Earthquake Risk Reduction for Healthcare Facilities

January 20, 2020

Missouri Earthquake Summit

Poplar Bluff, Missouri
CUSEC: A partnership approach

Mission: “...the reduction of deaths, injuries, property damage and economic losses resulting from earthquakes in the central United States.”
Overview

- Potential Impacts
- Structural & Nonstructural Concerns
- Mitigation
Missouri is Earthquake Country…
Know How to Protect Yourself…

Christchurch, New Zealand     September, 2010         Magnitude 7.0
Know How to Protect Yourself

In most situations and building types:

Drop on to your hands and knees, where you are.
Know How to Protect Yourself

In most situations and building types:

Cover your head and neck with one arm and hand.

- *If a sturdy table or desk is nearby, crawl underneath it for shelter*
- *If no table/desk, crawl against a wall or next to low furniture for sideways protection*
Know How to Protect Yourself

In *most* situations and building types:

Hold On to your shelter until shaking stops

- Be ready to move with your shelter
- *If not under a shelter*, hold on to your head/neck with both arms and hands
What are the risks to Healthcare?

- **Life Safety**
  - Deaths or casualties

- **Property Loss**
  - Dollar loss or cash

- **Functional Loss**
  - Downtime or closure

Post-Earthquake Safety Concerns

- Aftershocks are common
- Fire following
- DO NOT ENTER or RE-ENTER obviously unsafe areas
- Natural gas leaks
- Falling hazards (above/around you)
- Shock/electrocution hazards
- Water/sewage leaks
Unique Disaster Medical Challenges

- Traumatic Injuries
- Compartment Syndromes
- Dust Impaction/Inhalation
- Crush Syndrome
- Hypothermia
- Exacerbation of Chronic Illness
Where is this? Not Missouri…
Northridge, CA 1994            Magnitude 6.7
Lessons Learned: Christchurch, New Zealand

- 2/22/2011
- M6.3
- 185 Fatalities
- > 2,000 Injuries
- $30-50 Billion Economic impact

Is your Facility Vulnerable?

- Hazard Exposure
  - Proximity to hazard
  - Site geology
  - Secondary hazards

- Facility Performance
  - Structural components
  - Nonstructural components
  - Critical components

- All-Hazard Preparedness
- External Factors
Structural vs. Non-Structural

- Hangar Wires For Ceiling
- Air Conditioning Duct
- Light Fixture
- Air Difuser
- Fire Sprinkler System
- Studs
- Beam
- Electrical Conduit
- Contents
- Non-Load Bearing Partition
- Masonry or Concrete Structural Wall
- Reinforced Concrete Slab on Metal Deck
- Steel or Concrete Column
- Exterior Cladding
- Suspended Ceiling
Facility Vulnerabilities: Structural
Is This Facility Obviously Vulnerable?

- Built 1985 (pre-code)
- Steel Frame/Reinf. Masonry(?)
- Architectural details
- Site Geology?
Non-Structural Elements

75%

Hangar Wires For Ceiling
Air Conditioning Duct
Beam
Fire Sprinkler System
Studs
Electric Conduit
Light Fixtures
Air Difuser
Exterior Cladding
Suspended Ceiling
Contents
Studs
Non-Load Partition
Reinforced Concrete Slab on Metal Deck
Steel or Concrete Column
Significance of Non-Structural Damage

• Non-Structural damage impacts:
  • Life Safety
  • Functional Loss
  • Property Loss
Nonstructural Hazards
Critical Components: Generator
Critical Components: Heating & Cooling
Critical Components: Other
External Factors
When to call an Engineer…

• Seismic risk assessment
• Critical components
• Some nonstructural items
• After an earthquake…
Non-Structural Mitigation Options

- Retrofit
- Replace
- Relocate
- Replicate (redundancy N+1/ provide a back-up)

- Plan for the consequences of failure
Earthquake Mitigation Challenges

- Disruption to operations/Loss of Space
- Temporary relocation of patients and patient care services
- Specialized areas
  - MRI, X-ray, etc.
  - Pharmacies
  - Bio Hazards
  - Records
- Deep foundations
What level do we need to prepare to?

7-10% Probability (~500 year event)
What level do we need to prepare to?

25-40% Probability (~100 year event)
Incremental Risk Reduction

- Do Nothing
- Replace
- Rehabilitate

- No Cost
- High Cost
- Single Stage
- Incremental

- High Risk
- Low Risk
- Continuous Use
- Loss of Use
- High Cost
- Low Cost
Mitigation Food for Thought

- Do it right the first time from today forward

- Long-term strategy:
  - New Construction
  - Planned facility outages
  - Renovations & remodels
  - New equipment installations
  - Aging equipment replacement
  - During equipment maintenance activities

- Earthquake mitigation does not happen overnight
Mitigation & Training Resources

FEMA P-767 Workshop
Earthquake Mitigation for Hospitals

• April 22, 2020
• Cape Girardeau, MO
• FREE!

https://www.surveymonkey.com/r/EarthquakeMitigation_04-22-2020
Contact Info

Brian Blake
Associate Director
Central U.S. Earthquake Consortium
bblake@cusec.org