FEMA Guidance on Post-disaster Building Safety Evaluations (FEMA P-2055)

Report on the Current State of Practice, including Recommendations Related to Structural and Nonstructural Safety and Habitability

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Disaster Recovery Reform Act (DRRA) of 2018 (signed 10/5/18)

- DRRA Sec. 1241: Post-disaster Building Safety Assessment
  - (a) Requires FEMA to publish guidance on conducting post-disaster building safety assessments by licensed architects and engineers, specifically related to structural integrity and livability
  - (b) Requires FEMA to ensure the functions of post-disaster building safety assessment are accurately resource typed within the National Incident Management System (NIMS)
FEMA P-2055 project stats and acknowledgments

- Stakeholder organizations engaged (SLTTs, HUD, AIA, ICC, NCSEA, ASHRAE)
- 7 SME authors on the project development team
- 8 member project review panel
- 30 participant stakeholder workshop
- 16 FEMA staff reviewed
- 1,000+ review comments (for all drafts)
- 225 pages
- 4,000+ downloads since publication on November 27, 2019
- 200+ downloads in Puerto Rico after recent earthquakes

Project Technical Committee
- Bret Lizundia, SE
- Catherine Bobenhausen, MS, CIH, CSP, AIHA Fellow
- Rosemarie Grant, AIA
- Edwin Huston, PE, SE
- Laurence Kornfield, CBO
- Scott Nacheman, MSc.Eng., AIA
- Jim Olk, CBO
FEMA P-2055 Target Audience

**Primary:** Architects, engineers, and building officials.

**Secondary:** Emergency managers and health officials.

**Tertiary:** Policy makers at local, state, tribal, territorial, and federal level.

The target audience has been expanded beyond the architects and engineers explicitly listed in the Section 1241(a) charging language to include others who are directly involved in the post-disaster assessment process and to include policy makers since recommendations include legislative changes.
FEMA P-2055 Types of Incidents (Disasters)

- Earthquake
- Hurricane
- Tornado
- Flood
- Tsunami
- Land Instability
- Volcano
- Snow/hail/ice
- Fire
- Explosion

Photo credit: Bret Lizundia, 2010 Chile Earthquake

Photo credit: CalOES SAP Training Slides

Photo credit: 2010 Chile Tsunami

Photo credit: 2018 Paradise, CA Wildfire

FEMA P-2055 Scope

Focus of the P-2055 Guide

- Pre-disaster Program Management
- Building Safety Evaluation
- Post-disaster Program Management and Implementation
- Possible Temporary Habitability Standards
- Habitability Evaluation
- Long-term Repairs and Rebuilding
- Retrofitting Buildings and Other Mitigation Activities

Timeline
FEMA Individual Assistance Program

• The 2019 *Individual Assistance Program and Policy Guide* (IAPPG) states that FEMA defines “habitable” as safe, sanitary, and functional.
  o “Safe” refers to being secure from disaster-caused hazards or threats to occupants.
  o “Sanitary” refers to being free of disaster caused health hazards.
  o “Functional” refers to an item or home capable of being used for its intended purpose.

• FEMA Home Repair Assistance is intended to make the home safe, sanitary, and functional and will NOT necessarily return the home to its pre-disaster condition.

• This assistance is NOT a substitute for insurance and may NOT compensate for all losses caused by a disaster.
• Safety Inspections are eligible for PA funding as an Emergency Protective Measures

• The 2018 Public Assistance Program and Policy Guide (PAPPG) states that:

• “Post-incident safety inspections for public and private facilities are eligible, as well as posting appropriate placards (e.g., “red-tagging” a building that is unsafe)”
DRRA Sec. 1206: Eligibility for Code Implementation and Enforcement

- Amended Stafford Act Sec. 402 & 406
- Authorizes FEMA to provide post-disaster assistance to state and local governments for building code and floodplain management ordinance administration and enforcement.
- Adds post-disaster surge staffing assistance for code officials

STAFFORD ACT > TITLE IV > § 402

Sec. 402. General Federal Assistance (42 U.S.C. 5170a)
In any major disaster, the President may -

(5) provide assistance to State and local governments for building code and floodplain management ordinance administration and enforcement, including inspections for substantial damage compliance; and


(a) Contributions -

(1) IN GENERAL - The President may make contributions -

(C) base and overtime wages for the employees and extra hires of a State, local government, or person described in paragraph (1) that perform eligible work, plus fringe benefits on such wages to the extent that such benefits were being paid before the major disaster; and

(D) base and overtime wages for extra hires to facilitate the implementation and enforcement of adopted building codes for a period of not more than 180 days after the major disaster is declared.
Building Code Administration and Enforcement Requirements for Building Safety Evaluations

• Section 2.5 in FEMA P-2055 describes the authorities granted to code officials related to building safety evaluations and the resulting action that may be needed.

• Building code officials have the authority to:
  • Inspect for unsafe conditions
  • Prevent access to a structure or facility that they deem as damaged and unsafe
  • Close sidewalks and streets adjacent to unsafe buildings:
  • Deputize or delegate certain powers of their authority, including those listed above

• See P-2055 for the specific sections of the IBC, IRC and IEBC
Building Safety Evaluations after Puerto Rico EQs
Building Safety Evaluations after Puerto Rico EQs

Ponce

Guanica
Building Safety Evaluations after Puerto Rico EQs
QUESTIONS?

Post-disaster Building Safety Evaluation Guidance

Report on the Current State of Practice, including Recommendations Related to Structural and Nonstructural Safety and Habitability

FEMA P-2055 / November 2019

FEMA P-2055
Available for free download on FEMA website
FEMA P-2055 Scope

Focus of the P-2055 Guide

- Post-disaster Program Management and Implementation
- Building Safety Evaluation
- Habitability Evaluation
- Possible Temporary Habitability Standards
- Long-term Repairs and Rebuilding
- Pre-disaster Program Management
- Incident
- Timeline
- Retrofitting Buildings and Other Mitigation Activities
Session 2E: FEMA P-2055 Post-disaster Safety Evaluation Guidance

Urban Search and Rescue

Removal of remains of the deceased

Local Authorities

EERI: VERT

Utility Companies

NSF CONVERGE

SAFETY EVALUATIONS

“disaster tourists”

Graphics from Creative Commons
EERI Involvement

Virtual Earthquake Recon Team (VERT)
- Blogging/curating EERI Clearinghouse
- Interfacing with on-site EERI members
- Assisting EERI Learning from Earthquake team prepare for deployment
- Assisting reconnaissance team members post-process data
- Participating in potential research projects

Young members are welcome!

Learning from Earthquakes (LFE)
- Accelerating and increasing learning from earthquake-induced disasters that affect the natural, built, social and political environments.
- Disseminating lessons and opportunities for reducing earthquake losses and increasing community resilience.
- No safety evaluations (no tagging).
Earthquake Clearinghouse management following a major earthquake in the United States

- In CA: provide a location, real or virtual, after a damaging earthquake, where engineers, geologists, seismologists, sociologists, economists, and other professionals who arrive in the affected area can become part of a larger, temporary organization to facilitate the gathering of information, maximize its availability, and better use the talents of those present.
National Science Foundation
Other Assessments

- FEMA:
  - Public Assistance (PA), Individual Assistance (IA), Preliminary Damage Assessment (PDA), Mitigation Assessment Teams (MAT)

- Substantial Damage assessment by local authority
  - only in Special Flood Hazard Area.
  - triggered when cost of repairs (including NS) >50%

- Substantial Structural Damage:
  - Separate determination by Building Official

- Insurance claim inspections:
  - by claims adjusters (Insurance company’s or claimant’s)
Post-earthquake Safety Evaluations

Scope of Review by Post-disaster Building Safety Evaluator

- Building Safety Evaluation
  - Structural Safety
  - Nonstructural Safety

- Habitability Evaluation
  - Initial Environmental Hazard Scan
  - Nonstructural Function Scan

If Needed

- More Detailed Evaluation by Environmental Specialist
- More Detailed Evaluation by Building Systems Specialist
Best Practice for Earthquakes

Photo Credit: CEM Lecture Series (ATC, 2005). Image is from 1989 Loma Prieta Earthquake.
<table>
<thead>
<tr>
<th>Evaluation Type</th>
<th>Conducted by</th>
<th>Duration (typ)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windshield Survey</td>
<td>Building Official</td>
<td></td>
<td>General report</td>
</tr>
<tr>
<td>Rapid Evaluation</td>
<td>Building Official or deputized evaluator</td>
<td>30 minutes</td>
<td></td>
</tr>
<tr>
<td>Detailed Evaluation</td>
<td>Building Official or deputized evaluator</td>
<td>1-4 hours</td>
<td></td>
</tr>
<tr>
<td>Engineering Evaluation</td>
<td>Engineer retained by owner</td>
<td>Several days, analytical studies, FEMA 306, FEMA 352</td>
<td>Engineering report, may include repair solutions</td>
</tr>
</tbody>
</table>
ATC-20 Procedures and
ATC-20-1 Field Manual

ATC-20-2 Addendum,
ATC-20-3 Case Studies,
Techbrief

ATC-45
Windstorm
and Floods

ATC-20-1
Field Manual
Second Edition

1989 Northridge EQ
1989 Loma Prieta EQ

1994

1999-2002

2004

2010
Christchurch
New Zealand EQ

2014

ATC-20-1 Observations
from New Zealand

1989

1999-2002

2004

ATC-20-1 Bhutan

Session 2E: FEMA P-2055 Post-disaster Safety Evaluation Guidance
Recommended Improvements

- More examples of low and moderate damage
- Examples of what not to do
- Add usability categories (ATC-20-1 Bhutan)

<table>
<thead>
<tr>
<th>Damage Intensity</th>
<th>Posting</th>
<th>Usability Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light damage</td>
<td>INSPECTED</td>
<td>G1: Occupiable, no immediate further investigation required. G2: Occupiable, repairs may be necessary.</td>
</tr>
<tr>
<td>Moderate damage</td>
<td>RESTRICTED USE</td>
<td>Y1: Short-term entry. Y2: Repairs required for safe entry to damaged parts.</td>
</tr>
<tr>
<td>Heavy damage</td>
<td>UNSAFE</td>
<td>R1: Unsafe but stable. Repairs may be possible. R2: Unsafe and unstable. May not be repairable. R3: At risk from adjacent premises or ground failure.</td>
</tr>
</tbody>
</table>

- Classification scheme
- Data collection topics
- Evaluation criteria for land instabilities
- Geotechnical rapid evaluation forms.

<table>
<thead>
<tr>
<th>Land stability</th>
<th>Diagram</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landslide (i.e mass movement and shallow instability)</td>
<td><img src="image" alt="Landslide Diagram" /></td>
<td>A landslide in this context is a downslope movement of a soil or rock mass in either rotational or translational movement. Rotational slides move along a surface rupture feature within the slope that is curved and concave. For a translational slide, the mass displaces along a planar or undulating surface within the slope.</td>
</tr>
<tr>
<td>Boulder roll (rockfall)</td>
<td><img src="image" alt="Boulder Roll Diagram" /></td>
<td>Boulder rolls are abrupt, downward movements of individual rocks that detach or are ejected from steep slopes or cliffs. The falling mass may break on impact, may begin rolling on steeper slopes, and may continue until the terrain flattens.</td>
</tr>
<tr>
<td>Cliff collapse (rockfall)</td>
<td><img src="image" alt="Cliff Collapse Diagram" /></td>
<td>A cliff collapse begins with the detachment of soil and/or rock from the cliff, most often along a pre-existing fracture or weakness. The material subsequently descends, mainly by falling, and may break up in flight or on impact and accumulate as a debris wedge or cone at the base of the cliff.</td>
</tr>
<tr>
<td>Debris flow</td>
<td><img src="image" alt="Debris Flow Diagram" /></td>
<td>Debris flows are the mobilization of a mass of material downslope caused by saturation of the material, usually from inundation of a large volume of water. They often descend rapidly and can scour a channel in the slope during descent. The material in a debris flow can consist of soil, rock boulders, timber and other debris.</td>
</tr>
<tr>
<td>Incident Type/Building Type</td>
<td>Best Practice</td>
<td>Interim Recommendation</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Windstorms and Floods</td>
<td>ATC-45</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
| Volcano                     | None          | Use ATC-20-1 and ATC-45 | • Use ATC-20-1 for volcano-induced ground shaking, explosive damage from volcanic blasts, damage to roofs from the weight of ash and projectiles, and reduced capacity from structural elements exposed to fire and heat from lava.  
• ATC-45 is recommended for use in assessing damage from mudflows (lahars) and flooding caused by melting snow.  
• A volcano-specific field manual should be developed. |
| Hail                        | None          | Use ATC-45 and Composition Roofs Damage Assessment Field Guide | Add focused section on hail damage to ATC-45. |
| Snow and Ice Storms         | None          | Use ATC-20-1            | Need standardized protocol on determining weight of snow. |
| Fire                        | None          | Use ATC-20-1            | • Develop evaluation methodology specific to fire damage to structural and nonstructural components.  
• Evaluation of structures following wide-area wildland/urban interface fires and other large-scale fire events. |
| Explosion                   | None          | Use ATC-45              | Develop evaluation methodology specific to blast loading. |
| Multi-hazard Incidents      | None          | Utilize existing resources to respond. | Build a culture of awareness. |
| Historic and Cultural Resources | CalOES SAP Evaluator Training Manual | Not applicable | Focus of Manual is on earthquake damage. Additional information on damage in other incident types is needed. |
Post-earthquake Safety Evaluations

Scope of Review by Post-disaster Building Safety Evaluator

- Building Safety Evaluation
  - Structural Safety
  - Nonstructural Safety

- Habitability Evaluation
  - Initial Environmental Hazard Scan
  - Nonstructural Function Scan

If Needed

More Detailed Evaluation by Environmental Specialist

More Detailed Evaluation by Building Systems Specialist
Environmental Hazards (Section 4.4)
- Natural gas
- Carbon monoxide
- Chemical release
- Soot and fumes
- Blackwater, sewage, and mold
- Asbestos
- Lead-based paint
- Parasites
- Wild, stray, and dead animals
- Biting and stinging insects
- Debris and refuse

Building Systems/Services (Section 4.5)
- Sanitation
- Lighting
- Ventilation
- Heating/cooling
- Electricity
- Potable water
- Smoke and carbon monoxide alarms
- Fire suppression (sprinklers)

Other Code Issues (Section 4.6)
- Habitable space
- Means of egress/escape
- Accessibility
- Security
Post-Earthquake Environmental Hazards

- Natural gas
- Carbon monoxide
- Chemical release
- Asbestos release
- Lead-based paint
- Parasites
- Wild, dead, stray animals and insects
- Refuse and debris
### Environmental Hazard Evaluation Strategies

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Evaluation Strategy for Building Safety Evaluator</th>
<th>Evaluation Strategy for Specialist or Owner</th>
<th>Type of Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>• If evidence of gas leak (smell) or fire is observed:</td>
<td>Investigate, shut off gas where appropriate, and mitigate leaking gas line.</td>
<td>Fire department or utility</td>
</tr>
<tr>
<td></td>
<td>◦ Evacuate the building.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>◦ Avoid using mobile phones and other potential ignition sources nearby.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>◦ Notify the fire department or utility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>• If there is damaged HVAC equipment in the building, or equipment such as a generator, inside or closer than 20 feet from doors windows, or any other building opening, notify the requesting jurisdiction.</td>
<td>Use intrinsically safe, hands-free, CO or multi-gas meters.</td>
<td>Fire department or hazard materials unit</td>
</tr>
<tr>
<td></td>
<td>◦ If CO alarm goes off, get to fresh air and notify the fire department or utility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazard</td>
<td>Evaluation Strategy for Building Safety Evaluator</td>
<td>Evaluation Strategy for Specialist or Owner</td>
<td>Specialist/Comments</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Asbestos        | • Some common examples of asbestos containing materials include gypsum, drywall tape and filler/mud; pipe, furnace and boiler insulation; sprayed-on ceiling finishes; siding; and fireproofing.  
                    • If any of these are damaged, flaking, or friable:  
                      ○ Evacuate the building.  
                      ○ Barricade and post a RESTRICTED USE placard. | • Query the jurisdiction for asbestos records (permits) for larger buildings to identify or discount the potential for asbestos-containing materials.  
                    • If material containing more than 1% asbestos has been severely damaged, the area should be restricted and asbestos mitigated. | Only accredited asbestos professionals and properly trained and equipped contractors should evaluate and remediate. |
| Lead-based paint| • If the building was constructed or renovated before 1978, it may contain lead-based paint:  
                    ○ Observe paint for fair or poor condition—deterioration, flaking, dust.  
                    ○ Communicate need to cover/isolate areas of lead dust which may be encountered by children or families. This is only a temporary measure post-disaster. | • Evaluate presence of paint debris, flaking, or chipped paint.  
                    • Conduct sampling and lab tests. | Only accredited abatement contractors who are properly trained and equipped should remediate. |
| Parasites       | • If contaminated food, water, and surfaces are observed:  
                    ○ Avoid contact.  
                    ○ Notify public health officials. | • Evaluate presence of standing water, lack of sanitation, and unsanitary conditions that would promote the presence of parasites.  
                    • Conduct sampling and lab tests. | Public health officials. |
QUESTIONS?

FEMA P-2055
Available for free download on FEMA website
Outline for Remaining Presentation

- **Habitability Evaluation Issues**
  - Permanent standards vs. potential temporary standards
  - Framework for developing temporary habitability policies
  - Example issues/questions – interactive audience discussion

- **Pre-disaster and post-disaster program management**
  - Mutual aid/liability
  - Deployment prioritization
  - Quality assurance
  - New resource types
  - Changing/removing a placard
  - Cordonning

- **Emerging technologies**

- **Conclusions and Recommendations**
Habitability Evaluation

Environmental Hazards (Section 4.4)
- Natural gas
- Carbon monoxide
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Building Systems/Services (Section 4.5)
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- Lighting
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- Potable water
- Smoke and carbon monoxide alarms
- Fire suppression (sprinklers)

Other Code Issues (Section 4.6)
- Habitable space
- Means of egress/escape
- Accessibility
- Security
# Standards for Building Systems/Services

<table>
<thead>
<tr>
<th>System/Service</th>
<th>Permanent Standards</th>
<th>Potential Temporary Standards/Issues</th>
</tr>
</thead>
</table>
| Sanitation                            | • IRC, IBC, or NFPA 5000.  
• Every dwelling unit must have a toilet, lavatory, and a tub or shower. | • Community restroom and shower facilities.                                                          |
| Light, ventilation, and heat          | • IRC, IBC, NFPA 5000, and ASHRAE 55.  
• Glazing at least 8% of floor area, with half openable.  
• Heat to 68F. | • Reduced ventilation and light.  
• Heat requirements will likely depend on climate.  
• Allow use of operable windows.  
• Increased ventilation if cooling is essential. |
| Electrical                            | • NFPA 70, National Electrical Code.  
• Minimum number of receptacles/fixtures. | • Reduction in number of receptacles and fixture.                                                    |
| Potable water                         | • IRC, UPC  
• Every dwelling must have potable water | • Bottled water, water trucks, temporary tanks.  
• Graywater (bath water) for toilets.                                                               |
| Fire and CO alarms and fire protection systems | • IRC, IBC, IEBC, and NFPA 5000.  
• Varies by dwelling type, but can include: smoke, CO, and heat detectors; extinguishers; emergency lights and communication; fire suppression/standpipe/pumps; smoke control. | • Initially, fire watch, additional extinguishers, and battery-powered smoke and CO alarms.  
• Then restoration of electrical alarms and emergency exit illumination.  
• Then sprinklers, standpipes, fire pumps, and other specialized systems (e.g. smoke control). |
## Standards for Other Code Issues

<table>
<thead>
<tr>
<th>Issue</th>
<th>Permanent Standards</th>
<th>Potential Temporary Standards/Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitable space</td>
<td>• IRC and IBC (70 sf), NFPA 5000 (49 sf).</td>
<td>• Reduction in required square footage.</td>
</tr>
<tr>
<td></td>
<td>• 7 feet high over at least half the room. Local standards may be more stringent.</td>
<td></td>
</tr>
<tr>
<td>Means of escape</td>
<td>• IRC and NFPA 5000. Primary and secondary means of escape (unless primary leads directly outside and there are sprinklers), emergency escape in sleeping rooms, side-hinged primary door (no sliding front door), minimum egress widths.</td>
<td>• One usable exit from every occupied area.</td>
</tr>
<tr>
<td></td>
<td>• Stair or fire escape for stories above/below grade.</td>
<td>• This should change with building size and will also be affected by the height above grade.</td>
</tr>
<tr>
<td></td>
<td>• IBC has additional requirements for residential occupancies not allowed by the IRC, such as apartments, dormitories, hotels, half-way homes, and boarding facilities.</td>
<td></td>
</tr>
</tbody>
</table>
# Standards for Other Code Issues

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<thead>
<tr>
<th>Issue</th>
<th>Permanent Standards</th>
<th>Potential Temporary Standards/Issues</th>
</tr>
</thead>
</table>
| Accessibility for persons with disabilities or access and functional needs and seniors | • IBC Chapter 11.  
• State law (varies by jurisdiction).  
• 2010 ADA Standards for Accessible Design.  
• 2004 ADAAG Guidelines.  
• Titles II and III of ADA.  
• Above standards cover accessible entrance/path, common/public use areas, doors, switches/outlets/thermostats, kitchens/bathrooms. | • Assess on a case-by-case basis.  
• Depends initially on needs of occupants.  
• Not a requirement for single-family homes, unless needed by the occupants.                                                                 |
| Security                                                            | • The IRC does not require that doors or windows have locks, but if they do the locks must be readily openable from inside without the use of a key or special knowledge or effort. | • Increased police/security patrols.  
• Boarding up damaged openings.  
• Is a lockable door needed?                                                     |
Temporary Habitability Standard – What is it?

- Flexible, adaptable to community.
- Encourages shelter-in-place of residential buildings and continued use of non-residential buildings.
- Temporarily allows lower requirements than permanent occupancy requirements.
- Key Question: How low can the community go with temporary environmental hazard and building service requirements?
- We are only framing the questions to ask. We are not defining any standard.

From Safe Enough to Stay (SPUR, 2012)
Temporary Habitability Standard: Sample Questions Regarding *Initial* Re-occupancy

- Domestic water and sewer service to an apartment building are lost due to earthquake damage to infrastructure lines, but the building is fine otherwise.
  - If the owner or the city provides alternative portable toilets, water supplies, and community showers, can the building stay open?
  - If this is acceptable initially, how long can this continue until a return to permanent standards is required?

2010-2011 Christchurch NZ Earthquakes
ATC-109 Report (ATC, 2014)
Temporary Habitability Standard: Sample Questions Regarding Initial Re-occupancy

- An earthquake damages the fire sprinklers in this hotel, so they don’t work, but structural safety of the building is not compromised, and power is on, so no one needs to use candles to see.
  - Should the building official close the hotel?
  - Or should the hotel management be able to make the decision?
  - What if the management informs the hotel guests of the situation, sets up a fire watch by staff, and has adequate extinguishers in place?
  - Is a standardized information guide needed?
Temporary Habitability Standard: 
More Questions Regarding Initial Re-occupancy

- Egress: Is a second means of escape needed for reoccupancy? Does it depend on the size of or number of stories in the building? Can reduced occupant loads be allowed when some exits are compromised?
- Elevator: How many stories are acceptable without a working elevator?
- Disabled access: What aspects of accessible building design are required? Is an accessible path required if there was one before?
- Power: Is power required? Does it need to be continuous?
- Heat: Is heat required? Should it depend on the climate? Is there a target thermal range?
- Security: Does the building have to be lockable?
Temporary Habitability Standard: Broader Questions

- **Milestones:** How long would the alternative habitability standard be permitted? SPUR (2012) proposed an aggressive timeframe:
  - Immediately after the event.
  - One week after the event.
  - One month after the event.
  - Three months after the event.
  - At the end of the declared emergency.

- **Scale:** How does the scale of the incident impact what is acceptable?

- **Occupancy:** What requirements change when the building is not residential? Should there be different requirements for grocery stores, pharmacies, hardware stores? How about public schools?

- **Pre-incident Deficiencies:** What should be done if the building systems were already not in compliance before the earthquake?
Temporary Habitability Standard: Broader Questions

- Authority to Permit Occupancy: Who makes the decision to permit occupancy in buildings without fully functioning building systems? Is it only the building official? Can they delegate the authority?
- Enforcement: Who would enforce habitability requirements during the recovery period? Is enforcement practical?
- Changing and Removing a Placard: Who has the authority to remove a placard? Is repair to the pre-existing condition sufficient, even if it was deficient before the earthquake?
- Communication: How will environmental hazard and building system deficiency restrictions be communicated?
- Conflicting Laws: Are there laws that need to be changed to permit this to occur, including those that relate to building, fire, and health and safety codes?
- Stakeholder and Community Engagement: Which stakeholders may be most resistant to this idea? What will change their mind?
Temporary Habitability Standard: Approach Options

- Option 1: Ad hoc response to each incident, without pre-planning or policies? This is not recommended.

- Option 2: Assignment of habitability responsibilities during pre-planning, but no formal policy.

- Option 3: Adopt a policy with milestones and targets for select services and systems. No enforcement.

- Option 4: Same as Option 3, but with broader scope of targets.

- Option 5: Adopt a formal temporary habitability standard with enforcement.
Program Management and Implementation

The basic issue is how to run an effective post-disaster safety assessment program that addresses both the tree and the forest.
<table>
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<th>Pre-Disaster</th>
<th>Post-Disaster</th>
</tr>
</thead>
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<tr>
<td>• Pre-planning</td>
<td>• Implementation of Plans</td>
</tr>
<tr>
<td>• Resource Typing</td>
<td>• Safety of Evaluators and Tools</td>
</tr>
<tr>
<td>• Certification and Training</td>
<td>• Evaluation Prioritization</td>
</tr>
<tr>
<td>• Mutual Aid Resources and Agreements</td>
<td>• Deployment Resources</td>
</tr>
<tr>
<td>• Volunteers, Liability, Good Samaritan Laws, Workers’ Compensation</td>
<td>• Data Collection and Reporting</td>
</tr>
<tr>
<td>• Laws and Policies</td>
<td>• Quality Assurance</td>
</tr>
<tr>
<td></td>
<td>• Reevaluation Triggers</td>
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<tr>
<td></td>
<td>• Changing a Placard</td>
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<td></td>
<td>• Cordonning and Barricading</td>
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<td></td>
<td>• Communication</td>
</tr>
<tr>
<td>Topic</td>
<td>Best Practice</td>
</tr>
<tr>
<td>------------------------------------</td>
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</tr>
<tr>
<td>Pre-planning</td>
<td>None</td>
</tr>
</tbody>
</table>
| Resource typing                    | NIMS Resource Typing Library Tool provided by FEMA NIC | NA                                    | • NIMS resource typing required by DRRA Section 1241(b) was coordinated with FEMA P-2055.  
• New resource type guides will be issued soon by FEMA for several existing and new roles. |
| Volunteers, liability, Good Samaritan Laws | None          | AIA and ACEC model language | • A number of states need to pass laws to provide consistent volunteer protection. |
| Other laws and policies            | NA            | Pass legislation where missing | • Pass legislation to provide authority to (1) evaluate and post buildings, (2) deputize evaluators, (3) restrict occupancy, and (4) demolish buildings. |
## Pre-Disaster Management Best Practices

<table>
<thead>
<tr>
<th>Topic</th>
<th>Best Practice</th>
<th>Interim Recommendation</th>
<th>Additional Discussion/Needs/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutual aid resources and agreements</td>
<td>EMAC</td>
<td>NA</td>
<td>• Emergency Management Assistance Compact (EMAC) legislation has been enacted in all 50 states.</td>
</tr>
</tbody>
</table>
| Certification and training   | Cal OES SAP training program for safety evaluators | Building officials and other responsible for coordinating building safety and evaluation functions should take post-disaster safety evaluation training | • Enhance Cal OES program beyond earthquake/wind/flooding.                                          
• Have higher level certification.                                                                 |
• Apply consistent approach across the US.                                                                 |
• Require ICC Building Official Certification to include safety evaluation training.                                                                 |
• Develop curriculum for post-disaster safety evaluation as part of emergency management and disaster science education programs. |
Volunteers, Liability, Good Samaritan Laws, and Mutual Aid

- Good Samaritan Laws to protect volunteers from civil litigation vary widely throughout the U.S. AIA and ACEC have sample model language. States need to pass such legislation.

- Mutual aid: An affected jurisdiction reaches out to an unaffected region for equipment, supplies, and personnel.

- The Emergency Management Assistance Compact (EMAC) has been signed by all 50 states, Puerto Rico, Guam and US Virgin Islands. USE IT.

- EMAC provides liability protection, workers’ compensation, and license/certification reciprocity, and reimbursement.
Certification and Training

• NZ did not have a program of training and certification. It was done at the site briefly with mixed results. Approach used for training (4-6 hr class) and certification in California is recommended. Recertification is required every 5 years. A consistent approach across the US is desirable.

• Should there be different levels of training? This should be encouraged, with classes for Detailed Evaluations, to better address more complicated buildings.
# Post-Disaster Management Best Practices

<table>
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</thead>
<tbody>
<tr>
<td>Implementation of post-disaster safety evaluation plans</td>
<td>Include safety plan with incident action plan</td>
<td>None</td>
<td>• The official in charge of managing the safety evaluation program should provide this information to the Incident Commander for their appropriate Command/General Staff.</td>
</tr>
<tr>
<td>Evaluators safety</td>
<td>FEMA P-2055</td>
<td>NA</td>
<td>• Detailed safety guidance by incident type is needed.</td>
</tr>
<tr>
<td>Evaluation prioritization</td>
<td>None</td>
<td>FEMA P-2055</td>
<td>• Develop targeted building safety evaluation teams for essential facilities, grocery and hardware stores, and pharmacies.</td>
</tr>
<tr>
<td>Deployment resources</td>
<td>Existing national/state organizations</td>
<td>FEMA P-2055</td>
<td>• Create national volunteer database.</td>
</tr>
</tbody>
</table>
| Data collection and reporting              | None          | None                    | • Develop consistent list of data points to collect and report, including usability categories.  
  • Develop standardized electronic tools for data collection. |
| Quality assurance                          | None          | Include Technical Supervisor role | • Develop quality assurance guidelines.  
  • Update ATC-20-1 with examples of inappropriate practices.  
  • Technical Supervisor has quality assurance responsibility. |
Quality Assurance Issues

Red Tag Due to Damage Over Front Entrance

2 Yellow Tags on Side Entrance Around Corner

Photo Credits: Bret Lizundia, 2010 Eureka, CA Earthquake
Quality Assurance Issues

Initial Yellow Tag (Pending Engineer’s Review)  Then Green Tag (Engineer’s Review Required)

Photo Credits: Bret Lizundia, 2010 Eureka, CA Earthquake
Quality Assurance Issues

- Outdoor seating restricted, “except during the following times: (1) Monday – Friday, 4:30pm to closing, (2) Saturday to Sunday – All Day.”

- The restrictions should not relate to when the restaurant is open, but rather to the hazard itself.

- Placing exceptions for specific times is inappropriate and potentially endangers patrons.

Photo Credits: Bret Lizundia
2014 Napa, CA Earthquake
Who Does What – Resource Typing

- Post-disaster Building Safety Evaluator
  - Traditional ATC-20 evaluator

- Post-disaster Building Safety Evaluation Team Leader
  - Administration, staffing, deployment decisions, coordination with others

- Post-disaster Building Safety Evaluation Strike Team Technical Supervisor
  - Quality assurance, answering questions, identifying trends, advice on deployments

- Post-disaster Complex Structural Condition Evaluator
  - Structurally complicated buildings and issues, higher level of experience and training

- Post-disaster Complex Architectural System Condition Evaluator
  - Complex architectural systems (fire safety, environmental, envelope, communication, accessibility, elevator), focus on habitability, higher level of experience and training
Post-disaster Building Safety Evaluation Strike Team Leader

Post-disaster Building Safety Evaluation Strike Team Leader
Administration, staffing, deployment decisions, coordination with resources outside the team, and coordination of Strike Team activities within the Incident Command System structure.

Incident Command or General Staff

Note: "Evaluation Team" is the two-person Post-disaster Building Safety Evaluation Team.
FEMA is Finalizing Resource Typing Guides

**POST-DISASTER BUILDING SAFETY EVALUATION STRIKE TEAM TECHNICAL SUPERVISOR**

<table>
<thead>
<tr>
<th>RESOURCE CATEGORY</th>
<th>Emergency Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESOURCE KIND</td>
<td>Personnel</td>
</tr>
<tr>
<td>OVERALL FUNCTION</td>
<td>The Post-Disaster Building Safety Evaluation Strike Team Technical Supervisor (Building Safety Evaluation Strike Team Technical Supervisor) provides enhanced quality assurance and consistent evaluation results in the post-disaster evaluation process.</td>
</tr>
</tbody>
</table>
| COMPOSITION AND ORDERING SPECIFICATIONS | 1. This position can be entered as a single resource or in conjunction with a National Incident Management System (NIMS) Type team (Post-Disaster Building Safety Evaluation Team).  
2. Discuss logistics for deploying this position, such as working conditions, length of deployment, security, lodging, transportation, and meals, prior to deployment.  
3. Requestor orders this position to accompany NIMS Type Post-Disaster Building Safety Evaluation Teams based on incident needs and complexity.  
4. Requestor specifies any necessary personnel specialty areas based on incident-specific hazards.  
5. The Building Safety Evaluation Strike Team Technical Supervisor and the Building Safety Evaluation Strike Team Leader may be the same individual depending on the incident scale. |

Each type of resource builds on the qualifications of the type below it. For example, Type 1 qualifications include the qualifications in Type 2, plus an increase in capability. Type 1 is the highest qualification level.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>SINGLE TYPE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTION</td>
<td>The Building Safety Evaluation Strike Team Technical Supervisor:</td>
<td>Not Specified</td>
</tr>
<tr>
<td></td>
<td>1. Reports to the Post-Disaster Building Safety Evaluation Strike Team Leader</td>
<td></td>
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<td></td>
<td>2. Answers questions regarding evaluation criteria, procedures, and appropriate conclusions, as well as language to use on placards</td>
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<td></td>
<td>3. Performs spot-checks of submitted evaluations from the field and in damage photos</td>
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<td></td>
<td>4. Helps decide when to perform Detailed Evaluations</td>
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<td></td>
<td>5. Identifies incident trends and determines how to evaluate them</td>
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<td></td>
<td>6. Advises on upcoming deployment priorities</td>
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</tr>
<tr>
<td></td>
<td>7. Conducts just-in-time training for new inspectors upon arrival</td>
<td></td>
</tr>
<tr>
<td>EDUCATION</td>
<td>Not Specified</td>
<td>Not Specified</td>
</tr>
</tbody>
</table>
# Post-Disaster Management Best Practices

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</table>
| Reassessment triggers       | None          | Indicator buildings for earthquakes | • Increase building instrumentation coverage.  
• Develop guidance for other incident types.                                                                                                                                                                                        |
| Changing or removing a placard | None       | Local jurisdiction develop own policy | Consensus and guidance are needed on (1) who has authority to reassess and change a rating, (2) whether a qualified private engineer or architect can be permitted to change ratings, (3) as aftershock, wind, flood, and fire risk diminish, can placard restrictions be relaxed, and (4) what is need to go from UNSAFE to RESTRICTED USE and from RESTRICTED USE to INSPECTED. |
| Communication                | None          | San Francisco Procedures        | Update with broader stakeholder involvement and cover specifics for communicating with public, media, and building owners.                                                                                                           |
| Cordonning and Barricading   | 2013 CALBO Interim Guidance document | NA                              | Update CALBO document to cover (1) research on effectiveness of scaffold and barricades, (2) expanded stakeholder involvement and refinement of protection of public way and adjacent buildings, (3) specific criteria to permit more flexibility in fencing and barricade placement, and (4) required follow-up inspections. |
Indicator Buildings

- From 2010-12 Christchurch: Select a representative subset of building stock to initial recheck after major aftershock.
  - New damage, then reinspect other buildings.
  - No damage, then do not inspect other buildings.

- Instrument indicator buildings with strong motion sensors.

- Add video for remote viewing when possible.

Photo Credits: ATC / Bret Lizundia
2010-11 Christchurch, NZ Earthquakes
Consensus and guidance are needed on:

• Who has authority to reassess and change a rating.

• Whether a qualified private engineer or architect can be permitted to change ratings.

• As aftershock, wind, flood, and fire risk diminish, can placard restrictions be relaxed.

• What is need to go from UNSAFE to RESTRICTED USE and from RESTRICTED USE to INSPECTED.
Cordonning and Barricading

- Reduce cordons quickly
- Use internet to give current info

CALBO has 2013 *Interim Guidance for Barricading, Cordonning, Emergency Evaluation and Stabilization of Buildings with Substantial Damage in Disasters.*

- 1.5H:1V recommended as distance for fencing.
- If V is to top of separated gable, the fence would need to much farther into the street.

Photo Credits: Bret Lizundia, 2014 Napa, CA Earthquake
Emerging Technologies and Development Needs

- Building owner’s guide to safety assessment. Watch list:
  - Noticeable tilt or lean based on a clear measurement method.
  - Collapse or partial collapse of any element.
  - Evidence of smoke or fire.
  - Over half of windows are broken.
  - Cracks in exterior walls permit view to interior.
- Social media
- Machine learning and artificial intelligence
- Strong-motion data
- Geospatial data
- Aerial vehicles
Key Conclusions and Recommendations

- Current post-disaster building safety evaluation guidelines following wind, flood, and earthquake incidents have a proven track record of success in past incidents. Only minor refinements are recommended.

- Best practice guidelines for other incident types are needed. FEMA P-2055 provides interim recommendations and advice on what could be developed in the future.

- Proper planning, management, and implementation are essential for evaluation programs to work.
Key Conclusions and Recommendations

Before an incident:

- Train and certify building safety evaluators and evaluator supervisors to properly perform evaluations, train building officials and emergency managers in managing the evaluation process;
- Develop appropriate emergency management plans;
- Verify mutual aid resource agreements are set up and understood.
Key Conclusions and Recommendations

After an incident:

• Consider deployment safety, management and prioritization of appropriate evaluators for the incident type and scale;

• Employ methods of effective collection and reporting of the data developed during the evaluation process such as placard posting status and rationale;

• Provide quality assurance oversight of field evaluators by experienced and technically qualified individuals.

• Implement policies on reevaluation triggers for aftershocks, how placards can be changed or removed.

• Develop procedures for cordonning and barricading damaged buildings and for effective communication with the public, media, and building owners.
Key Conclusions and Recommendations

• In many local jurisdictions across the United States, laws and policies are needed to properly implement post-disaster evaluations, including Good Samaritan Laws to protect the design professionals who volunteer as evaluators, and legislation to create the authority to evaluate and post buildings, deputize evaluators, restrict occupancy, and demolish buildings.

• FEMA P-2055 provides a detailed discussion of:
  • Pre-disaster habitability requirements and how they apply and are evaluated following an incident.
  • The concept of allowing temporary, reduced standards for selected building services and systems until full repairs can be made is reviewed;
QUESTIONS?

Post-disaster Building Safety Evaluation Guidance

Report on the Current State of Practice, including Recommendations Related to Structural and Nonstructural Safety and Habitability

FEMA P-2055 / November 2019

FEMA P-2055
Available for free download on FEMA website