Business Interruption and Resilience

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Acknowledgement to Contributors

- Laurence Kornfield, City of SF
- Larry Stevig, State Farm
- Josh Marrow, Partner Engineering and Science, Inc.
- Glen Granholm, ETC Building & Design
- Janiele Maffei, California Earthquake Authority
- Daniele Hutchings Mieler, ABAG
- Erol Kalkan, USGS
- Fred Turner, Alfred E. Alquist Seismic Safety Commission
- Abe Lynn, Cal Poly
- Andre Barbosa, Oregon State
- Dave McCormick, SGH
- Andy Thompson, Lauren Biscombe, Candice Avanes, Sean Merrifield (Arup)
Scope

- Focused on small businesses in downtown Napa and winery facilities
- Non-URM buildings
- Extent of downtime unknown at this time
Small Business, Big Problems
Non-structural damage

- Yellow-tagged due to broken storefront glazing and ceiling damage
Adjacency issues
Who is responsible for repairs?

- Business owner does not always own building
- No earthquake/BI insurance
Follow-up tagging

- How do business owners find out information about their tagging status?
Napa is a tight-knit community
Primary Causes of Business Interruption

- Yellow and red tags caused by **non-structural damage**
- Yellow and red tags caused by **“adjacency issues”**

- **Content damage** – it depends on magnitude and criticality to building’s primary function but also a **“life safety”** issue
Content Damage
Content damage

- Many stores open for business
- Not big contributor to BI for retail or offices
Heavy contents = “life safety” hazard

▪ **Lesson:**
  anchor heavy contents
Contents in labs

- **Lesson**: protect mission-critical contents
Content Damage at Wineries and Storage Facilities

Slides courtesy of Josh Marrow and Abe Lynn.
Additional content by Glenn Granholm and Dave McCormick
Barrel Storage Co-op Warehouse

- Adjacent to downtown Napa
- Storage for 45 small, high-end wineries
- 12,000+/- barrel storage (figures below from the owner/manager of facility):
  - $50k-$100k/barrel
  - ~60% toppled
  - ~20% of those blown or cracked
- Can small wineries survive?
- Life safety hazard
Barrel Storage Co-op Warehouse

- Estimated 5 weeks complete re-stack time (a time-consuming and proven hazardous operation)

2 weeks after main shock →

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Two-Barrel Rack vs. Four-Barrel

- Two facilities located within 1 mile of the fault, 2 miles north of epicenter, 1,000 feet from each other
  - Same soil conditions
  - Same stack heights (6-high)
- Facility with two-barrel racks – 50% of barrels collapse
- Facility with four-barrel racks – lost 2 barrels from top of stack

**Lesson:** four-barrel rack is preferred alternative
Stainless Steel Tank Damage

- Damage to tanks within 7 mile radius of Napa
- Half-dozen reported complete failures
- Dozens of anchorage failures
- **Lesson**: Design tanks for seismic loads and detail anchorage
Non-structural Component Damage
Non-structural damage

Broken pipes cause water damage

Damage to mechanical equipment and anchorage

Caused Business Interruption

Did not Cause Business Interruption

Some ceiling tiles displaced
Façade damage

- Yellow tagged
- Out of operation until Halloween
Façade damage

- Red tagged
- Downtime unknown
Adjacency Issues
Adjacency issues
Adjacency issues
Hospitals and Essential Facilities
Hospital Performance (Summary)

- Facilities under OSHPD jurisdiction (6 General Acute Care Hospital Facilities with 58 Buildings) generally performed very well.

- Queen of the Valley Medical Center had the most issues (at 7.7 miles epicentral distance)
  - 6 buildings with pre-Northridge moment connections need investigation
  - 3 buildings yellow tagged
    - Elevators out of service
    - Ceiling damage
    - Cracks in elevated floor slabs/beams
    - Stucco exterior walls pulled down from upper deck
    - Cracks in gypsum walls due to building drift

- Napa State Hospital
  - 1 red tag (unoccupied building)
  - 7 yellow tag

Slide is courtesy of Erol Kalkan and OSHPD
Air Traffic Control Tower

- Windows broken out
- Air traffic control transferred to Oakland Airport
- Several weeks to get new windows (Ian Gregor, FAA spokesman)
Conclusions/Observations
Summary of Observations

- Damage to architectural/mechanical components (facades, storefront glazing, pipes) causes yellow or red tags
- “Failed” facades (even in new buildings) are Life Safety hazards and also cause adjacent buildings to be tagged
- Damage to un-retrofitted URMs cause adjacent buildings to be tagged
- Content damage can cause BI depending on criticality but more importantly, heavy contents cause Life Safety issues
- Tagging unclear and owners don’t know how to follow up
- Cordonning didn’t prevent public from getting close to damaged buildings
Recommendations and Areas for Future Study

- To prevent BI, reduce damage
- Non-structural component design (improved standards)
  - Out-of-plane requirements for facades (testing?)
  - Stronger anchorage of equipment
  - Laminated storefront glazing
- Contents
  - Anchor heavy contents and mission-critical contents
- Wineries
  - Utilize 4-barrel racks – more research
  - Tanks should be designed for seismic loads and anchors should be properly detailed
- Policy
  - Resilient Central Business Districts – “beyond code” standards?
  - Penetration of EQ/BI insurance
  - Tagging – Contact info/Orange tag?
Outlook for Recovery

We have a bit of damage to fix.
A little shakie... shakie won't breakie...
breakie the Mustard Seed Clothing co.

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Agenda

September 15, 2014, 12:00 pm – 1:45 pm

Welcome
Jay Berger, EERI and Stephen Mahin, PEER

Reconnaissance and Clearinghouse Overview
Marko Schotanus, Rutherford+Chekene & EERI

Seismology and GeoScience
Timothy Dawson, California Geological Survey

Geotechnical Engineering
Jonathan Bray, UC Berkeley, GEER, & PEER

Structures
Andre Barbosa, Oregon State University, PEER, & EERI

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Lifelines
Charles Scawthorn, PEER, SPA Risk, EERI, & TCLEE

Bridges
Abolhassan Astaneh-Asl, UC Berkeley

Q&A