Consequences of a Future Hayward Fault Earthquake: Known, Unknown, and Plans for Better Forecasts

Hazard Characterization (USGS, CGS)

Consequences Characterization (RMS, ABAG, ...)

Local Government (EERI-NC)

Business - Finance (RMS)

Lifelines (EERI-NC, use existing EERI document?)

Increased Resiliency

“Risk Owners”
Local Government
- Tax base
- Publicly owned facilities
- Emergency responders
- Shelters
- Displaced residents

Lifelines
- Power, water, communications
- Employees
- Buildings
- Transportation
- Suppliers
- Shaking
- Ground failure
- Other lifelines
- Roads open for access?
- Secondary hazards
- Market share

Business - Finance
- Legislation
- Encourage retrofits
- Rebuilding standards
- Identify hazardous buildings
- Modify insurance program
- Stockpile supplies
- Agreements w/ providers
- Redundancy
- Insurance
- Resumption plans
- Employee awareness
- Provide better info on outages
- Redundancy
- Replacement
- Funding
- Standards
- Working groups
- Repair plans & materials
Motivation for better understanding consequences

• Not to scare (doesn’t work)
• To provide appropriate info to risk owners
• To identify interdependencies
• To identify most at risk sectors
• To focus mitigation (all forms) where impact is greatest
• To cause policy implementation
• To assist in providing solutions
• **Known**
  - Hazards
  - Scale of disaster (previous disasters)
  - Loss estimates (RMS)
  - US Bureau of Labor Statistics study
  - 1996 EERI report
  - ABAG studies
  - Proactive organizations (congratulate)
  - Mitigation (> $30B)

• **Unknown**
  - Interdependencies
  - Which sectors have highest risk?
  - Long-term effects on economy
  - Effect on vulnerable populations
  - Reach tipping point(s)?
  - How soon?
EXPOSURE

- East Bay has not experienced intense shaking since 1868 - old infrastructure
- Highly urbanized
- From Silicon Valley to world-class universities to low income communities
Similarities to 1995 Kobe Japan earthquake
Scenario for a Magnitude 7.0 Earthquake on the Hayward Fault

1996 EERI Hayward Fault Scenario
EXPECTED LOSSES

M7 earthquake, like 1868

• Total Economic Loss $165B (privately owned buildings, contents, business interruption)
  - Residential $90B
  - Commercial $75B
  - Does not include fire, damage to infrastructure and related disruption

• Loss covered by insurance
  - Residential $4.4B 95% loss uninsured
  - Commercial $11.7B 85% loss uninsured
% RESIDENTIAL LOSSES
95% uninsured

% COMMERCIAL LOSSES
85% uninsured
TOTAL ECONOMIC LOSSES

% of Losses uninsured

100%
90%
80%
70%
60%
50%

$90B Hayward M7 - Residential
$75B Hayward M7 - Commercial
$141B Katrina
Loss Ratios
commercial

(expected loss) / (total value of commercial & industrial buildings & contents)
by zip code
Loss Ratios
all residential

(expected loss) / (total value of single family & multifamily residences & contents) by zip code
Loss Ratios
multifamily residential
(expected loss) / (total value of multifamily residences & contents) by zip code

Apartment dwellers!
Ethnic Population

% Asian & Hispanic households by zip

>20% English is a second language
US Bureau of Labor Statistics

*Exposure* study

*For Alameda County*

**MMI VIII+**
25,776 Employers
400,521 Employees
$5.1 B in Quarterly Wages

**MMI VII**
11,567 Employers
208,709 Employees
$3.1 B in Quarterly Wages
USBLS study - known

- Industries likely to be affected:
  - Health care and social assistance
  - Manufacturing
  - Educational services
  - Retail
  - Professional, scientific and technical services

- Exposures of employers, employees, and wages is 5 to 8 times larger than from Hurricane Katrina
USBLS - Unknowns

• Potential for major economic dislocation to businesses, employees and economy (exposure vs disruption)
• Possible wide-ranging multiplier effects across industries
• Effects felt in Bay Area and California
Others

• Association of Bay Area Governments Studies
  - ~90,000 uninhabitable units
  - Displacing 220,000 residents
  - 65,000 seeking shelter

• Bay Area Economic Forum
  - $17B potential economic losses if Hetch Hetchy fails
    • 2.4M residents are served
    • 30% loss related to fire

• Census
  - 27% Alameda county speak a 1\textsuperscript{st} language other than English
  - 11% population has incomes < poverty line
Lifelines - known

• BART being retrofit
• Bay Bridge retrofit
• Airports and ports built on damage-prone fill
• Communications may be lost & overloaded
• EBMUD entering 2\textsuperscript{nd} phase
• PG&E pipeline replacement & other programs
• 1,100 road closures, 900 in Alameda County alone (ABAG)
• Bond measures have been successful

180,000 commuters
Lifelines - unknown

• “expect to be without service for 72 hours”
• Locations & durations of service disruptions?
• Sewage systems
• Interdependencies?
• Cascading failures?
• Fire
• Soon enough?
Conclusions

• Acknowledge successes
• We’re making progress in understanding consequences
• Residential (& commercial?) insurance not sufficient
• Multifamily residences – high % of residential risk
• Plan to support ethnic population
• Vital businesses & economy “exposed”
• Additional lifeline studies?
• Our work doesn’t end with consequences