Regaining Building Access to Assess Collection Damage

Shut Out After "The Big One"

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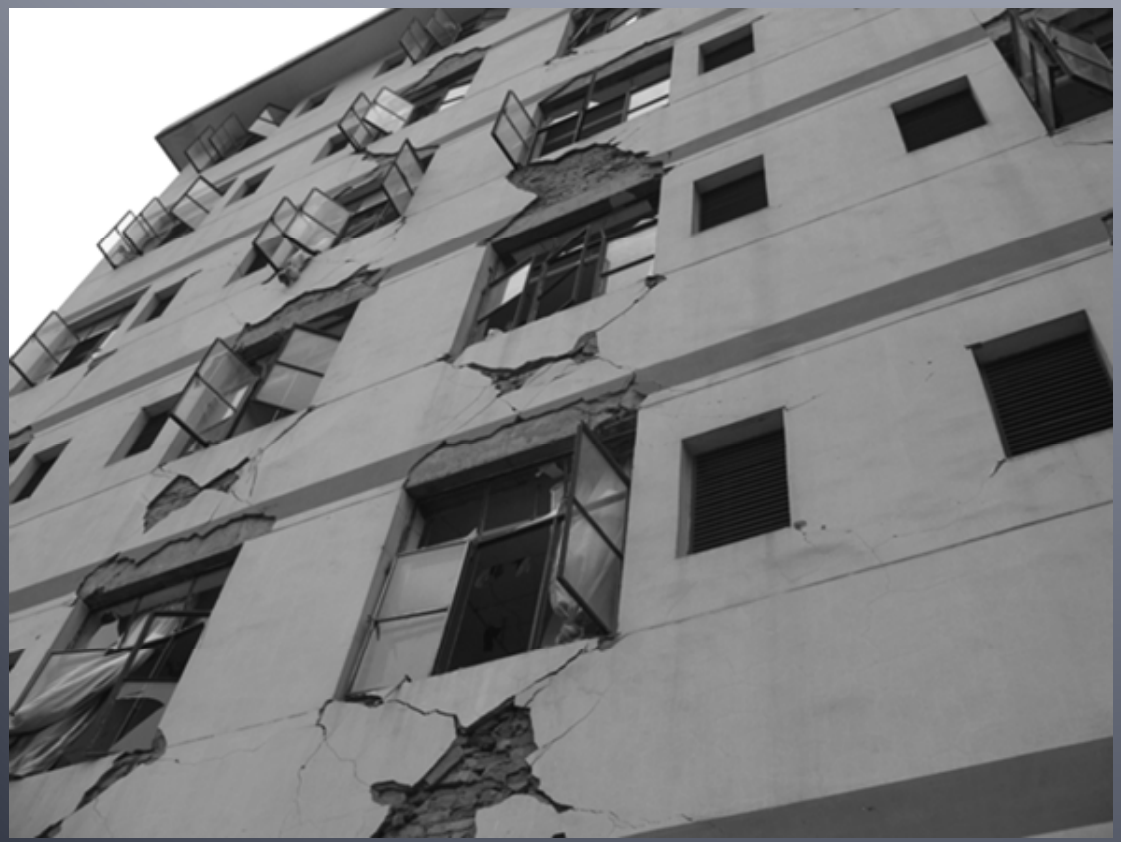
Structural Engineers Association of Utah (SEAU)

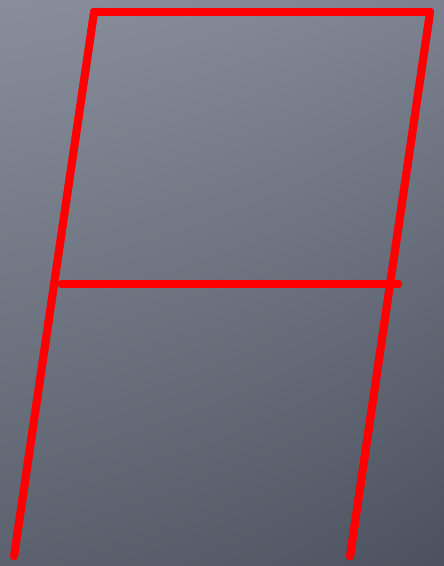
How will my building perform?

Drift (Building Movement)

Damage to structure and everything attached to the structure

- Windows, cladding, non-bearing walls
- Can cause collapse or heavy damage, unless the building is designed for the expected drift





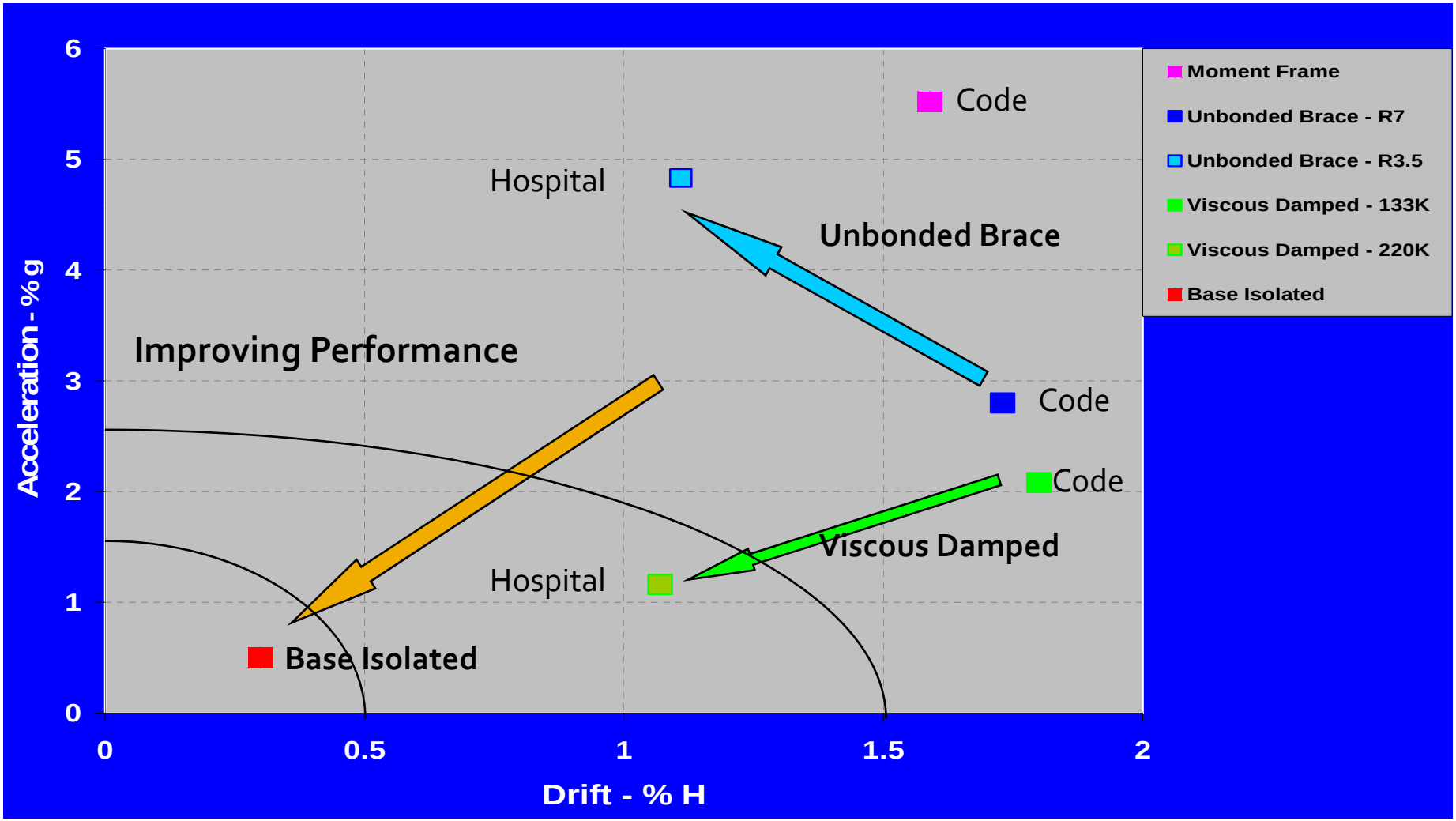
Acceleration Damage

- Damage from force (F=m*a) rather than drift
- Objects being tossed around

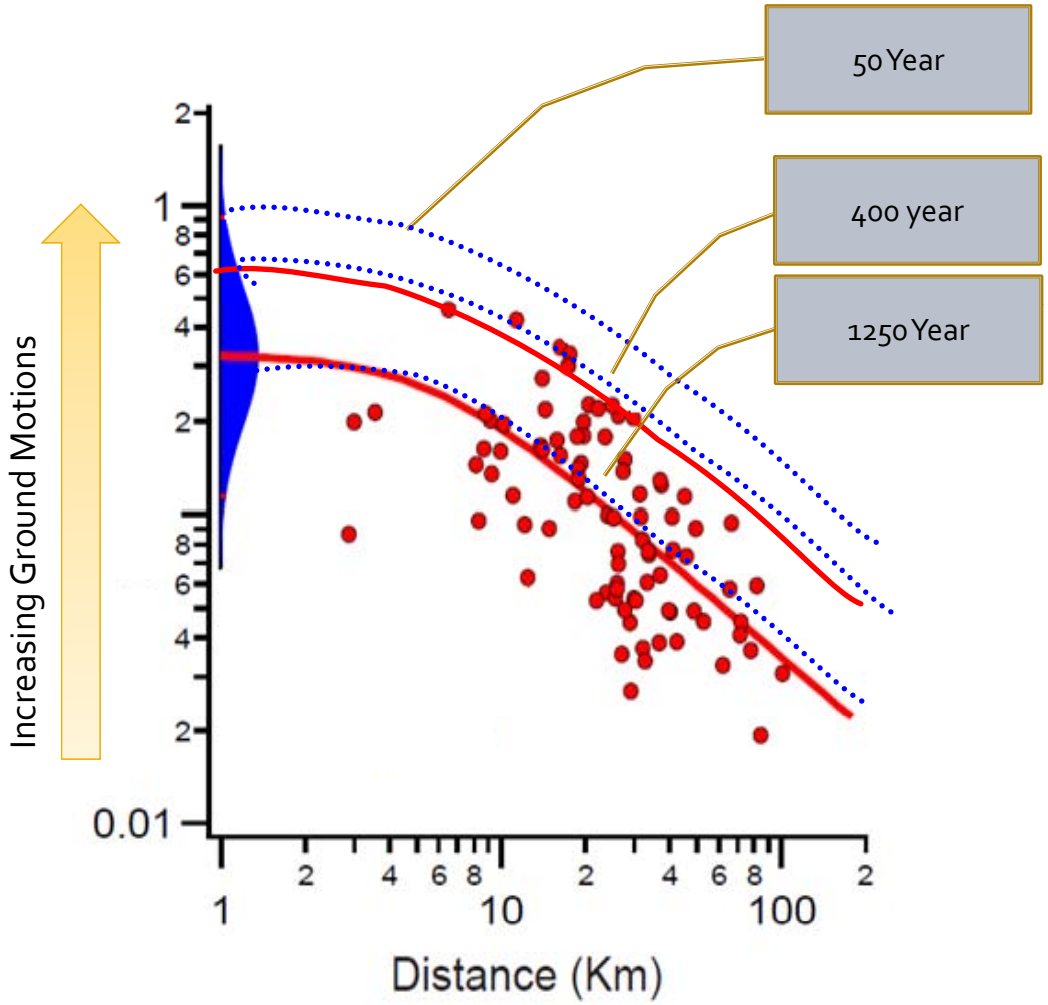
Base Isolated Hospital in Japan

http://www.youtube.com/watch?v=Pc1ZO7YwcWc

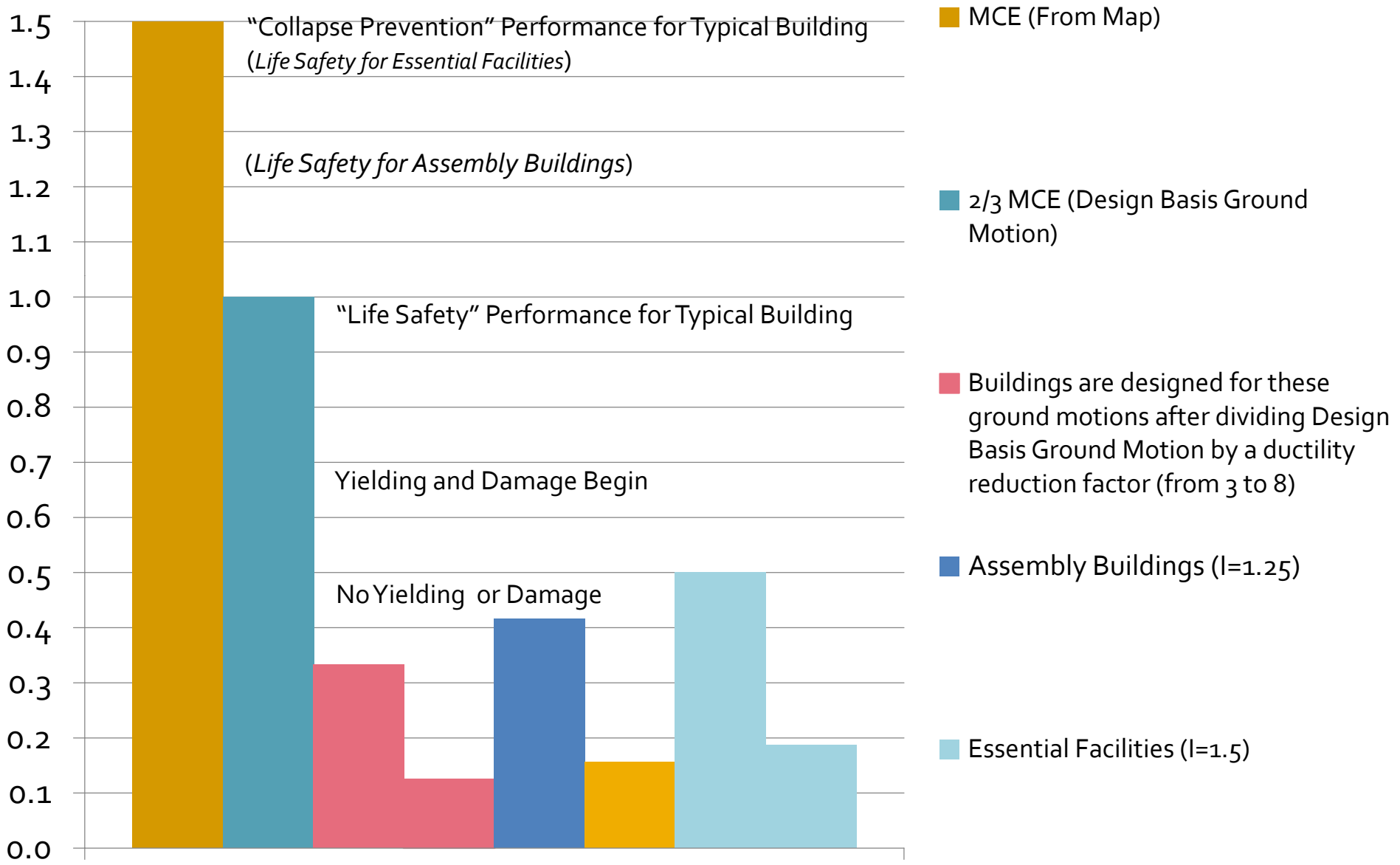
Earthquake Damage



What is MCE?
Maximum Considered Earthquake



Building Performance at Different Ground Motions



Summary

- Earthquake damage from
  - Drift
  - Acceleration
- Ground motions greatly vary
- Code ground motions are based on frequency of events
- Code designed buildings are safe, but will be damaged
- Older buildings do not have the strength or ductility of new buildings

Prior to the quake

- Understand how your building will perform when subjected to different levels of ground motion.
- Understand how your collections will perform when subjected to various levels of **acceleration**.
- Take action to **strengthen building**.
- Take action to **protect collections**.

After the quake

- Is my building safe to enter?
- How do I know?
- Who is responsible for assessing damage?
- How long will it take to tag my building?

ATC 20 – Rapid

ATC 20-1

Field manual: postearthquake safety evaluation of buildings

Second Edition

Applied Technology Council

ATC-20 Rapid Evaluation Safety Assessment Form

Inspection

Inspector ID: _____ Inspection date and time: _____ ☐ AM ☐ PM

Affiliation: _____ Areas inspected: ☐ Exterior only ☐ Exterior and interior

Building Description

Building name: _____

Address: _____

_____

Building contact/phone: _____

Number of stories above ground: _____ below ground: _____

Approx. "Footprint area" (square feet): _____

Number of residential units: _____

Number of residential units not habitable: _____

Type of Construction

☐ Wood frame ☐ Concrete shear wall

☐ Steel frame ☐ Unreinforced masonry

☐ Tilt-up concrete ☐ Reinforced masonry

☐ Concrete frame ☐ Other: _____

Primary Occupancy

☐ Dwelling ☐ Commercial ☐ Government

☐ Other residential ☐ Offices ☐ Historic

☐ Public assembly ☐ Industrial ☐ School

☐ Emergency services ☐ Other: _____

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Observed Conditions:	Minor/None	Moderate	Severe
Collapse, partial collapse, or building off foundation	☐	☐	☐
Building or story leaning	☐	☐	☐
Racking damage to walls, other structural damage	☐	☐	☐
Chimney, parapet, or other falling hazard	☐	☐	☐
Ground slope movement or cracking	☐	☐	☐
Other (specify) _____	☐	☐	☐

Estimated Building Damage (excluding contents)

☐ None

☐ 0–1%

☐ 1–10%

☐ 10–30%

☐ 30–60%

☐ 60–100%

☐ 100%

Comments: _____

Posting

Choose a posting based on the evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Localized *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

☐ Detailed Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: _____

Comments: _____

INSPECTED

LAWFUL OCCUPANCY PERMITTED

This structure has been inspected (as indicated below) and no apparent structural hazard has been found.

☐ **Inspected Exterior Only**

☐ **Inspected Exterior and Interior**

Report any unsafe condition to local authorities; reinspection may be required.

Inspector Comments:

_____

_____

_____

Facility Name and Address:

_____

_____

_____

Date _____

Time _____

(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:

_____

(Jurisdiction)

Inspector ID / Agency

_____

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

RESTRICTED USE

Caution: This structure has been inspected and found to be damaged as described below:

_____

_____

_____

_____

Entry, occupancy, and lawful use are restricted as indicated below:

_____

_____

_____

_____

_____

_____

Facility Name and Address:

_____

_____

_____

Date _____

Time _____

(**Caution:** Aftershocks since inspection may increase damage and risk.)

This facility was inspected under emergency conditions for:

_____

(Jurisdiction)

Inspector ID / Agency

_____

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

UNSAFE

DO NOT ENTER OR OCCUPY (THIS PLACARD IS NOT A DEMOLITION ORDER)

This structure has been inspected, found to be seriously damaged and is unsafe to occupy, as described below:

_____

_____

_____

_____

_____

_____

Do not enter, except as specifically authorized in writing by jurisdiction. Entry may result in death or injury.

Facility Name and Address:

_____

_____

_____

Date _____

Time _____

This facility was inspected under emergency conditions for:

_____

(Jurisdiction)

Inspector ID / Agency

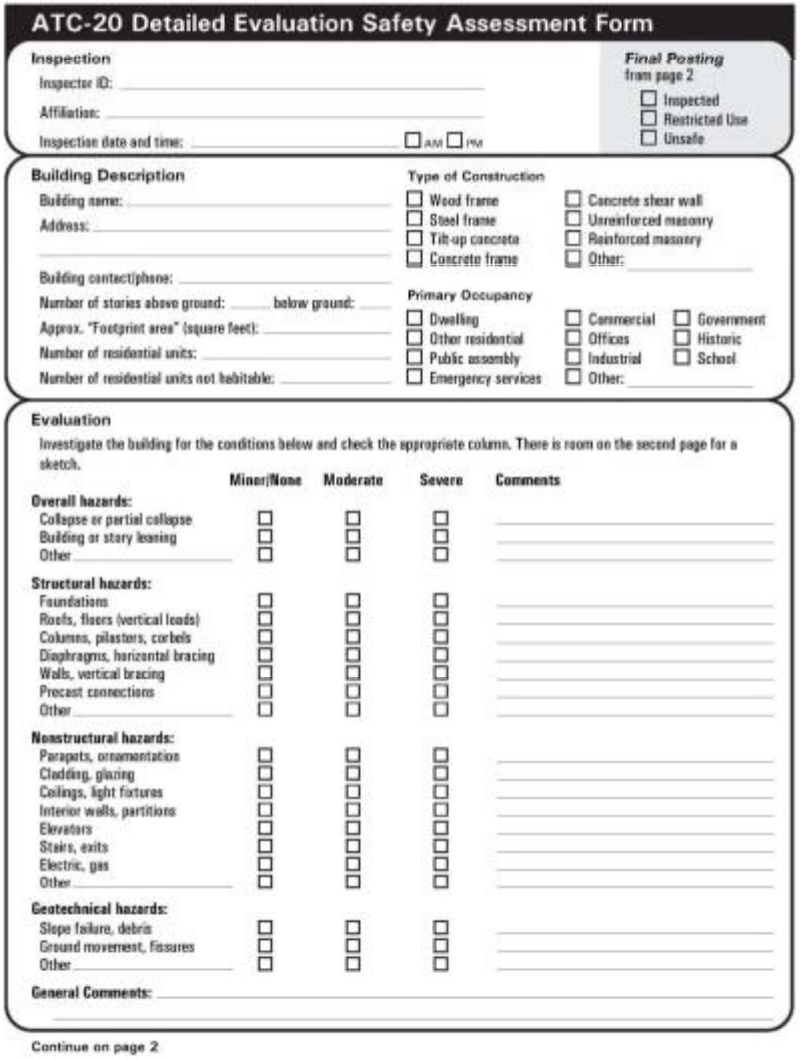
_____

_____

_____

Do Not Remove, Alter, or Cover this Placard until Authorized by Governing Authority

ATC 20 - Detailed Evaluation



ATC-20 Detailed Evaluation Safety Assessment Form

Inspection

Inspector ID: _____

Affiliation: _____

Inspection date and time: _____ ☐ AM ☐ PM

Final Posting from page 2

☐ Inspected
☐ Restricted Use
☐ Unsafe

Building Description

Building name: _____

Address: _____

Building contact/phone: _____

Number of stories above ground: _____ below ground: _____

Approx. "Footprint area" (square feet): _____

Number of residential units: _____

Number of residential units not habitable: _____

Type of Construction

☐ Wood frame
☐ Steel frame
☐ Tilt-up concrete
☐ Concrete frame
☐ Concrete shear wall
☐ Unreinforced masonry
☐ Reinforced masonry
☐ Other: _____

Primary Occupancy

☐ Dwelling
☐ Other residential
☐ Public assembly
☐ Emergency services
☐ Commercial
☐ Offices
☐ Industrial
☐ Other: _____
☐ Government
☐ Historic
☐ School

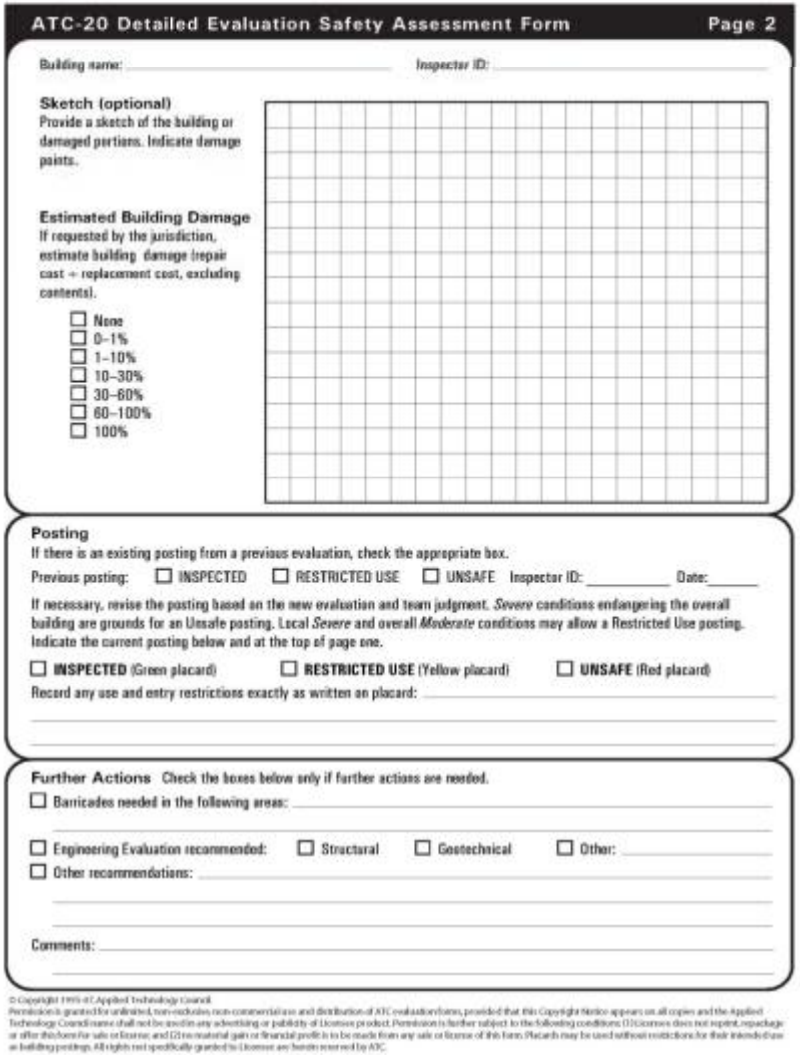
Evaluation

Investigate the building for the conditions below and check the appropriate column. There is room on the second page for a sketch.

	Minor/None	Moderate	Severe	Comments
Overall hazards:				
Collapse or partial collapse	☐	☐	☐	
Building or story leaning	☐	☐	☐	
Other _____	☐	☐	☐	
Structural hazards:				
Foundations	☐	☐	☐	
Roofs, floors (vertical loads)	☐	☐	☐	
Columns, pilasters, corbels	☐	☐	☐	
Diaphragms, horizontal bracing	☐	☐	☐	
Walls, vertical bracing	☐	☐	☐	
Precast connections	☐	☐	☐	
Other _____	☐	☐	☐	
Nonstructural hazards:				
Parapets, ornamentation	☐	☐	☐	
Cladding, glazing	☐	☐	☐	
Ceilings, light fixtures	☐	☐	☐	
Interior walls, partitions	☐	☐	☐	
Elevators	☐	☐	☐	
Stairs, exits	☐	☐	☐	
Electric, gas	☐	☐	☐	
Other _____	☐	☐	☐	
Geotechnical hazards:				
Slope failure, debris	☐	☐	☐	
Ground movement, fissures	☐	☐	☐	
Other _____	☐	☐	☐	

General Comments: _____

Continue on page 2



ATC-20 Detailed Evaluation Safety Assessment Form — Page 2

Building name: _____ Inspector ID: _____

Sketch (optional)

Provide a sketch of the building or damaged portions. Indicate damage points.

Estimated Building Damage

If requested by the jurisdiction, estimate building damage (repair cost ÷ replacement cost, excluding contents).

☐ None
☐ 0–1%
☐ 1–10%
☐ 10–30%
☐ 30–60%
☐ 60–100%
☐ 100%

Posting

If there is an existing posting from a previous evaluation, check the appropriate box.

Previous posting: ☐ INSPECTED ☐ RESTRICTED USE ☐ UNSAFE Inspector ID: _____ Date: _____

If necessary, revise the posting based on the new evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Local *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Indicate the current posting below and at the top of page one.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

☐ Engineering Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: _____

Comments: _____

Tagging in Christchurch NZ

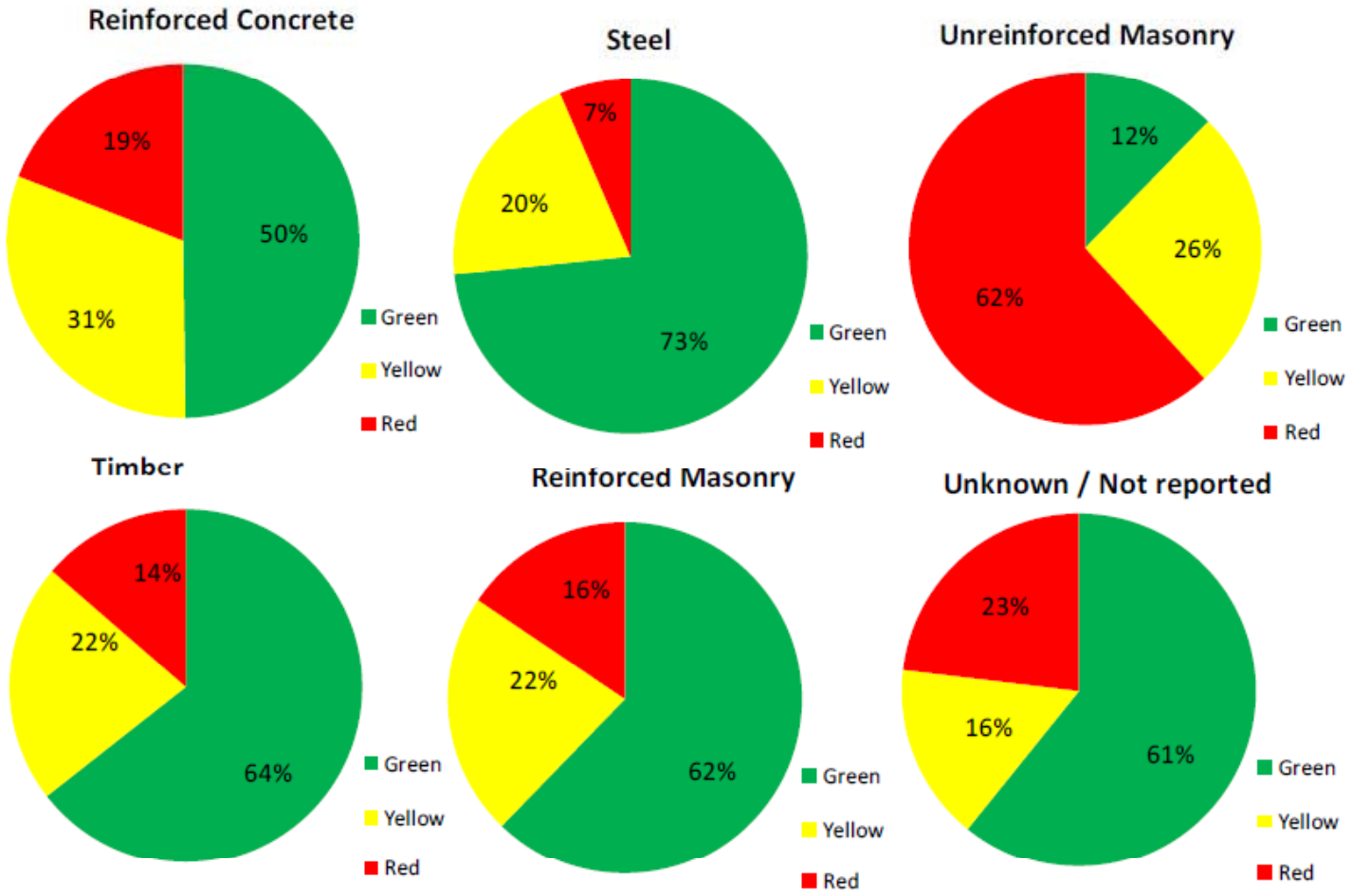


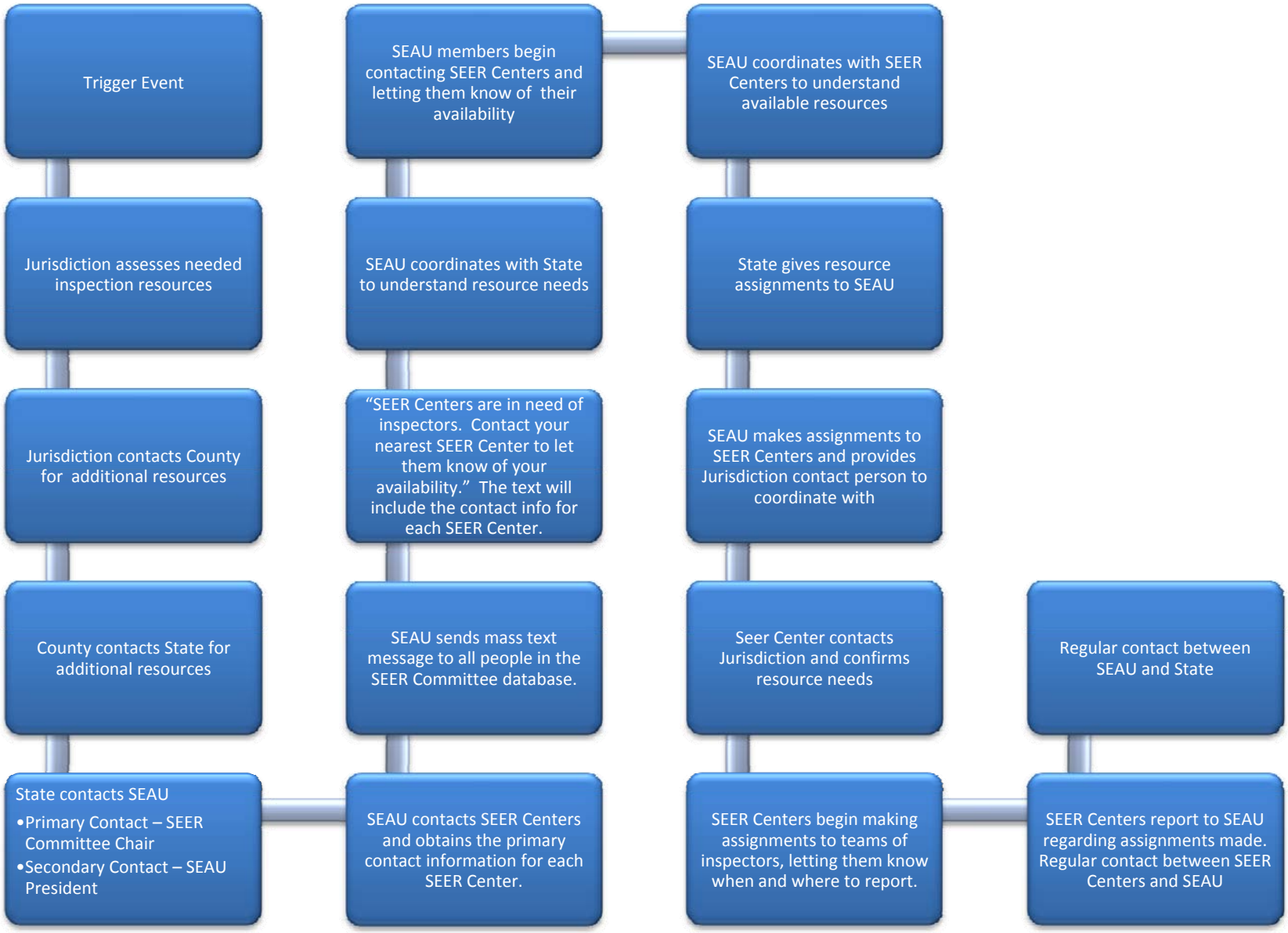
Figure 8: Building safety evaluation tagging status for CBD buildings as per 18th March 2011.

Tagging - will overwhelm existing resources

- City
- County
- State
- National

- Mostly done by volunteers

SEAU Volunteer Flow Chart



What if I can't wait for the city to provide inspectors?

Can I be proactive in preparing?

Building Occupancy Resumption Program

BORP

BORP

- The purpose of BORP is for a jurisdiction to preauthorize a post-earthquake building inspection.
  - Win for **Owner** – Immediate Tagging and Re-occupancy
  - Win for **Jurisdiction** – Fewer inspections and knowing that BORP buildings will receive better inspections
  - Win for **Public** – Faster access to resources

Additional Benefits of BORP

- Essential facilities will receive immediate pre-planned inspections allowing them to begin operations sooner.
- Business can begin functioning much sooner following the event.
- Building owners can be made aware of weaknesses in their building and can choose to strengthen their building prior to an earthquake.
- Building owners will be better prepared to deal with the effects of an earthquake.

Requirements for BORP

- Owner hires a structural engineer to prepare the BORP Plan.
- Engineer studies the building to understand the strengths and weaknesses.
- A detailed inspection plan is prepared.
- Plan includes names of specific inspectors who will be pre-authorized to inspect the building.
- BORP Plan is reviewed by an authorized reviewer.

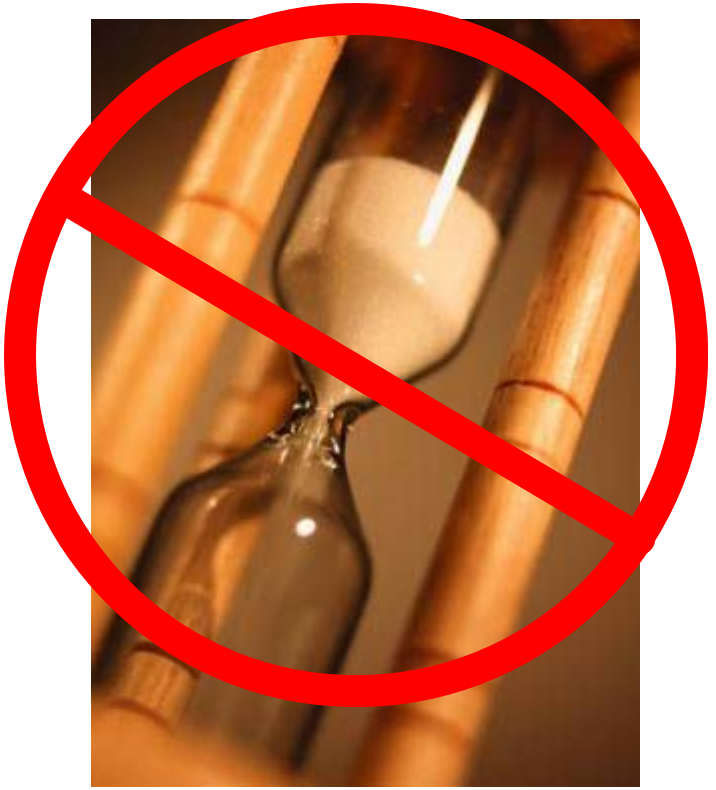
Cont.

- BORP Plan with review letter is submitted to the jurisdiction.
- Jurisdiction reviews BORP Plan.
- Jurisdiction returns plan to owner authorizing the listed individuals to provide post-earthquake inspection and tagging.
- A BORP Certificate of Approval is issued to Owner.

Following Event

- BORP Inspection Plan must be initiated within 2 or 3 days of the earthquake.
- If it is not implemented, then the jurisdiction may cancel the BORP and assign other inspectors to tag the building.

ACTION ITEMS



Assess Building and Collections

BORP