

April 12, 2012

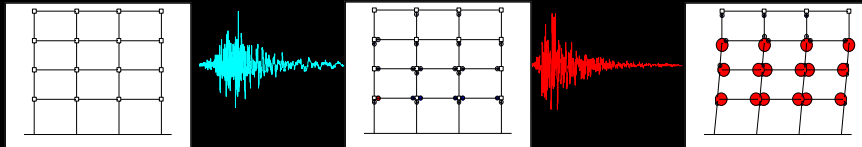
AFTERSHOCK COLLAPSE FRAGILITY FOR MAINSHOCK DAMAGED REINFORCED CONCRETE BUILDINGS

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OVERVIEW

- **Goal:** to quantify the influence of mainshock damage on a building's capacity to resist subsequent ground shaking
- **Methodology**
 - Analysis of intact (undamaged) building and determination of mainshock damage state(s)
 - Development of fragility curves for the intact building
 - Analysis of damaged building for different levels of mainshock damage and regeneration of fragility curves

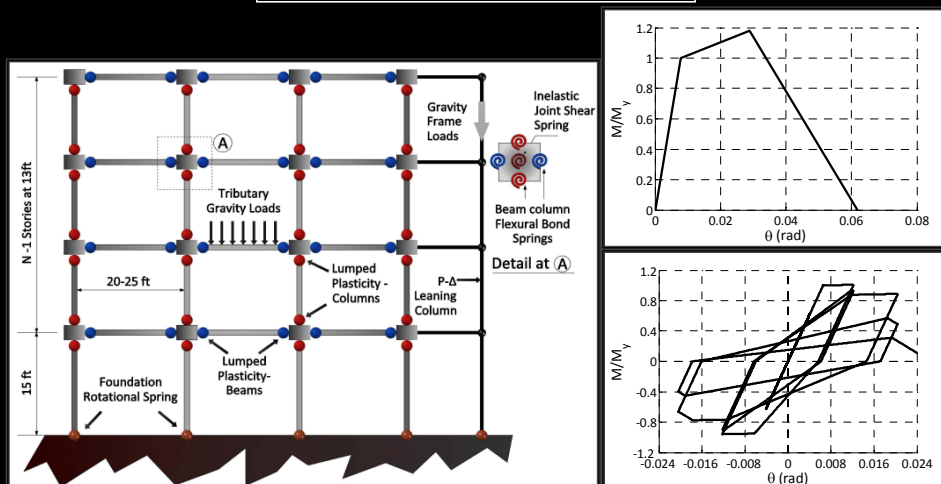


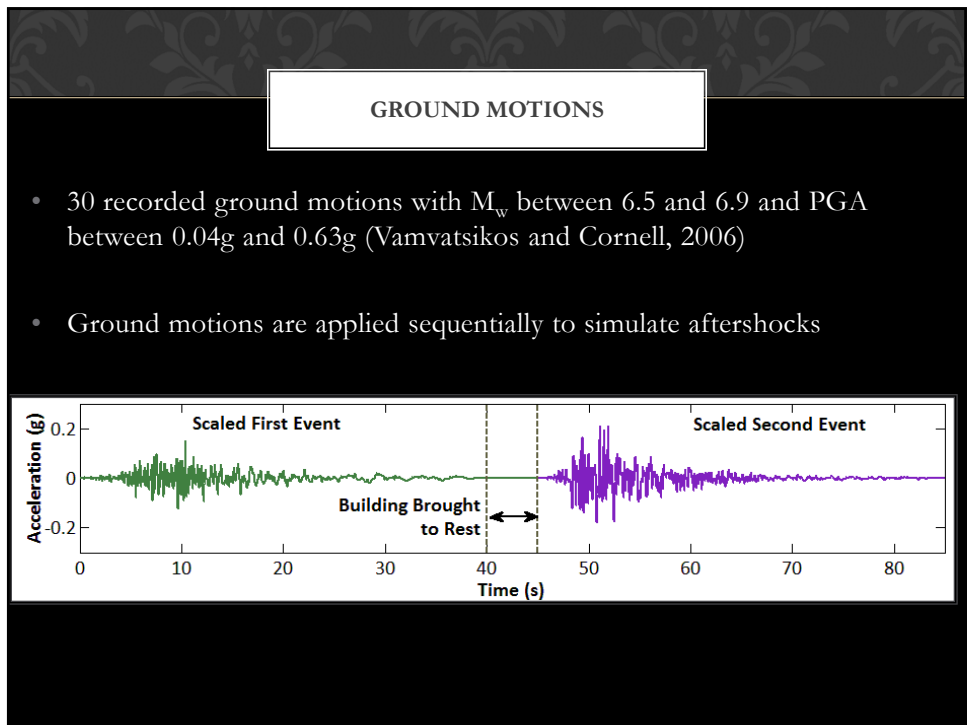
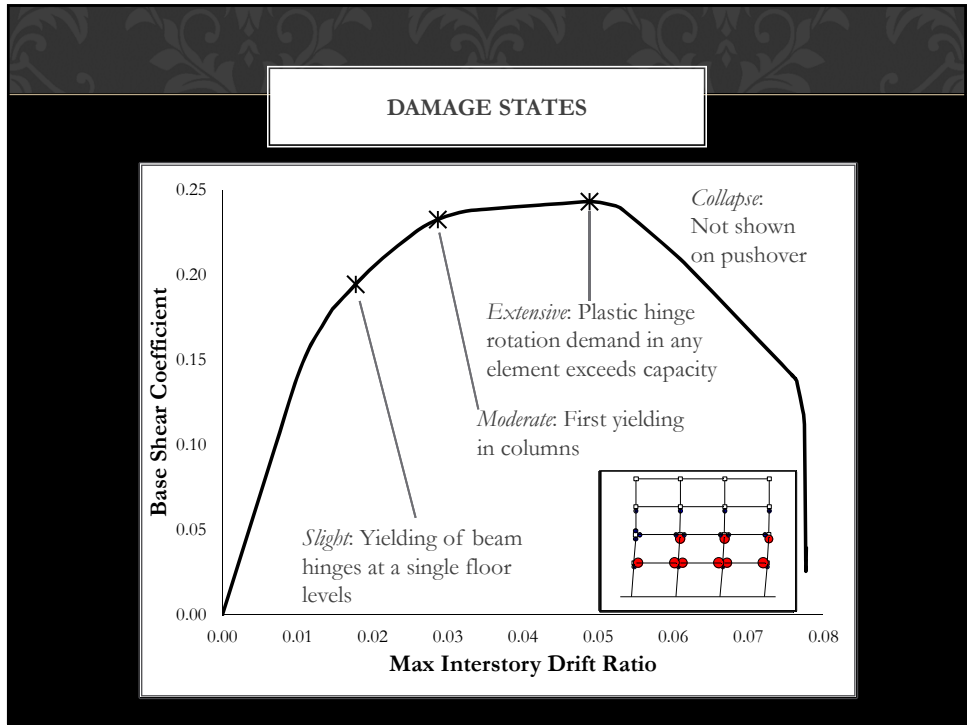
BUILDING STUDIED

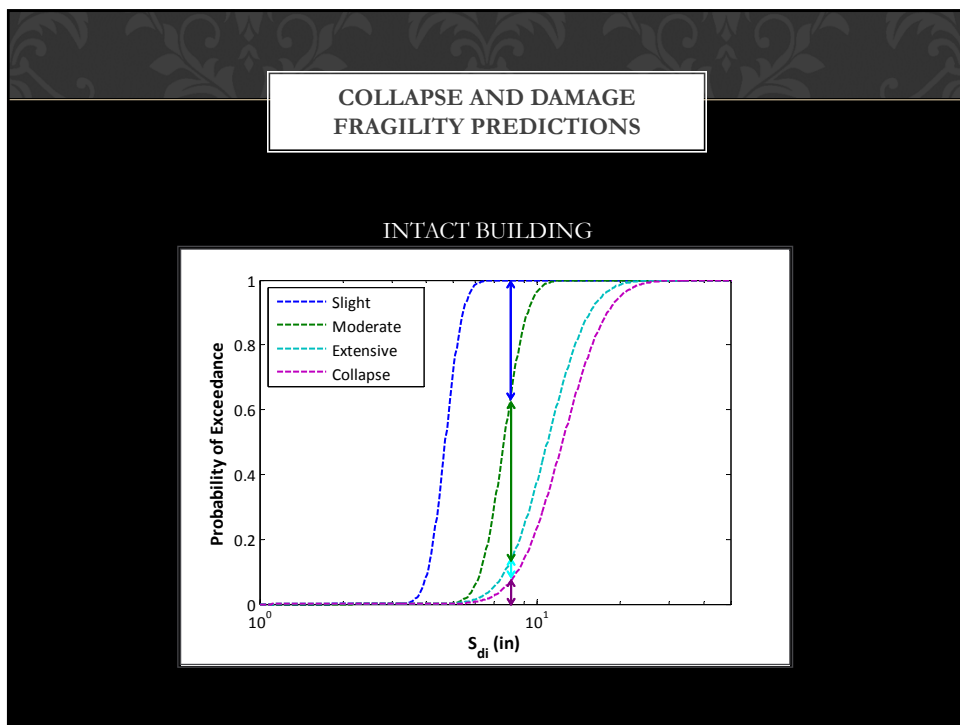
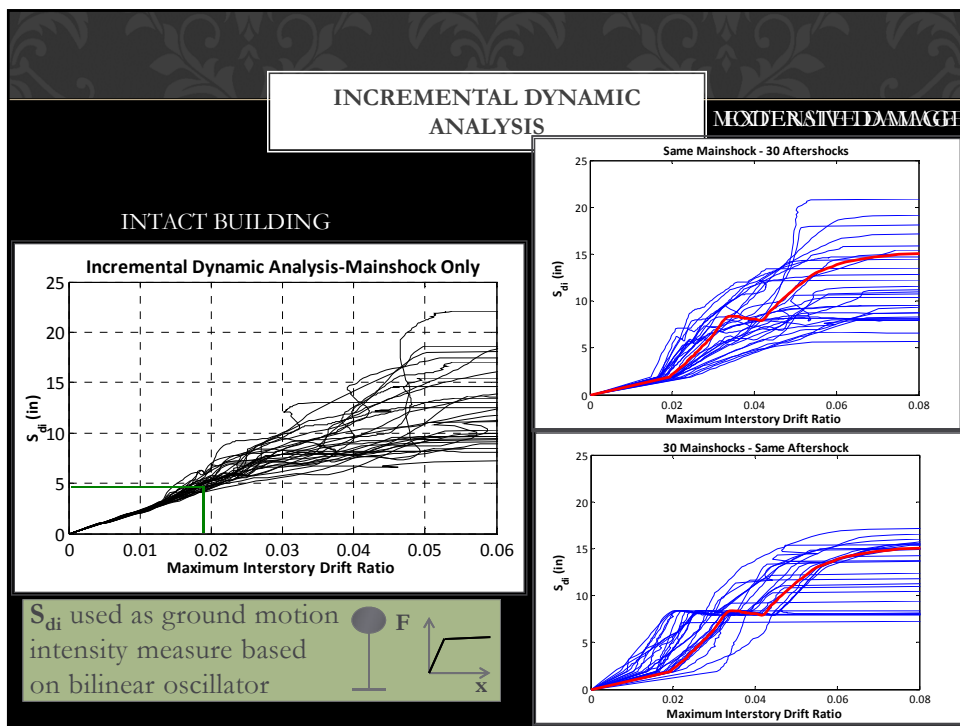
- 4-Story **nonductile** reinforced concrete frame building
- Representative of typical nonductile concrete construction in New Zealand



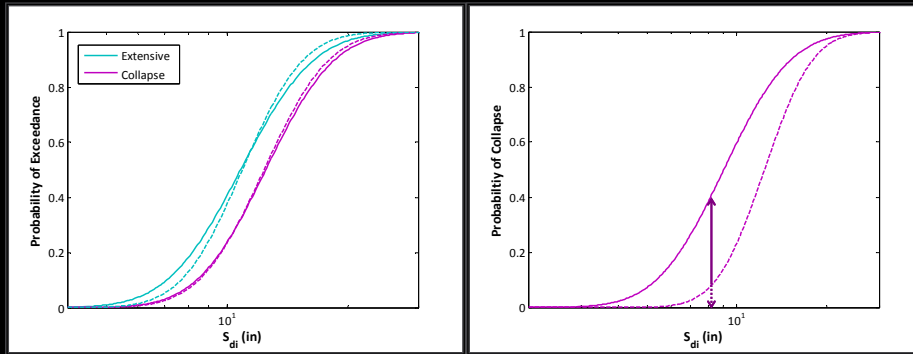
NONLINEAR SIMULATION MODEL







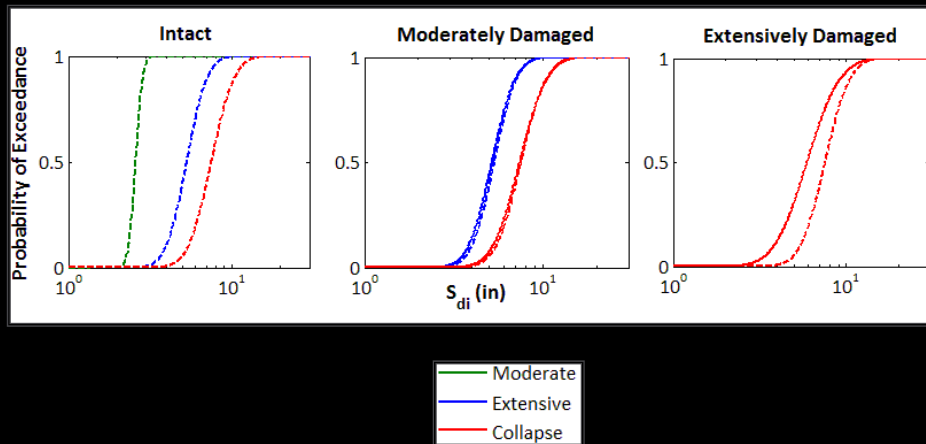
EFFECT OF MAINSHOCK DAMAGE



Building Moderately Damaged in Mainshock

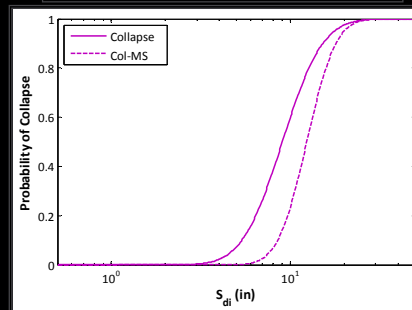
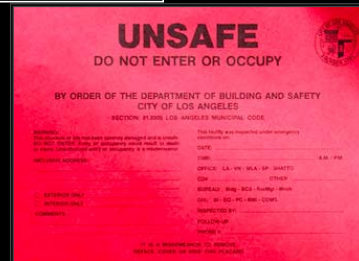
Building Extensively Damaged in Mainshock

COMPARISON WITH U.S. NONDUCTILE CONCRETE FRAME CONSTRUCTION



IMPLICATIONS FOR EMERGENCY RESPONSE AND BUILDING TAGGING

- Red tagged if:
 - Collapse or partial collapse
 - Noticeable leaning in building or individual story
 - Failure or incipient failure of columns
 - Serious degradation in column or beam elements
 - Severe panel zone cracking



NEXT STEPS

- Analysis of more buildings, including U.S.-type construction
- Analysis for more than two events
- Incorporation of site-specific aftershock hazard information
- More lessons for building tagging procedures, by more closely tying damage state definitions to building tagging procedures

QUESTIONS?

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