# Seismic Risk Assesment of Essential Buildings

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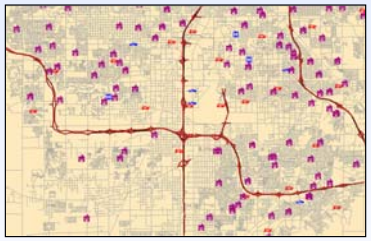
## Objectives

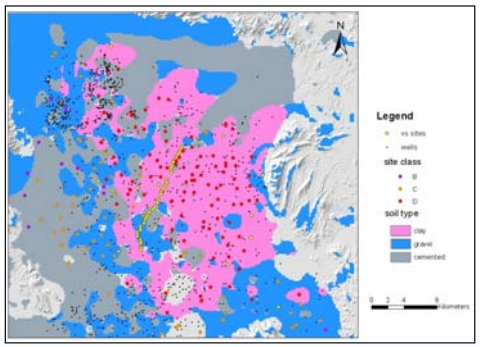
- Perform risk assessment of the critical public buildings.
- Develop a web- and GIS-based visualization for the general public, planners, and emergency response specialists.
- The study region was Clark County, Nevada with over 1.7 million population (2006). Young faults in the region are capable of approximately M 6.5 to 7.2 seismic events.


Study Region



GIS capabilities, the spatial relationship for each building

## Methods of Analysis




Locations of Well Logs, Shear Wave Velocity Measurements, Predominant Soil Type, and Site Class Assignments for Critical Facilities

### FEMA 154–Rapid Visual Screening

- Input Requirements
  - Seismicity
  - Building Site
  - Soil Characterization
  - Building Type
    - Height, Irregularities, Code, Location
- Basic Structural Hazard (BSH) Score
  - Minimum cutoff score is 2 (probability of 1 in 100 that the building will collapse)

### HAZUS-MH

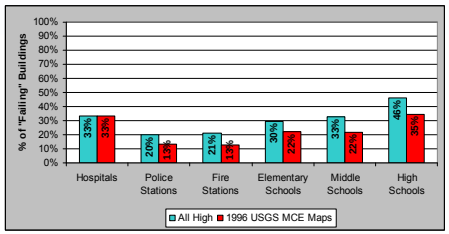
- Flexible multi-level analysis (allows the end user to modify the modeling parameters)
- Geotechnical Input
- Damage Functions
  - Building capacity curves
  - Building demand spectra
  - Building fragility curves
- Building Database information
  - Location, year built, name, address, building classification, soil type, etc.
- Failure Criterion
  - Building having a "complete" damage discrete probability greater than 1%

| Type of Earthquake | Source |
|---|---|
| Fault Name | Frenchman Mountain Fault |
| Historical Epicenter ID# | 795 |
| Longitude of Epicenter | -115.02 |
| Latitude of Epicenter | 36.19 |
| Earthquake Magnitude | 6.9 |
| Depth | 0.0 km |
| Rupture Length | 35.97 km |
| Rupture Orientation | 0.00 degrees |
| Attenuation Function | WUS Shallow Crustal Event-Extensional |

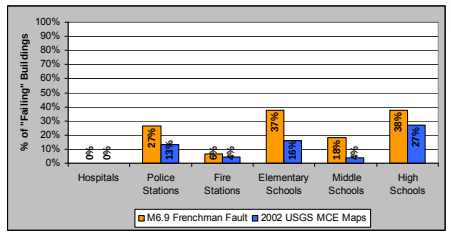
NBMG developed seismic event for Clark County

## Results & Conclusions

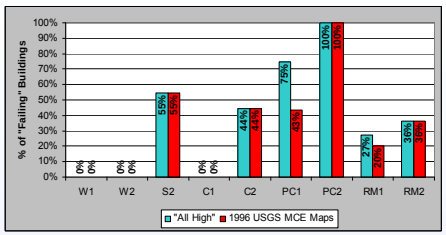
- An unacceptable large number of the essential buildings would fail in a significant seismic event.
- Fire and police personnel would find many of their facilities to be uninhabitable.
- Additional geophysical and structural investigations are in order to understand the validity of the results.
- Further analysis should include analytical modeling of some generic buildings.
- Results are available at: http://www.isu.edu/engineer/earthquake/



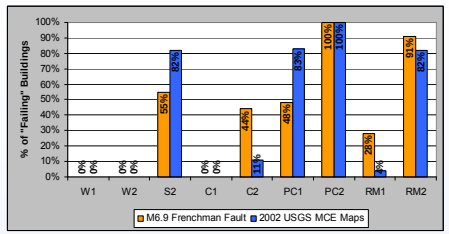

RVS Failure by Building Use



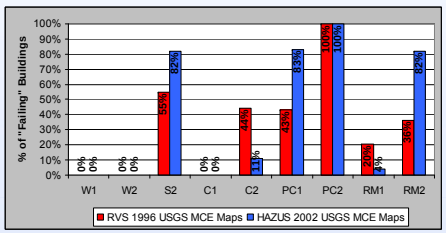

HAZUS Failure by Building Use



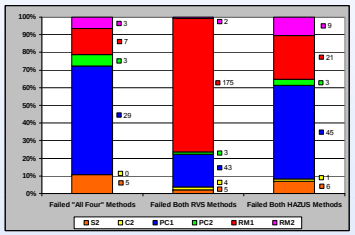

RVS Failure by Building Type




HAZUS Failure by Building Type




HAZUS/RVS Methodology Comparison- "Failure" by Building Type




Relative Building "Failure" by type for Each Analysis Method

Building Types (ASCE 2003) are: wood frame (W1 and W2); steel moment-resisting frame (S1); steel braced frame (S2); light metal frame (S3); steel frame with concrete shear wall (S4); steel frame with unreinforced masonry infill (S5); concrete moment-resisting frame (C1); concrete shear walls (C2); concrete frame with unreinforced masonry infill (C3); tilt-up structures (PC1); precast concrete frame (PC2); reinforced masonry with flexible diaphragms (RM1); reinforced masonry with rigid diaphragms (RM2); and unreinforced masonry (URM).