2.71292	-2.74078	-2.77002	-2.81064	-2.81747	-2.83825	-2.88457	-2.89744	-2.8657	-2.85108	-2.83281	-2.84377	-2.87769	-2.92762	-2.87881	-2.78517	-
	21	0.288527	0.252802	0.239339	0.191585	0.183458	0.173882	0.140137	0.117694	0.107578	0.078925	0.069284	0.055011	0.051232	0.05182	0.067549	0.066947	-0.01511	-
	22	1.19644	1.155275	1.122752	1.081215	1.043309	1.040496	1.03752	1.074056	1.116071	1.102362	1.037316	1.049809	1.014076	0.998844	1.033103	1.012551	0.906702	0
	23	0.634736	0.603527	0.614632	0.664042	0.7132	0.686877	0.734199	0.728692	0.768508	0.559884	0.646773	0.805793	0.850958	0.869931	0.859695	0.850864	0.739682	0
	24	-0.35518	-0.39143	-0.45813	-0.45688	-0.54053	-0.55049	-0.544	-0.57602	-0.57438	-0.62122	-0.67273	-0.63532	-0.64555	-0.63976	-0.64228	-0.68703	-0.75054	-
	25	1.090358	1.056733	1.039379	1.016155	0.990562	0.986125	0.969361	0.958165	0.953237	0.921685	0.906657	0.896438	0.891137	0.885443	0.872209	0.867713	0.809944	0
	26	-0.53864	-0.59284	-0.59212	-0.63533	-0.66949	-0.65704	-0.63095	-0.58815	-0.59114	-0.62891	-0.61847	-0.57786	-0.53794	-0.51519	-0.5638	-0.61349	-0.60594	-

Documentation: PEER Report 2011/03

Documentation of targets, selection methodology and summary data for each selected set (106pp)



PACIFIC EARTHQUAKE ENGINEERING RESEARCH CENTER

New Ground Motion Selection Procedures and Selected Motions for the PEER Transportation Research Program

Jack W. Baker
Ting Lin
Shrey K. Shahi
Department of Civil and Environmental Engineering
Stanford University

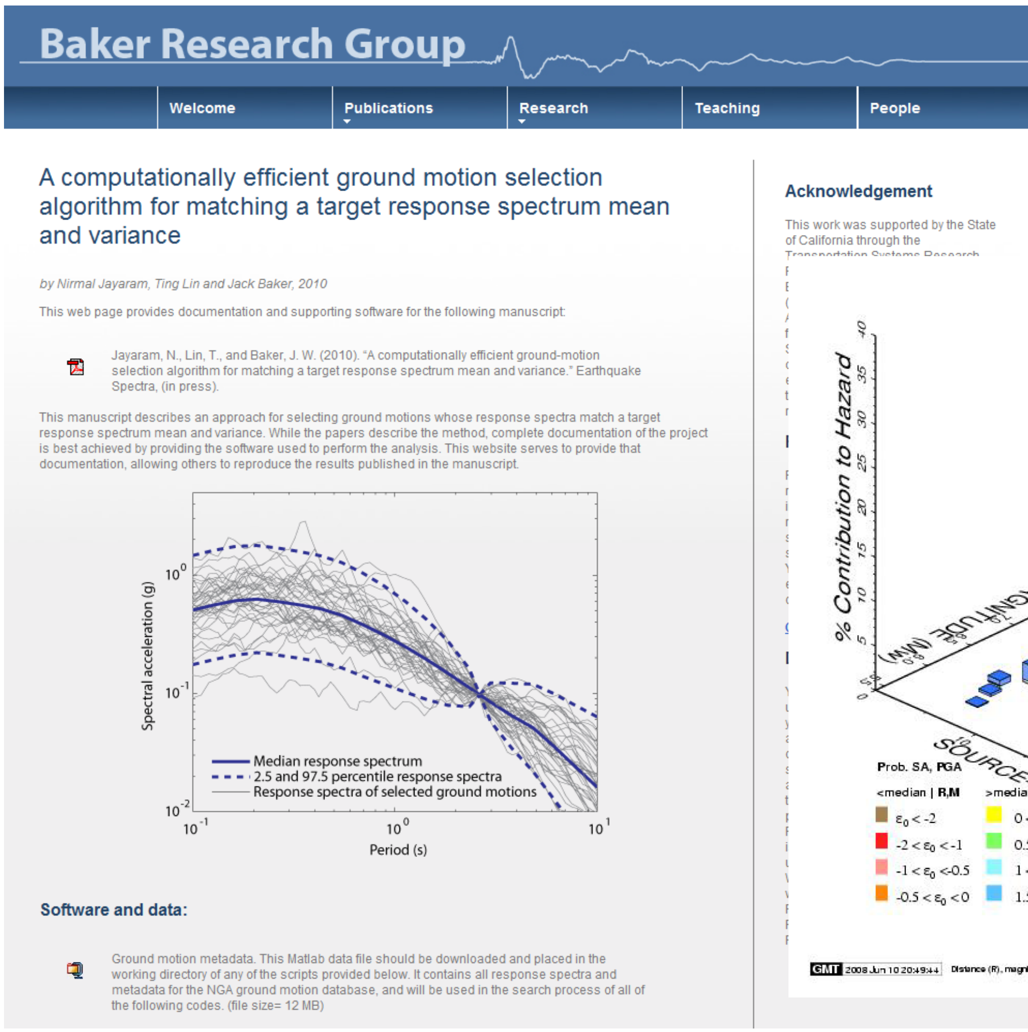
Nirmal Jayaram
Risk Management Solutions, Inc.

PEER 2011/03
MARCH 2011

Documentation: source code for broadband and CMS selection

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

Jayaram, N., Lin, T., and Baker, J. W. (2011). "A computationally efficient ground-motion selection algorithm for matching a target response spectrum mean and variance." Earthquake Spectra, (in press).



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A computationally efficient ground motion selection algorithm for matching a target response spectrum mean and variance

by Nirmal Jayaram, Ting Lin and Jack Baker, 2010

This web page provides documentation and supporting software for the following manuscript:

Jayaram, N., Lin, T., and Baker, J. W. (2010). "A computationally efficient ground-motion selection algorithm for matching a target response spectrum mean and variance." Earthquake Spectra, (in press).

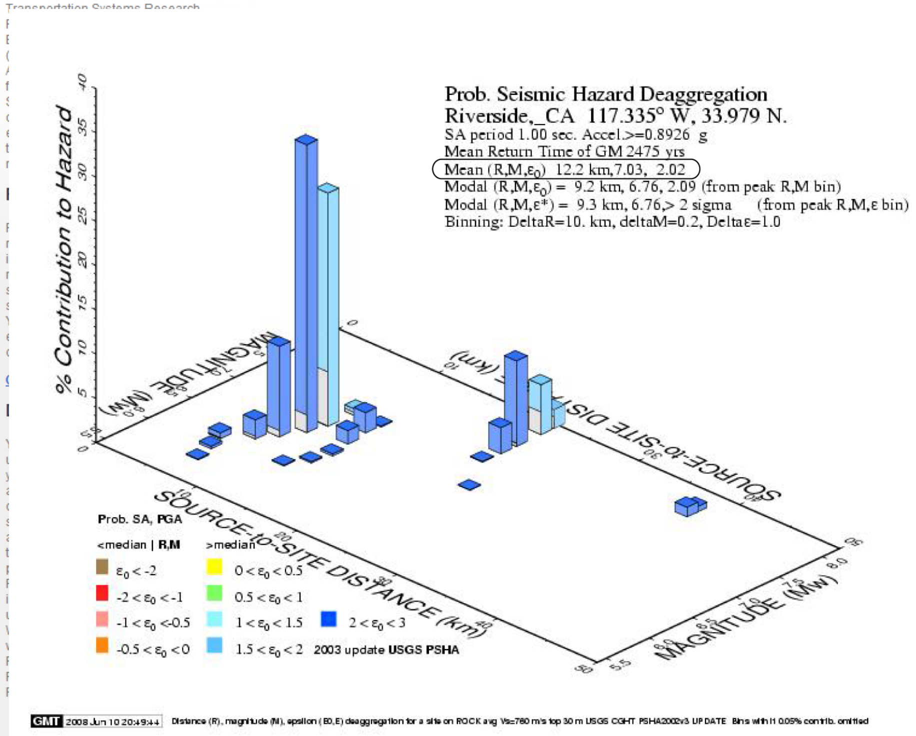
This manuscript describes an approach for selecting ground motions whose response spectra match a target response spectrum mean and variance. While the papers describe the method, complete documentation of the project is best achieved by providing the software used to perform the analysis. This website serves to provide that documentation, allowing others to reproduce the results published in the manuscript.

Software and data:

Ground motion metadata. This Matlab data file should be downloaded and placed in the working directory of any of the scripts provided below. It contains all response spectra and metadata for the NGA ground motion database, and will be used in the search process of all of the following codes. (file size= 12 MB)

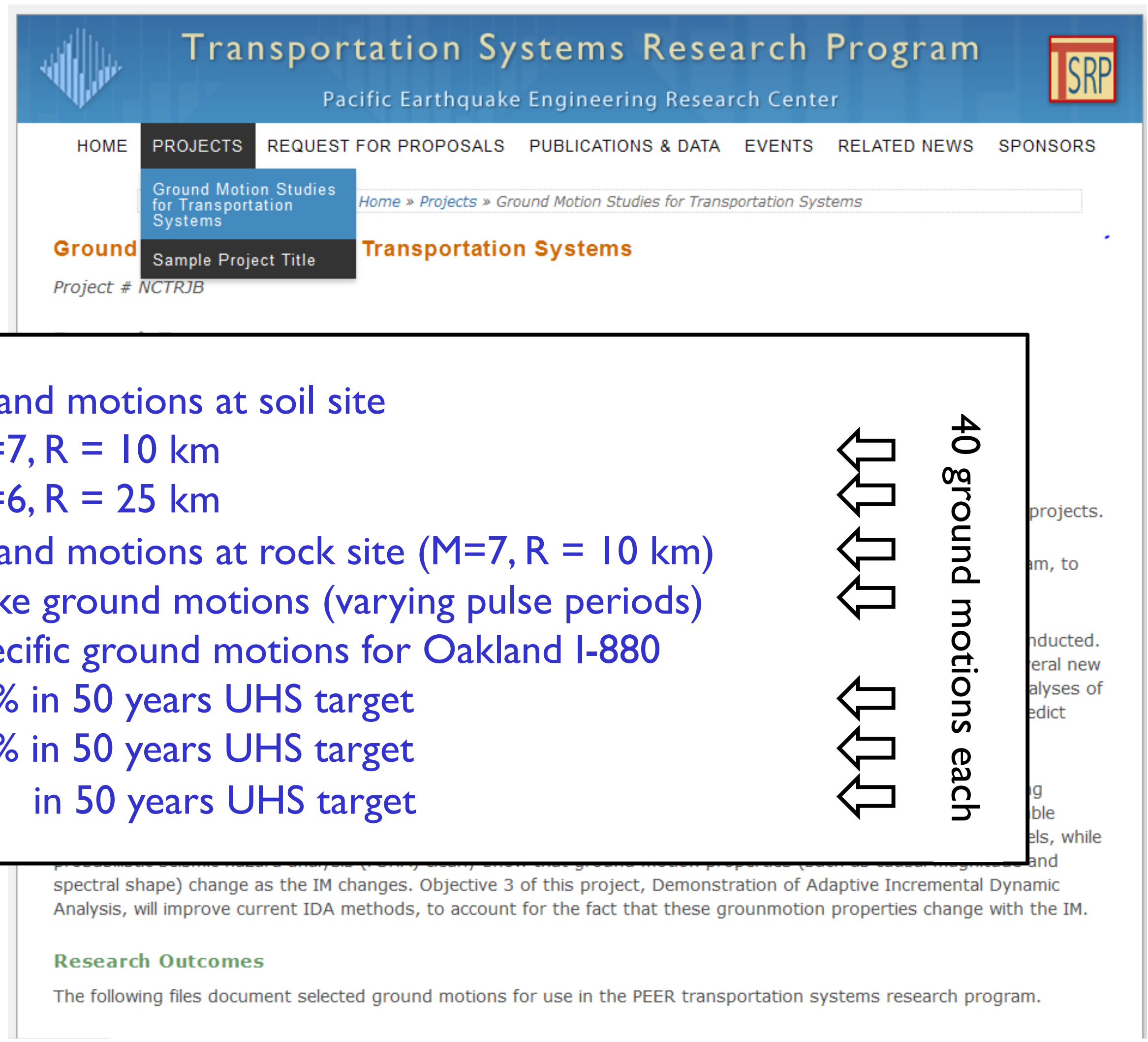
Acknowledgement

This work was supported by the State of California through the



Final product: several standardized ground motion sets

http://peer.berkeley.edu/transportation/projects/



Set 1: Broadband motions at soil site
- M=7, R = 10 km
- M=6, R = 25 km

Set 2: Broadband motions at rock site (M=7, R = 10 km)

Set 3: Pulse-like ground motions (varying pulse periods)

Set 4: Site-specific ground motions for Oakland I-880
- 50% in 50 years UHS target
- 10% in 50 years UHS target
- 2% in 50 years UHS target

40 ground motions each