



## PEER GMSM Program: Structures Used for Study

*Presented by:*

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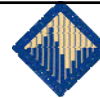
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*A Product of the PEER Ground Motion Selection  
and Modification (GMSM) Program*

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## Selection Criteria for Structures and Models

- ⇒ Goal - Develop findings that are:
  - ⇒ reliable,
  - ⇒ applicable to structures used in practice, and
  - ⇒ as general as possible.
- ⇒ To meet this goal:
  - ⇒ Select a set of structures that is *typical* and is *representative* of those designed in practice.
  - ⇒ Use structural models that are robust, so we can have confidence in the structural response predictions.
- ⇒ Scoping decision:
  - ⇒ Focus on modern buildings that do not have a high rate of collapse.

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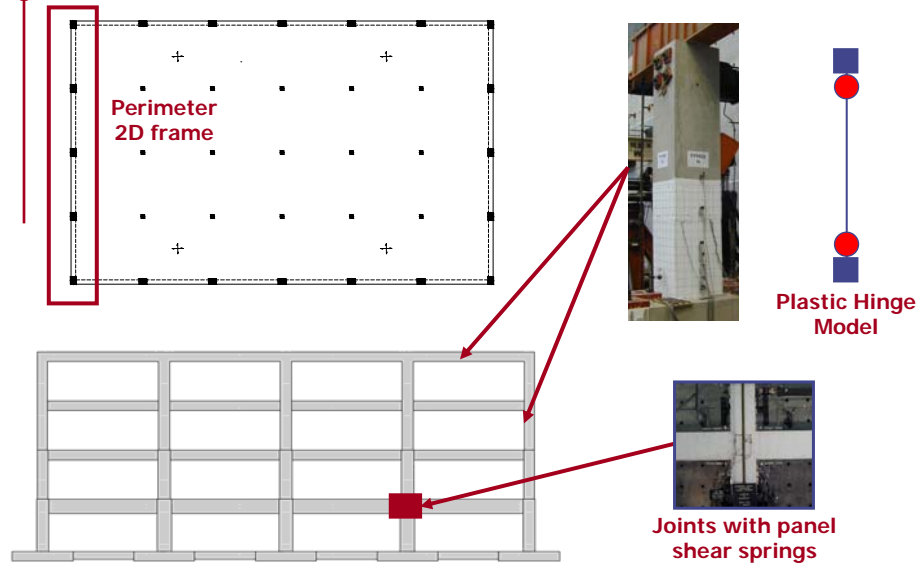
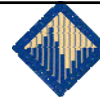
## Summary of Structural Models Selected



<i>Building</i>	<i>Building Type</i>	<i>Height (stories)</i>	$T_1$ (s)	<i>Building Code Compliance</i>	<i>Analysis Platform</i>
A	Modern RC special moment frame	4	0.97	ASCE7-02, ACI 318-02	OpenSees
B	Modern RC special moment frame	12	2.01	ASCE7-02, ACI 318-02	OpenSees
C	Modern RC special moment frame	20	2.63	ASCE7-02, ACI 318-02	OpenSees
D	Modern RC planar shear wall (ductile)	12	1.20	None specifically; but consistent with modern planar wall design	Drain-2dx

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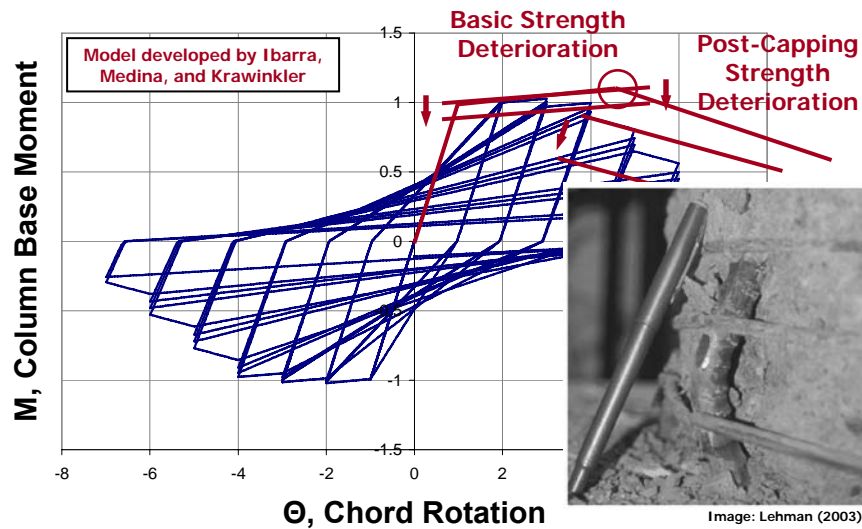
## Building A: Structural Modeling Overview



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Image: Paul Cordova of Stanford University

## Building A: Structural Modeling



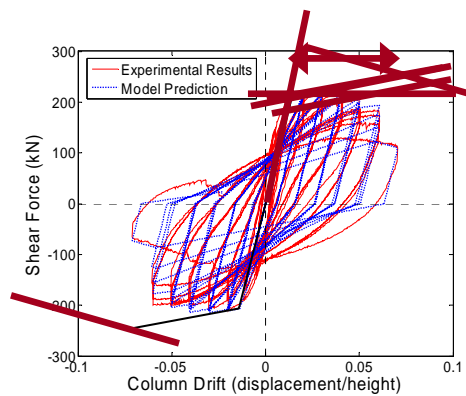
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## Building A: Structural Modeling

Model calibrated to 255 flexurally dominated test from PEER Structural Performance Database (Berry and Eberhard)

Model Parameters to be Predicted:

- Strength (easiest)
- Initial stiffness
- Post-yield stiffness
- Plastic rotation capacity
- Negative post-cap slope
- Cyclic deterioration rate



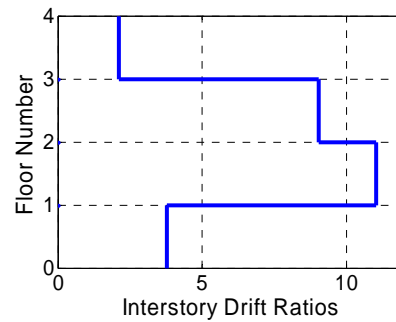
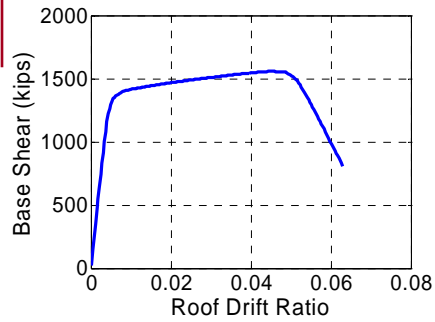
$$\theta_{cap,pl} = 0.13(1 + 0.55a_{sl})(0.13)^v(0.02 + 40\rho_{sh})^{0.65}(0.57)^{0.01c_{units}f'_c}$$

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## Building A: Period and Static Pushover

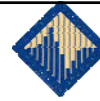


⇒  $T_1 - T_3$  (sec) = 0.97, 0.35, 0.18

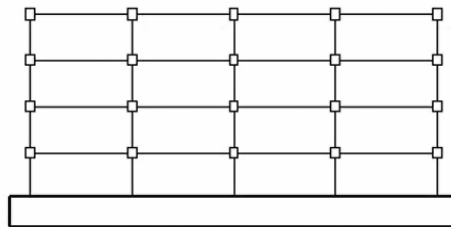


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## Building A: Collapse Video



⇒ Loma Prieta motion (in Gilroy array #3) scaled to intensity that just causes structural collapse.



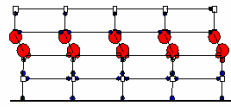
Deierlein, Haseilton, Liel; Stanford University

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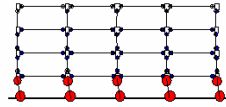
## Building A: Collapse Modes



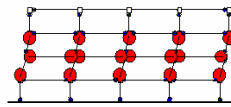
⇒ Nonlinear dynamic failure modes



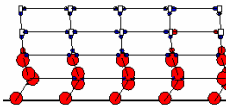
(a) 40% of collapses



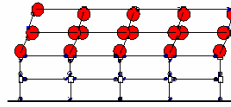
(b) 27% of collapses



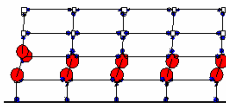
(c) 17% of collapses (PO)



(d) 12% of collapses



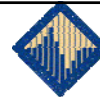
(e) 5% of collapses



(f) 2% of collapses

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## Structural Models Selected: Summary



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