

# PEER Ground Motion Selection and Modification Program

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*On behalf of the  
PEER Ground Motion Selection & Modification (GMSM) Program*

*Slide preparation in collaboration with Jack Baker, Christine Goulet, Curt Haselton, and Nico Luco*



## GMSM Objectives

- ▶ Median & probability distribution (CDF) of structural response **for a given  $S_a(T_1)$ , M, R (and S, F)\***
  - ▶ **Objectives 3 & 4**
- ▶ Median and probability distribution (CDF) of structural response **for a given M, R (and S, F)\***
  - ▶ **Objectives 1 & 2**

\* Hereafter M, R, S, & F will be abbreviated to M, R.

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## GMSM Methods for Objective 4

Index #	Name	Developer(s)	Objective(s)
4, 53	"Sa(T1) Scaling"	Shome	3 and 4
67	"ATC-58 [35% Draft] - Near-Field set"	Whittaker <i>et al</i> (Zareian)	3 and 4
<b>Sa(T1) Methods</b>			
980-9989	"Building Code Selection Mini-Study"	Baker	4
16	"Uniform Hazard Spectrum (UHS) Methods"		4
17	"Building Code (purposefully extreme selection)"	Watson-Lamprey	4
<b>Uniform Hazard Spectrum (UHS) Methods</b>			
10	"Conditional Mean Spectrum Selection w/ Scaling"	Baker	4
15	"Genetic Algorithm Selection based on CMS"	Nasim, Almeraji	4 or 3?
24	"Semi-Automated Selection & Scaling - To match CMS"	Ratinje, Ratke	4 or 3?
45	"Design Ground Motion Library (DGML)"	Power, Youngs, Wang	3 and 4
<b>Conditional Mean Spectrum (CMS) Methods</b>			
20	"Target Spectrum Based on Epsilon Correlations ..."	Stewart, Skyers, Goulet	3? and 4
31	"ε Selection with Sde(T1) Scaling"	Tohng, Luco	3? and 4
57, 58	"Sa(T1) Scaling - Matching Spectral Shape"	Shome	3, 4
83, 48	"ATC-63 - Farl/Nearl-Field set with the ε correction"	Haselton, Kircher	4
<b>Spectral Shape Proxy Methods</b>			
6	"Vector of Record Properties Identified by Proxy"	Watson-Lamprey	4
11	"Inelastic Response Surface Scaling - Basic set"	Shantz	3, 4
26, 27	"Inelastic Response Surface Scaling - With post-processing"	Luco, Tohng	3, 4
34, 35	"IM1&2E Selection/Scaling"	Luco, Tohng	3, 4
51	"Inelastic Response Surface Scaling - With post-processing"	Shantz	4
<b>Inelastic Ground Motion Parameter Methods</b>			

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## Sa(T1) Methods

- ▶ Selection: GMs consistent with given M, R
- ▶ Scaling: Match given Sa(T1)

Table B-3 Bin 1 - Near-Fault Ground Motions

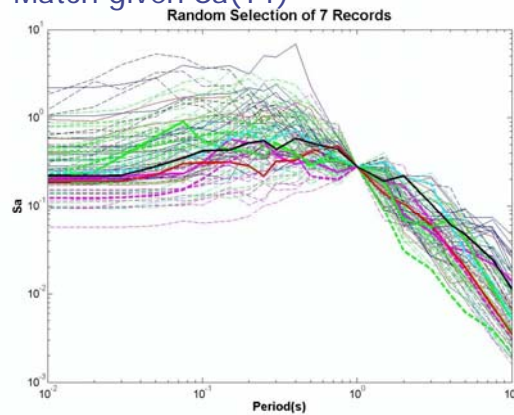
Designation	Event	Station	M <sup>1</sup>	r <sup>1</sup>	
NF1, NF2	Kobe 1995	SAC 2/50 for Los Angeles	6.9	3.4	
NF3, NF4	Loma Prieta 1989		7.0	3.5	
NF5, NF6	Northridge 1994		6.7	7.5	
NF7, NF8	Northridge 1994		6.7	6.4	
NF9, NF10	Tabas 1974		7.4	1.2	
NF11, NF12	Elysian Park 1 (simulated)		7.1	17.5	
NF13, NF14	Elysian Park 2 (simulated)		7.1	10.7	
NF15, NF16	Elysian Park 3 (simulated)		7.1	11.2	
NF17, NF18	Palos Verdes 1 (simulated)		7.1	1.5	
NF19, NF20	Palos Verdes 2 (simulated)		7.1	1.5	
NF21, NF22	Cape Mendocino 04/25/92		89156 Petrolia	7.1	9.5

(Source: ATC-58 35% Draft for Method #67)

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## Sa(T1) Methods

- ▶ Selection: GMs consistent with given M, R
- ▶ Scaling: Match given Sa(T1)



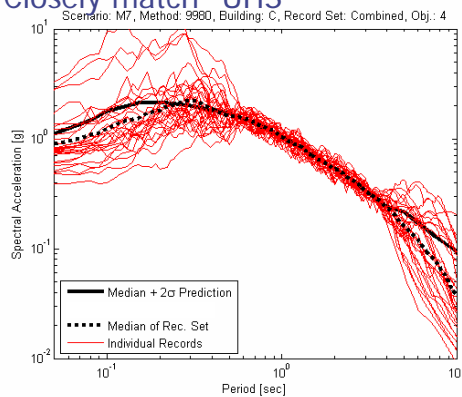
(Source: Shome for Methods #4 & 53)

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## UHS Methods

- ▶ Selection: GMs with spectral shape similar to UHS, perhaps consistent with given M, R
- ▶ Scaling: "Closely match" UHS



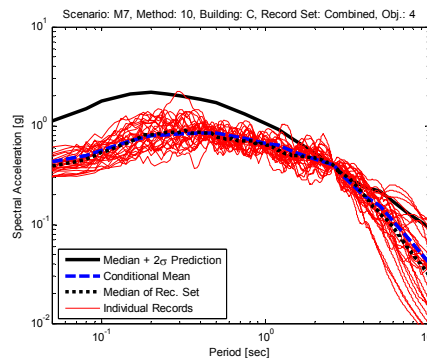
(Source: Haselton for Method #9980)

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## CMS Methods

- ▶ Selection: GMs with spectral shape similar to CMS, perhaps consistent with given M, R
- ▶ Scaling: Match given  $Sa(T1)$  or "closely match" CMS



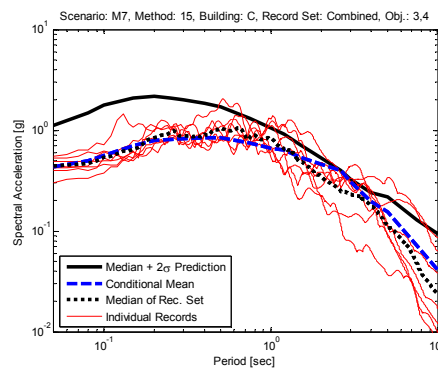
(Source: Haselton for Method #10)

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## CMS Methods

- ▶ Selection: GMs with spectral shape similar to CMS, perhaps consistent with given M, R
- ▶ Scaling: Match given  $Sa(T1)$  or "closely match" CMS



(Source: Haselton for Method #15)

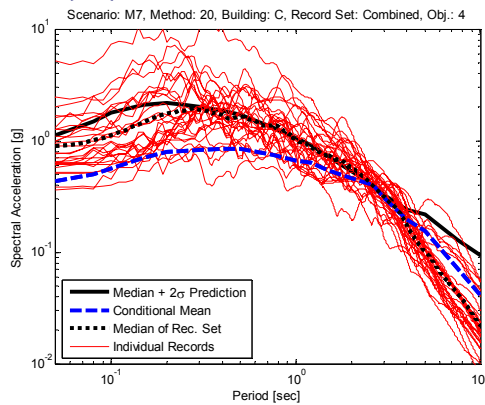
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## Spectral Shape Proxy Methods

- ▶ Selection: GMs consistent with given  $\varepsilon(T1)$  and M, R
- ▶ Scaling: Match given  $Sa(T1)$

e.g., for ...  
 $\varepsilon(T1) = 1-3$   
 $M = 6.7-7.3$   
 $R = 0-42\text{km}$   
 $S = 215-560\text{m/s}$



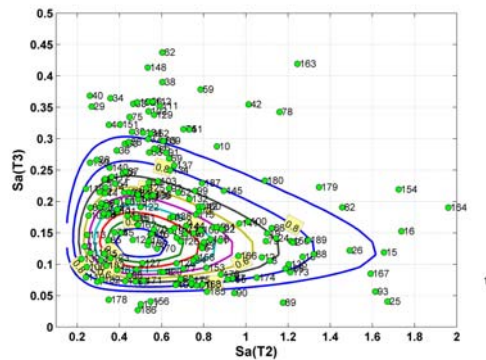
(Source: Haselton for Method #20)

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## Spectral Shape Proxy Methods

- ▶ Selection: GMs consistent with expected  $Sa(0.5T1)$  &  $Sa(2T1)$  for given  $Sa(T1)$ , M, R
- ▶ Scaling: Match given  $Sa(T1)$



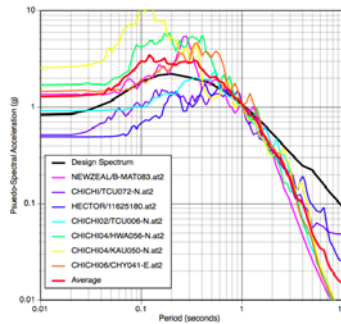
(Source: Shome for Methods #57 & 58)

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## Inelastic Methods

- ▶ Selection: GMs with expected  $S_{di}(T1,R)/S_{de}(T1)$  consistent with that and DurUNI, PGV,  $S_a(2T1)$  for given  $S_a(T1)$ , M, R
- ▶ Scaling: Match given  $S_a(T1)$



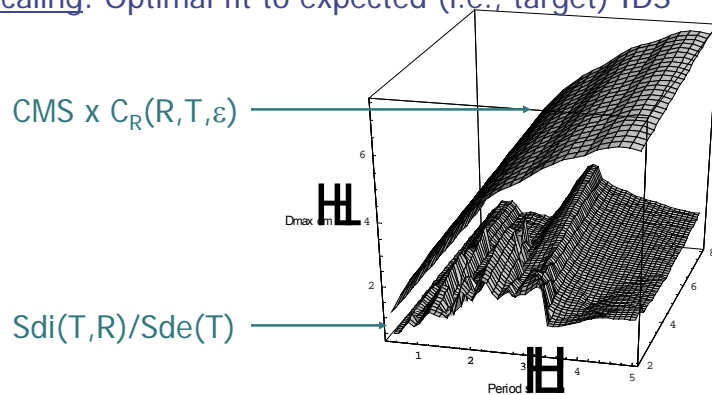
(Source: Watson-Lamprey for Method #6)

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## Inelastic Methods

- ▶ Selection: GMs with Inelastic Displacement Surface similar to that expected for given  $S_a(T1)$ , M, R
- ▶ Scaling: Optimal fit to expected (i.e., target) IDS



Watson-Lamprey Consulting (Source: Shantz for Method #11)



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57, 58	"Sa(T1) Scaling Considering Spectral Shape"	Shome	3, 4
43, 48	"ATC-63 - Far[Near]-Field set with the ε correction"	Haselton, Kircher	4
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