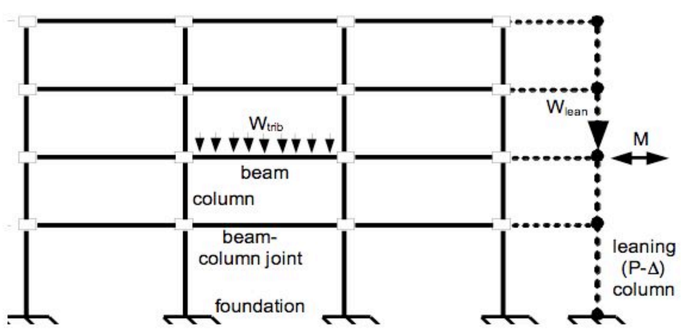
Assessing Seismic Collapse Risk of Buildings

PEER's performance-based earthquake engineering methodology has been applied to assess the risk of earthquake-induced collapse of reinforced concrete frame buildings. This process entails ...

the development of analytical models and simulation tools ...



Idealized model for nonlinear analysis of RC building frame

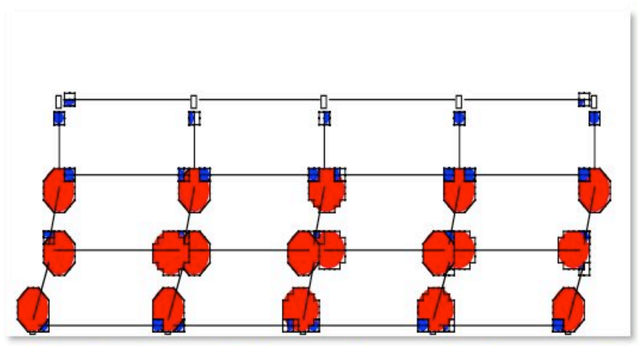
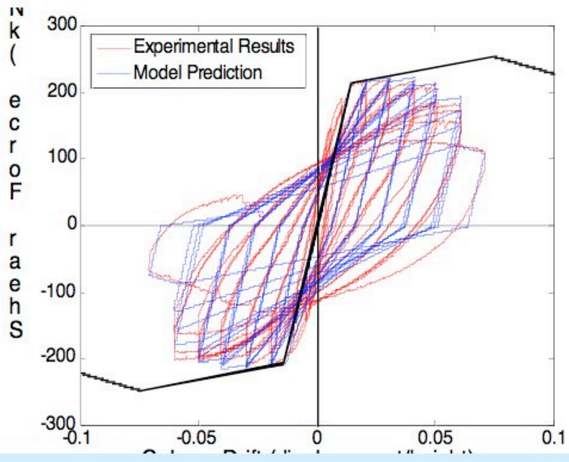


Illustration of dynamic analysis results

PEER has developed an open-source nonlinear analysis platform (opensees.berkeley.edu), which includes advanced material models and geometric transformations, and robust convergence algorithms that are capable of predicting structural behavior up to collapse.

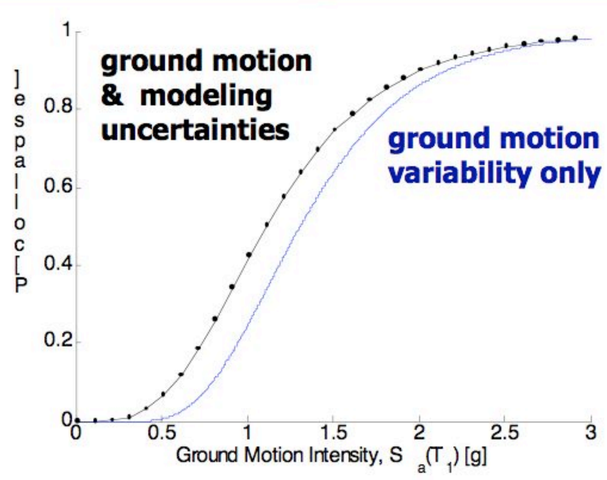
that are validated by experimental results ...

The PEER column performance database contains cyclic test data from over 400 reinforced concrete columns. PEER researchers have tested additional structural components, and calibrated nonlinear models for response simulation.



Comparison of cyclic test data with model predictions

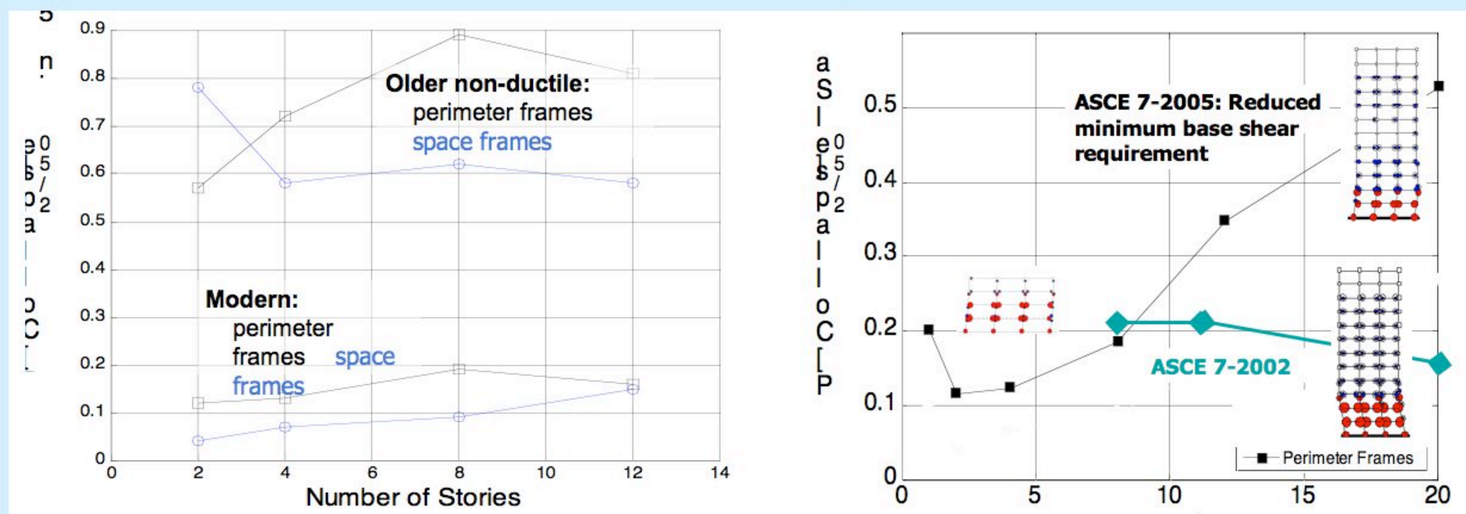
and incorporate key sources of uncertainty ...



Effect of modeling uncertainties on collapse fragility curve

Quantification and propagation of uncertainties in both ground motions and structural modeling are essential aspects of risk assessment.

to predict the structural collapse risk.



Conditional probabilities of collapse, given an extreme ground motion (2% in 50 year).

Above left, the collapse risk of older (1967 UBC) and modern (2003 IBC) reinforced concrete frame buildings of different heights and configurations are compared. The older non-ductile buildings are significantly more likely to collapse under large ground motions. Above right, reducing the minimum required base shear for taller long-period structures increases their risk.

Applications

These studies can be used to assess and improve current building code provisions. In the ATC-63 project, probabilistic collapse methods are used to assess building system performance factors, such as R-factors. Analytical studies of collapse risk are also useful for identifying vulnerable buildings for retrofit.

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