

OREGON BUILDING CODES DIVISION

POST EARTHQUAKE EVALUATION GUIDE



Introduction

Buildings can suffer a lot of damage as a result of earthquakes. Unfortunately, not everyone is aware of the immediate dangers that these damaged structures may pose. To ensure the safety of the public, post-earthquake safety evaluations may be performed. This guide is intended to be used as a quick reference for completing the process.

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The process

When an earthquake hits, no one is sure of the impact at first. Some places may have been hit harder than others. Some places may be completely unaffected. This is why Oregon follows a designated process, which looks like this:

- **Windshield**

Immediately after an earthquake, government agencies will determine the overall scope of the damage. This will decide which areas may need a closer look.

- **Rapid evaluation**

This is the first and, often times, the only safety evaluation performed. The structure's exterior and grounds are inspected for safe use. This guide will focus on how to perform this evaluation.

- **Detailed evaluation**

When a building is considered essential, or if a rapid evaluation determined a more thorough inspection was needed, a detailed evaluation is performed.

- **Engineer evaluation**

If damage to a building has been through an evaluation and determined to be unsafe, the owner can then have repairs evaluated by an engineer to show that the identified issues have been resolved.

Rapid evaluations

Some of the conditions you will see in a rapid evaluation are self-explanatory. Buckling, tilting structures, or collapse are easy to notice. However, some may be less obvious.

Regardless of the agency response, there is a standard process for evaluating a structure. With this process, there are some key things to remember:

The basic approach

- **A building official will determine if you are qualified**

A building official from the local government agency will determine if you have the knowledge necessary to safely perform inspections.

- **Agency in charge provides right to inspect**

You will be assigned the legal right as an agency representative to perform inspections.

- **Look for expected and unexpected damage**

Not all damage is obvious or predictable. Always make sure to look for unexpected damage, too.

- **Assume significant aftershocks will occur**

Aftershocks are expected, but your assessment is unable to predict them. Consider this potential when completing your assessment.

- **Use good judgment when assessing risk and damage**

You have experience in building construction that gives you the knowledge to assess the safety risks.

- **Seek additional help if needed**

If you have questions with an evaluation, contact a state-certified building official for assistance.

Safety concerns

After an earthquake, damage to individual buildings can vary greatly. Here are a few key safety concerns to look for when performing an assessment:

1. **Threat of total or partial collapse of the structural frame**
2. **Falling hazards from nonstructural elements (e.g., loose bricks, parapets)**
3. **Other hazards that prevent safe use (e.g., exposed chemicals, gas leaks, downed power lines)**

Assessing risk

It is important to remember that occupant safety is our primary concern when performing any evaluations. Safety can be compromised by a number of hazards, and the amount of risk is not always proportional to the amount of damage.

For example, a loose parapet near an entrance to a building is likely a small economic loss, since the damage is rather minimal. However, the parapet provides a dangerous falling hazard that may affect the usability of the structure.

In addition to structural hazards, there are some other concerns that you will want to keep in mind when you are completing your inspections. Here are just a few examples:

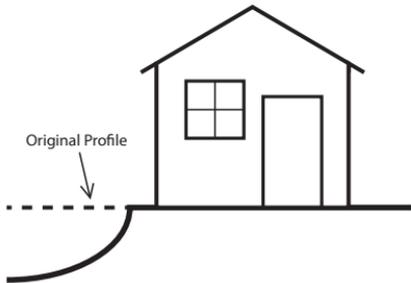
Hazardous materials such as flammable liquid and poisonous gas may be present on site. Be aware of fumes, odors, and visible spills.



Fallen power lines pose a real danger to occupants. Even if there is no power going through the cable now, that may change as repairs are made.

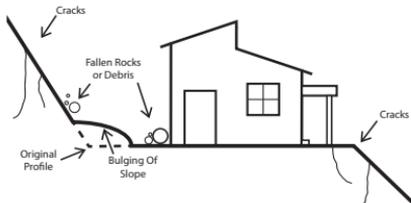
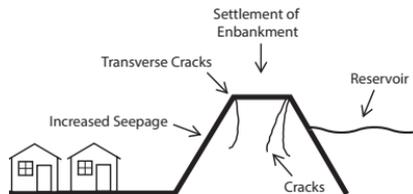
Geo-technical hazards

Not all hazards will come from the structure itself. In addition to structural damage, earthquakes can cause a number of issues with the ground the structure sits on. Be just as mindful of these hazards as any other structural hazard.



Unsafe area

In some events, structural safety may be a concern when the environment may cause more damage, such as a reservoir with a damaged wall, or bulging slopes on a steep cliff side.



Potential slope failures

Slope failures can pose a threat to more than just the structure. Keep an eye out for bulging slopes and large cracks. You may even see rocks or trees that have fallen from uphill.

Placard examples

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**

INSPECTED

No apparent hazard is found. Although repairs may be required, the original seismic resistance is not significantly decreased.

**No restriction
on use or occupancy**

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**

RESTRICTED USE

A hazardous condition exists (or is believed to exist) that requires restrictions on occupancy or use of the structure.

**Entry and use are
restricted as shown on
placard**

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:

Facility Name and Address:

Date _____
Time _____

This facility was inspected under emergency conditions for:

(Jurisdiction)

Inspector ID / Agency

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

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

UNSAFE

Extreme hazards that pose a threat to public safety are present. There may be imminent risk of further damage or collapse.

**Unsafe for occupancy
or entry without
special authorization**

- **No evidence of major structural damage**
 - **Buildings with cosmetic damage only**
 - **Buildings that are safe from geo-technical hazards**
 - **If damage is visible, the damage does not compromise the building or safety**
 - **Main exits are usable**
 - **No falling hazards or other life safety risks**
-

- **Brief entry to retrieve possessions only**
 - **Entry permitted to secure and repair**
 - **No public entry to building**
 - **Portions of the building cannot be safely occupied**
 - **Compromised cladding may result in further damage**
 - **Specific entry/exit unsafe due to damage**
-

- **Building is in danger of collapse**
- **Building is in danger of ground slope failure**
- **Building is structurally safe, but entry is prevented by other hazard (gas line, power line)**
- **Severe cracking in unreinforced masonry**
- **Exits are completely blocked**

The evaluation process

1. Examine the entire outside of the building

Just because the front of the building appears safe does not mean the rest of the building is. Make sure to inspect the whole exterior.



2. Examine ground for distress

Inspect the perimeter; look for visible foundation elements that may be affected. Bulging ground and cracks could mean a slope failure.

3. Discuss observations and evaluate

Discuss observations with your team. Are the grounds safe? Is the entry safe? Do not forget to consider the structure's use in your evaluation.



4. Post the building placard

Complete all relevant information for the placard you choose. If you are using a restricted use placard, make sure to detail all restrictions.

5. Inform occupants of hazards

Inform all building occupants of the hazards. If they understand the dangers you have found, they are more likely to obey the posted restrictions.



6. Fill out the assessment form

Makesuretheformsareaccurateandlegible. Remember, any restrictions must be repeated word for word on the assessment form.

Posting a placard

It is important that people are able to quickly identify buildings that have been inspected. This ensures that people are aware of risks, and limits public exposure to unsafe environments. When posting placards, follow these steps to minimize confusion:

- **Place in a clearly visible location near the main entry**
If a building is unsafe or restricted use, place additional placards at each entrance, unless it is a single-family dwelling.
- **Be consistent**
Try to post placards in a similar location on each building. This makes it easier to find the placard.
- **Use barricades and caution tape**
If an area is unsafe and should not be entered, place barricades or string caution tape.
- **You may require fencing**
When using fencing, set it back far enough to account for falling and other hazards.
- **Communicate with fire, police, and public works**
Emergency services will be working to resolve reported issues; communicate any hazards that may require their assistance.
- **One posting classification per building**
Remember, restricted-use postings can be used to indicate different restrictions of different parts of the same building.
- **Double check date and time on the placard**
To allow for proper re-assessment in the event of an aftershock, make sure the correct date and time are included on your original placard.

Assessment form example

Post Earthquake Rapid Evaluation Safety Assessment Form

Inspector ID #: #432584 Inspection date and time: 3/25/18 4:15 AM / PM
 Affiliation: _____

Building Description

Building Name: Smith Residence

Address: 123 Somewhere Drive
Portland, OR 97204

Building contact/phone: _____

Number of stories above ground: 2

Number of stories below ground: _____

Approximate footprint (Sq. Ft.): _____

Number of residential units: _____

Approximate footprint (Sq. Ft.): _____

Number of residential units: _____

Type of Construction

Wood frame Concrete shear wall
 Steel frame Unreinforced masonry
 Tilt-up concrete Reinforced Masonry
 Concrete frame Other (specify): _____

Dwelling Offices Government
 Other Residential Industrial Historic
 Public Assembly Emergency Services School
 Commercial Other: _____

of units not habitable: _____

Evaluation

Type of Construction

Full/partial collapse, or off foundation:

Minor/None Moderate Severe

Building or story leaning:

Racking damage to walls:

Other structural damage:

Falling hazards (loose chimney, parapet):

Ground slope movement or cracking:

Other (specify): Severed Gas Line

Comments: _____

Estimated Building Damage (excluding contents):

None 0-1% 1-10% 10-30% 30-60% 60-100% 100%

Posting

Choose the relevant placard based on the evaluation, as well as team judgment. Severe conditions that endanger the safety of the building or occupants should be posted as **UNSAFE**. Moderate conditions, including partial severe damage may allow for a **RESTRICTED USE** placard. **INSPECTED** can be used when a building is found to be safe.

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

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

Detailed Eval. Recommended: Structural Geotechnical Other: _____

Additional

Recommendations: Building requires major repairs. House has moved 1-2 feet off of it's foundation.

Cripple wall failure. Severed gas line has been shut off by the local gas company.

Documentation accuracy

The assessment form and placard are not just used to inform the public of the building's safety after an earthquake. They also provide necessary information for inspectors and engineers performing additional inspections, as well as to inform the agency in charge of the overall scope of damage.

For this reason, your document must be legible and accurate. For example, *234 10th Street* is not the same as *234 10th Avenue*. Here are some other important examples:

- **Inspection date and time**

Although simple, this information can help determine if a building needs to be re-inspected due to an aftershock. Be sure you have the correct date and time.

- **Estimates of damage**

The assessment form has a place to indicate the estimated damage percentage. This percentage is not a measure of monetary loss, but rather an indication of its safety status to the local jurisdiction.

- **Follow local jurisdiction guidance**

Follow the directions of the local jurisdiction. Fill out all placard and assessment forms that you are asked to complete.

- **Any restrictions MUST be repeated word for word**

When using a **RESTRICTED USE** placard, any restrictions you write on the placard must be repeated word for word on the assessment form. This will allow the local jurisdiction to clearly define any restrictions.

Explaining the evaluation

Occupants and owners can feel confused after a major earthquake. Some may even be suspicious and reluctant to cooperate. Stay factual, objective, and patient.

Make sure that the occupants understand any risks they may face. Try to answer any questions they may have if you can. Make sure you have common agency contact information.

Changing a posting

As conditions improve or worsen, a posting may need to be updated. This could be due to a number of reasons, including removal of a hazard, new hazards due to aftershock, or even a simple oversight.

Regardless of the reason, any change in the posting category must be completed only by an authorized representative of the government agency in charge.

Use good judgment

When completing inspections, remember that guidelines and procedures may not cover all situations you may encounter.

In situations like this, where no guidance has been provided, or if the guidance provided is not appropriate for the particular situation, you and your team must rely on your collective experience and knowledge to provide the best judgment.

If you are uncertain or do not have enough knowledge to make a judgment call, it may be necessary to obtain additional help. If this happens, contact your local jurisdiction for further direction.

REMEMBER TO

BE SAFE!

Always Work in Teams

Wear all State Required Safety Gear

Survey Building Perimeter

Be Alert for Falling Objects

Watch for Expected and Unexpected Hazards

Report Hazards to the Proper Authorities

Follow Your Municipality's Guidelines

When in Doubt, Use Good Judgment

Department of Consumer and Business Services

Building Codes Division

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