FEMA P-909

Home & Business Earthquake Safety and Mitigation

A “Train the Trainer” Course

July 2013

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Overall Purpose

Teach the general public about

earthquake mitigation

for homes and businesses.

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Overall Agenda

Part 1: Orientation for Trainers

Part 2: Presentation for the Public

Part 3: Hands-On Demonstrations

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PART 1 – FOR TRAINERS

Jocelyn Augustino/FEMA

Learning Objectives for Trainers

- Plan and organize an effective training session
- Address common questions from homeowners and business owners
- Identify potential earthquake hazards and evaluate potential risks
- Recognize costly consequences of failures
- Recall strategies that can limit future losses
- Teach others how to implement mitigation strategies

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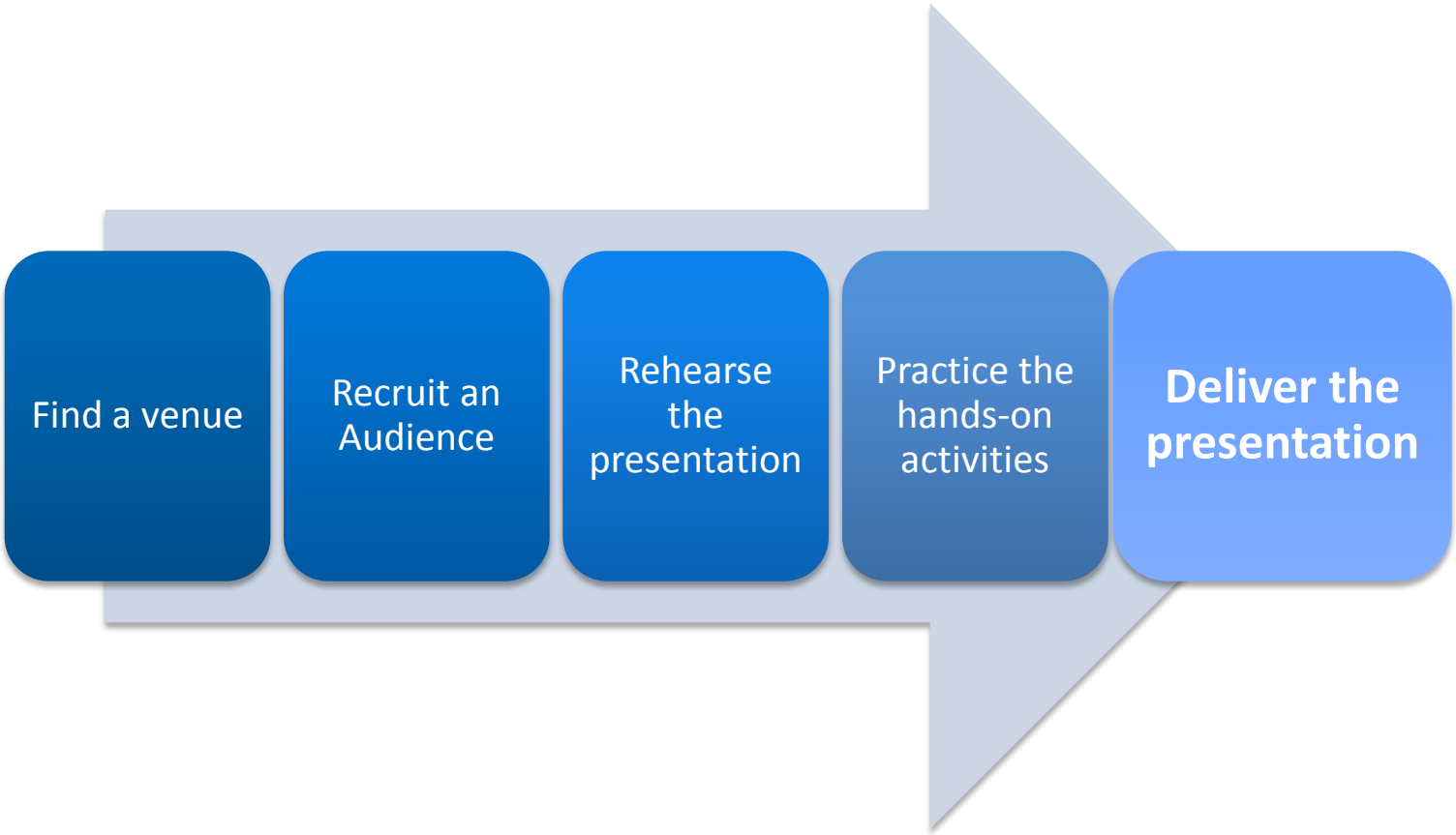
Planning a training session



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Recruit attendees

1. Send an email to a relevant distribution list
2. Contact your chamber of commerce
3. Partner with a building improvement store
4. Advertise at school board meetings, invite school administrators
5. Reach out to first responders
6. Contact city emergency managers
7. Reach out to local citizen groups

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Effective Training Strategies

1. Create a **comfortable** environment
2. **Know** your participants
3. Concentrate on what's **important**
4. Keep participants **engaged**
5. Get **feedback**

Create a comfortable environment

*Participants will be more engaged if the session is **informal**, **fun**, and **example oriented***

- Make it fun!
- Ask questions and encourage dialogue
- Use clear vocabulary
- Walk around the room, don't be a talking head
- Make yourself available before and after

Expert Tip

Provide email contact information

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Know your audience

At the beginning of the session, ask about:

1. Expectations
2. Skill sets
3. Level of knowledge and experience


Michael Medina-Latorre/FEMA

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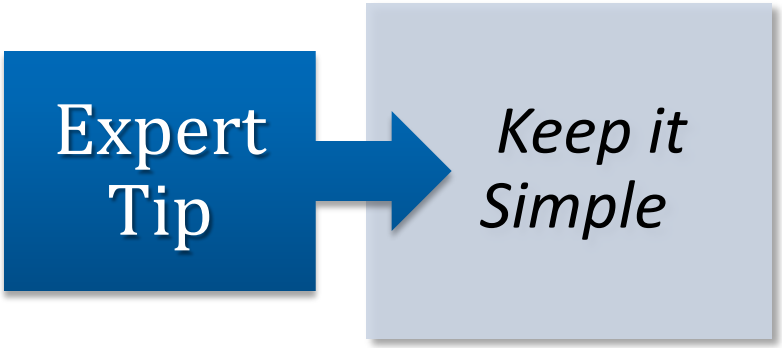
Concentrate on what's important

- Limit long sidebars or discussions
- Repeat the important points
- Keep a running list of questions you haven't answered and go through this list at the end



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Engage the class

*Use a variety of **approaches** and **activities***

- Focus on the hands-on demonstrations
- Analyze real situations. Adults tend to think in a problem-oriented way, take advantage of this.
- Use storytelling
- Give everyone a chance to participate

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Get feedback

- Hand out cards and ask participants to write down questions during the training. At the end, collect the cards and use them to do a review session.
- Ask participants for a summary of what they learned and compare this to the agenda
- Encourage the group to tell you what they liked and what you could improve

Expert Tip

Feedback reinforces learning and will help you be a more effective trainer

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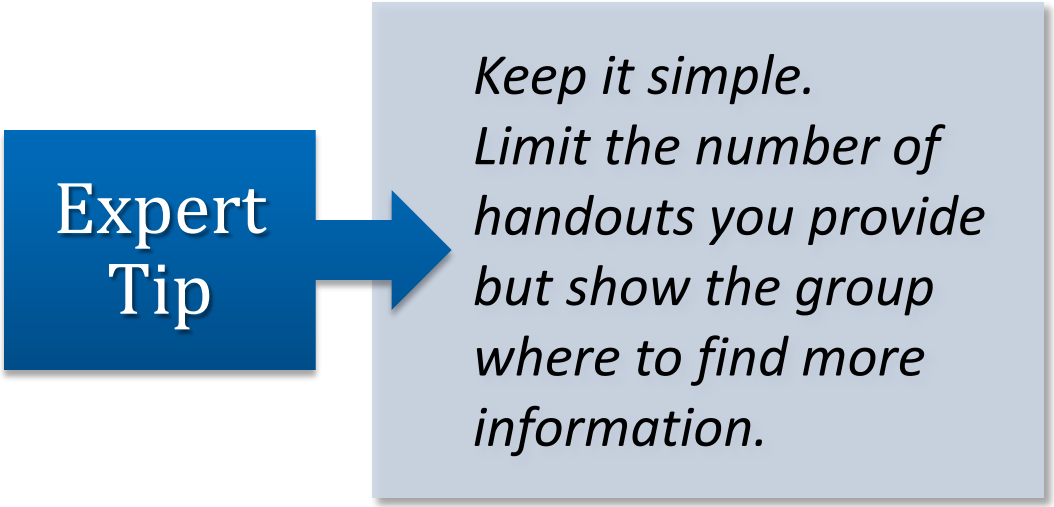
Suggested Handouts

- QuakeSmart Toolkit
- Home Hazard Hunt Poster
- FEMA 530, Earthquake Safety Guide for Homeowners
- FEMA E-74, Reducing the Risks of Nonstructural Earthquake Damage



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PART 2 – PRESENTATION

Agenda

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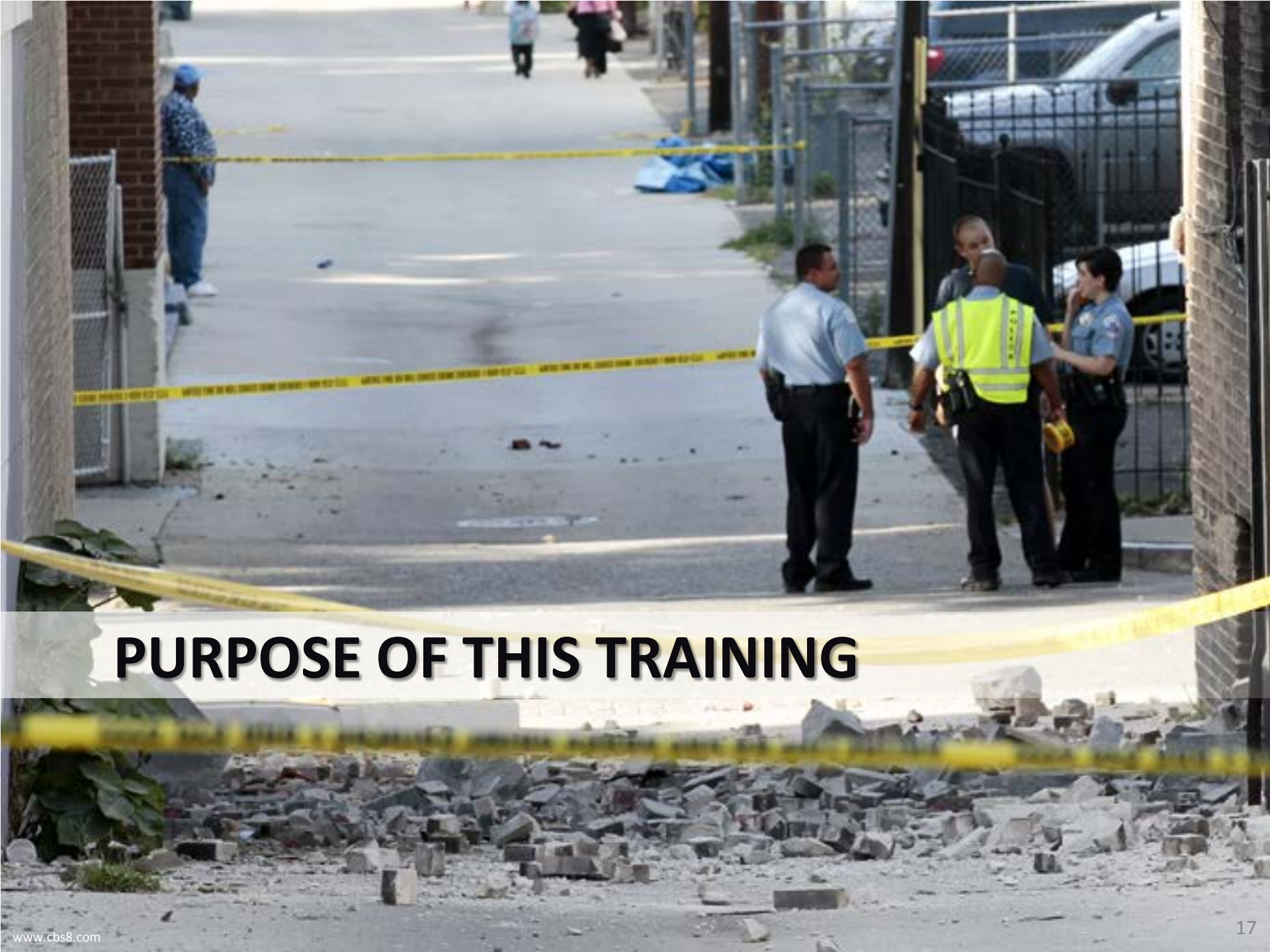

PURPOSE OF THIS TRAINING

www.cbs8.com

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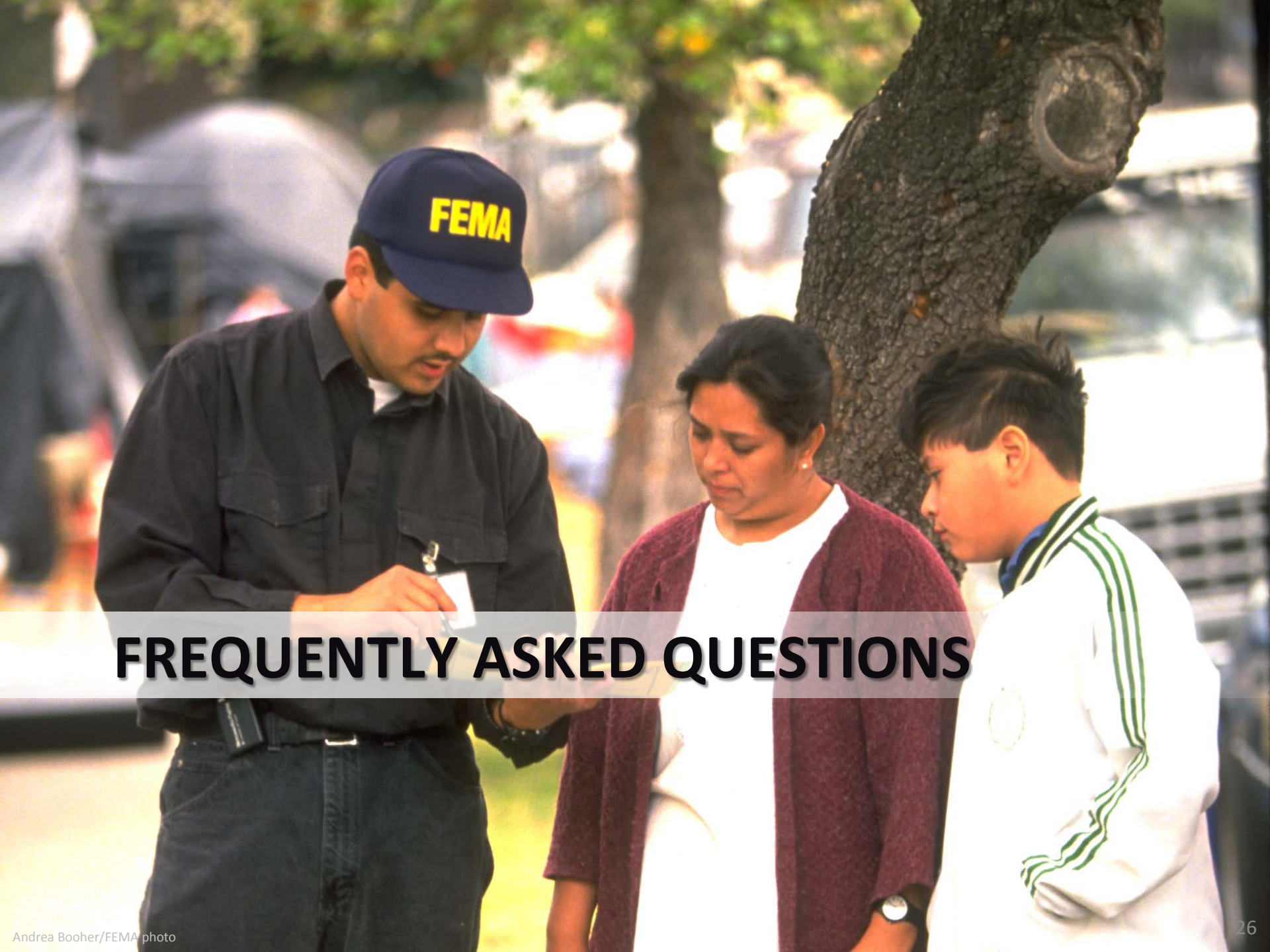
VIRGINIA
2011
M5.8
FIRE LINE DO NOT CROSS



FREQUENTLY ASKED QUESTIONS

Andrea Booher/FEMA photo

What is earthquake mitigation?

Degenkolb Engineers


John Shea/ FEMA News Photo

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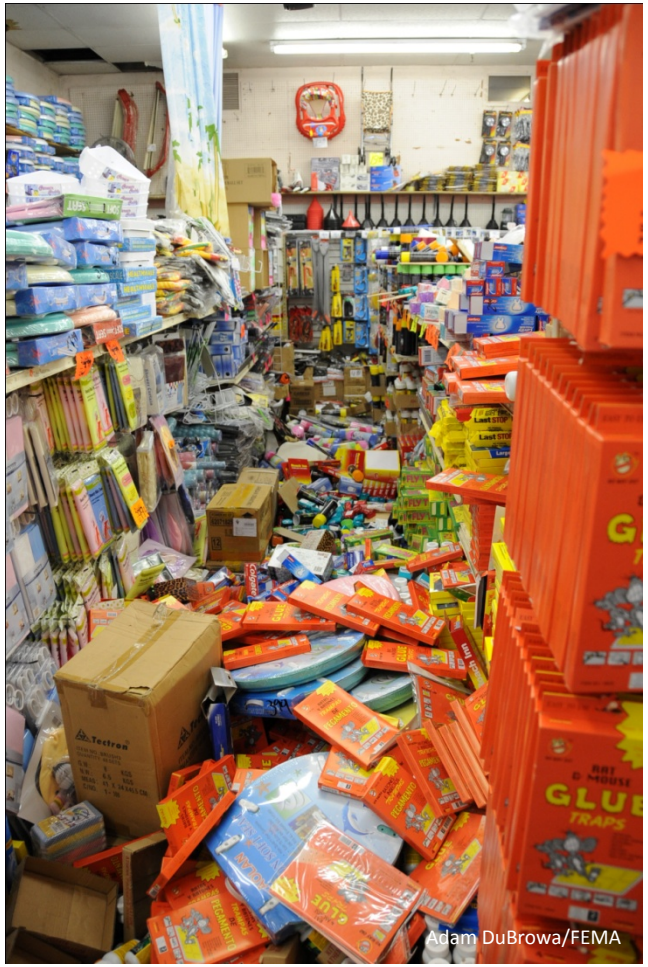
Mitigation reduces damage and losses



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What are structural components?

- Structural Elements:
  - Roof
  - Floors
  - Beams
  - Columns
  - Foundation
  - Braces
  - Concrete or Masonry Walls

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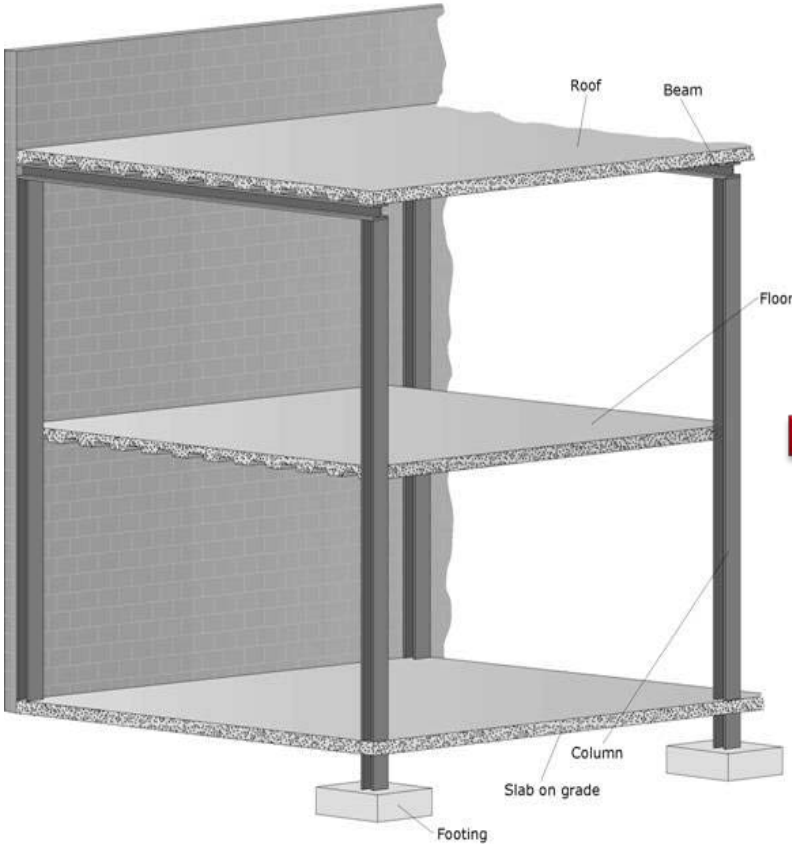
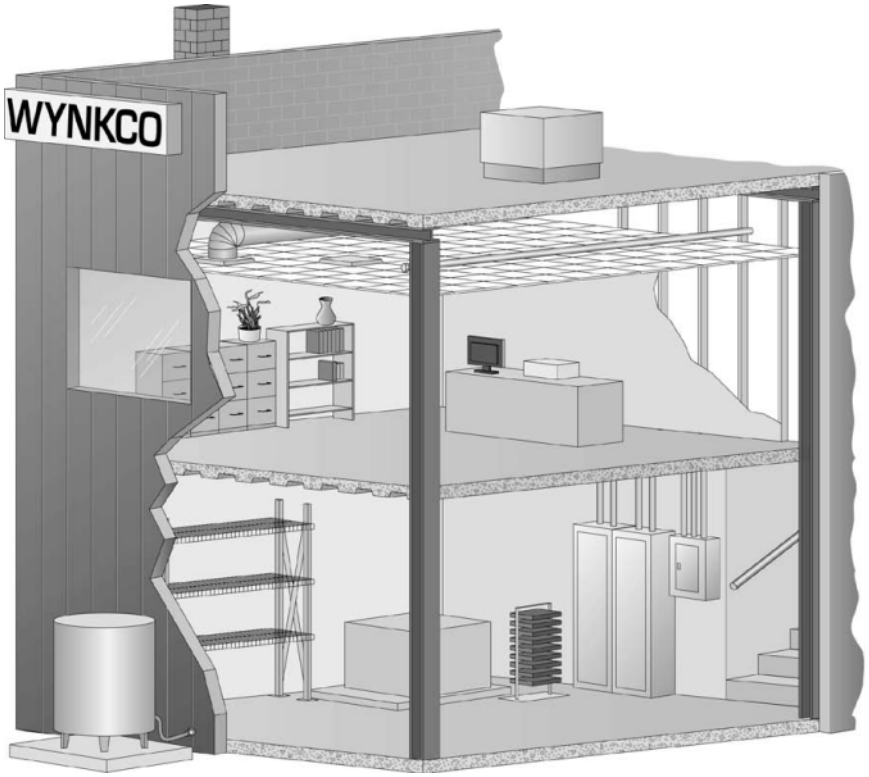
What are nonstructural components?





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Types of nonstructural components

Architectural Components

Mechanical, Electrical, And Plumbing (MEP) Components

Furniture, Fixtures & Equipment (FF&E), And Contents

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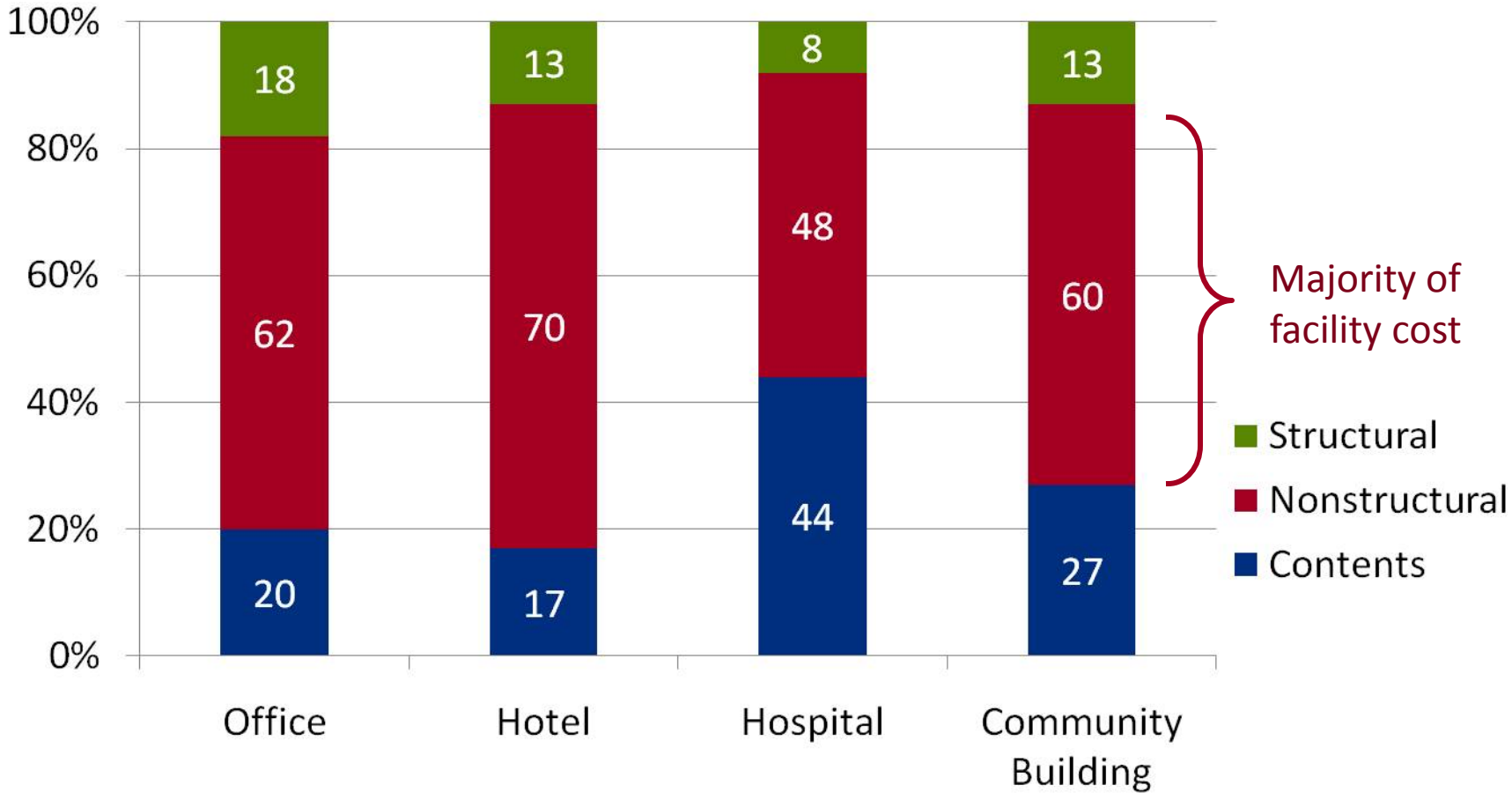
Nonstructural Elements = **75%** Total Building Cost



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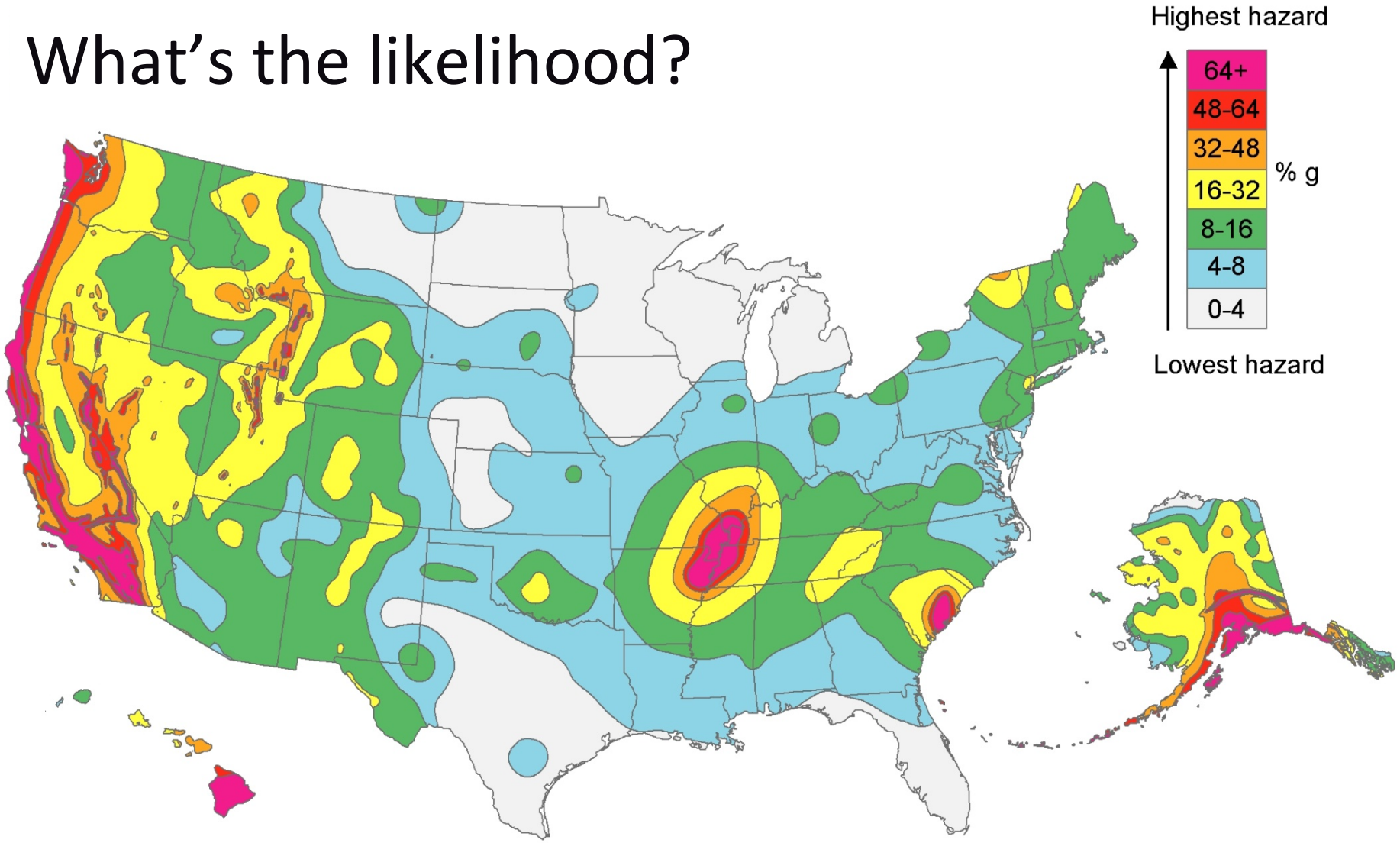
What's the likelihood?



It depends on where you live

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What's the risk for me?

Personal **SAFETY**

Damaged or loss of **PROPERTY**

Loss of **REVENUE** during cleanup

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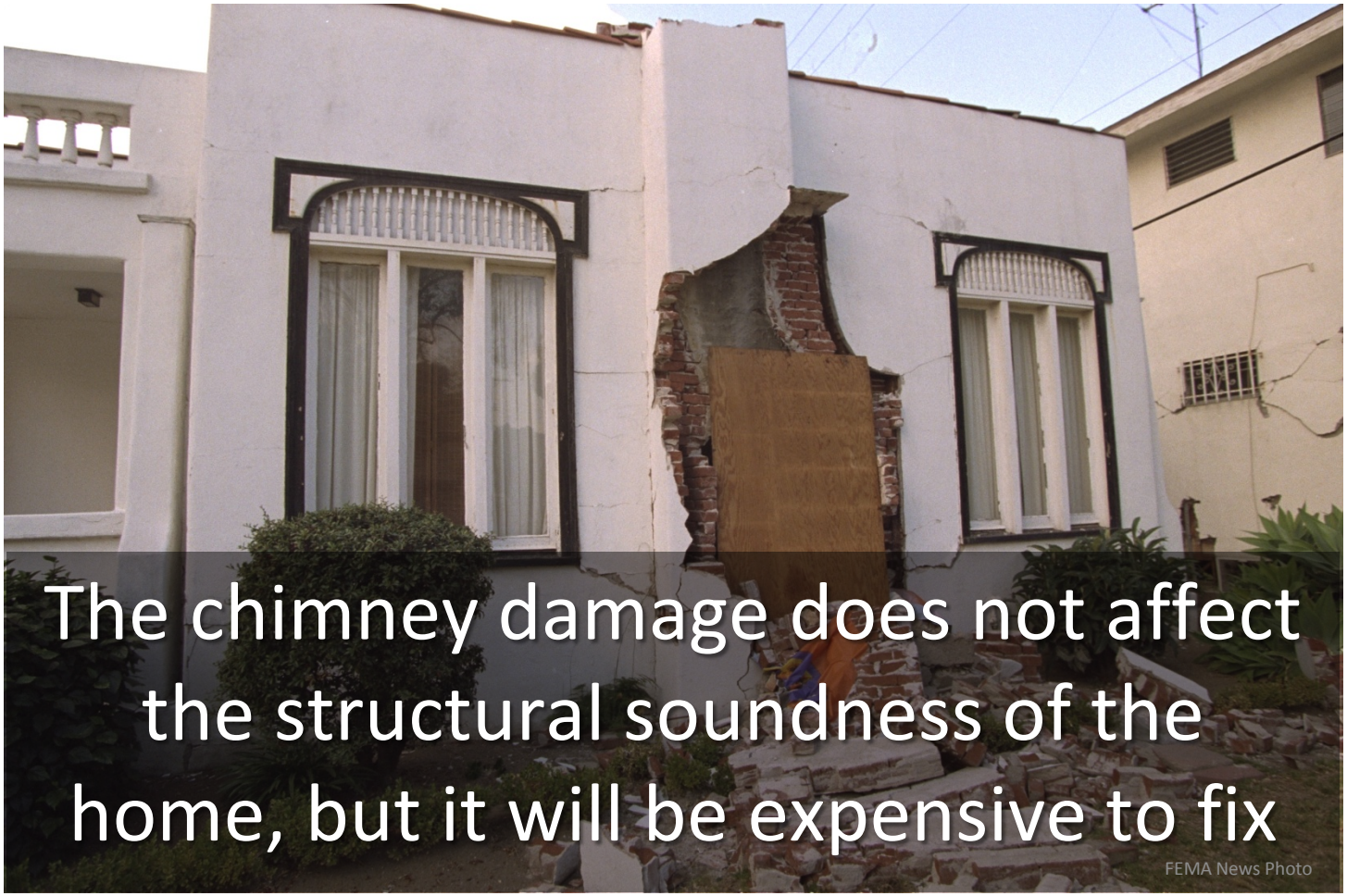
Minor damage to the building



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Minor damage to property in the building

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Loss of inventory

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Major damage – may not be salvageable

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Complete loss of property

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Displaced from home

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What about other costs?

You could be out of business while you repair the damage or while you're waiting for supplies

FEMA/Leif Skoogfors

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Who pays for damage?

Government

Insurance

You

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What do I do when an earthquake hits?

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Don’t run out of the building!

www.thetakeaway.org


FEMA News Photo by Kevin Galvin

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EARTHQUAKE RISK MITIGATION

Mark Wolfe/FEMA

So, what can I do?

1. Know your **RISK**

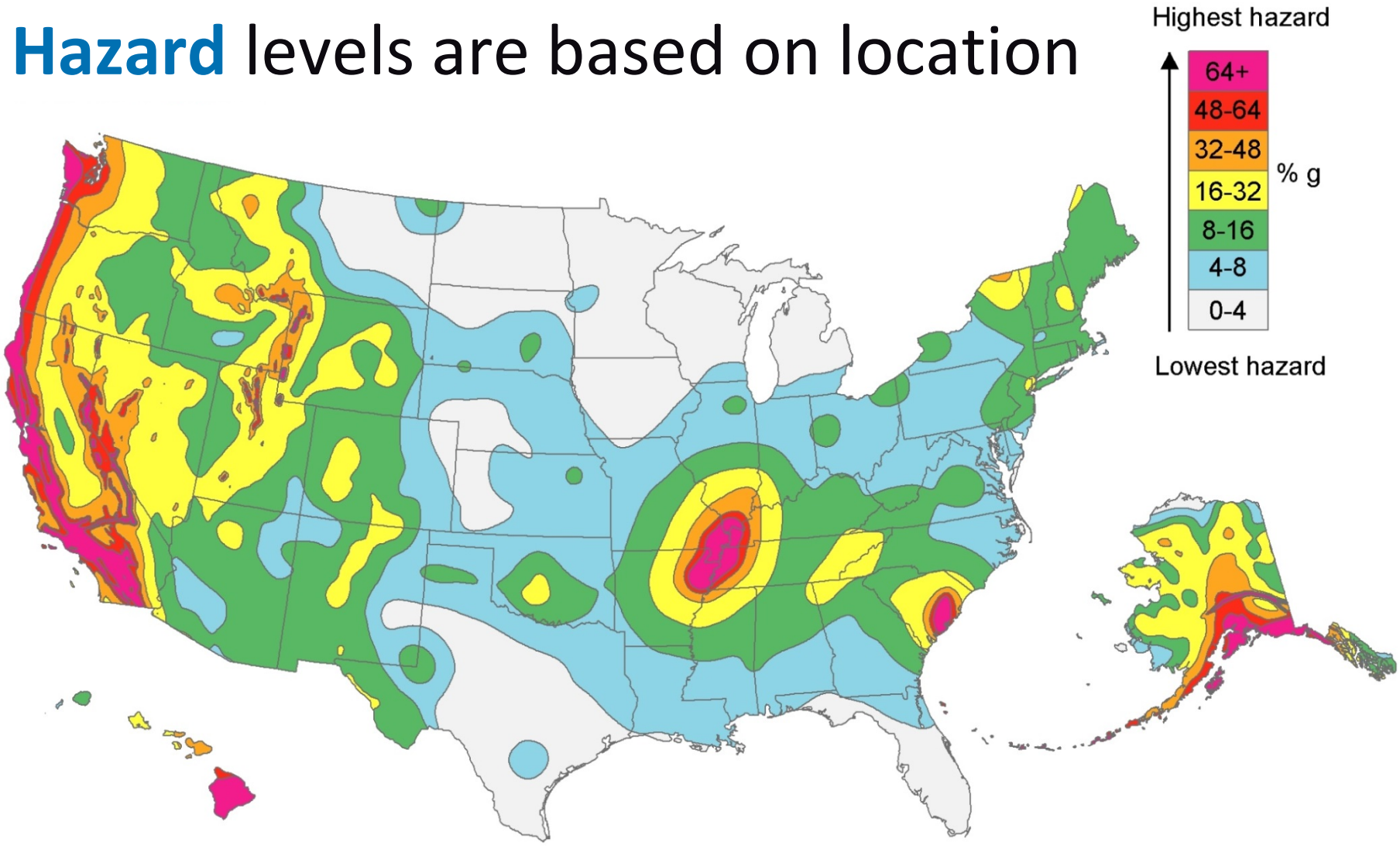
2. Make a **PLAN**

3. Take **ACTION**

Risk =

Hazard x Vulnerability

Hazard levels are based on location



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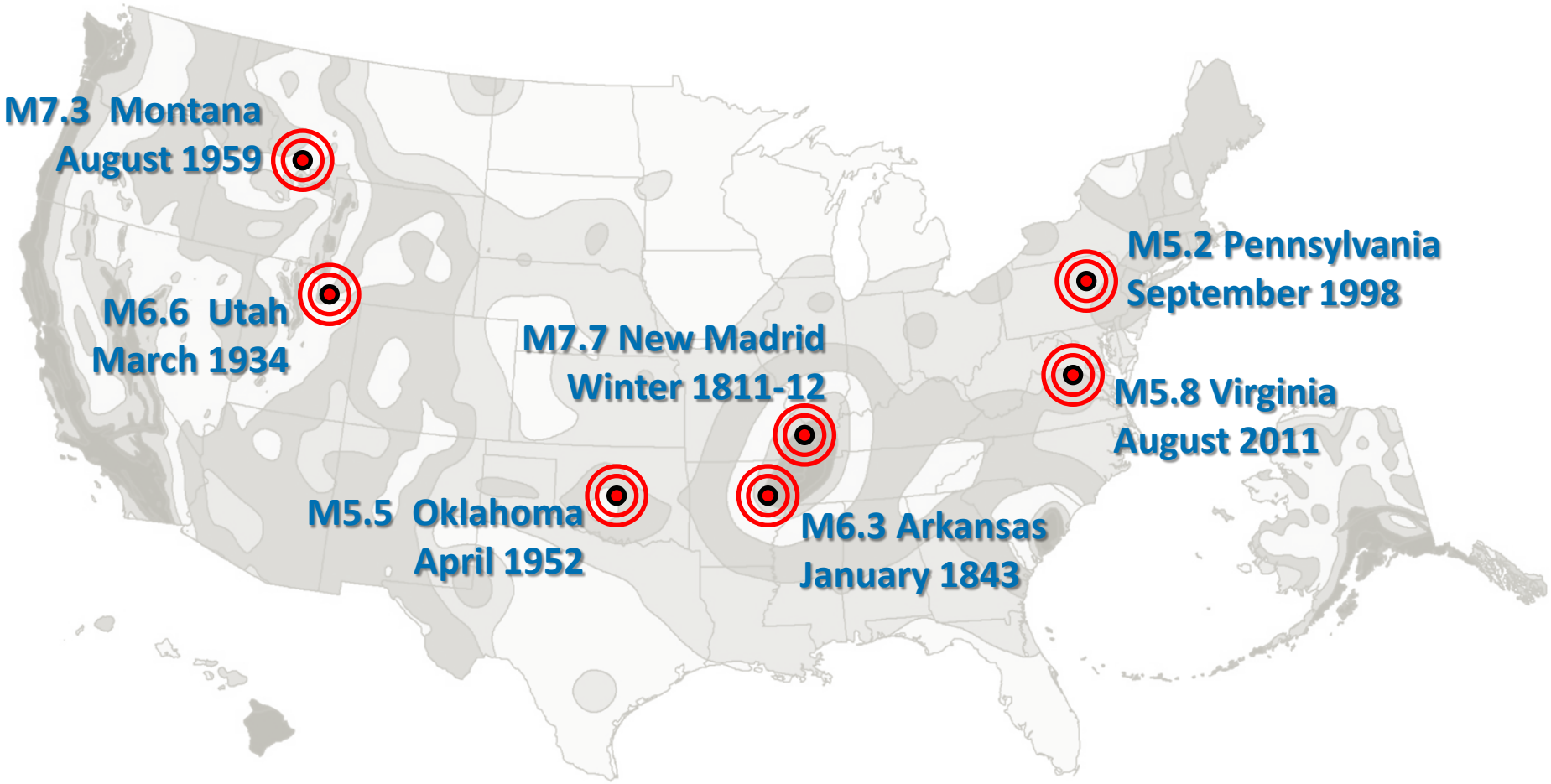
It’s not just California…



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More exposure = more risk

Seismic risk increases with **population density** and **urbanization**.

The more people, buildings, and infrastructure that are exposed to hazards, the greater the risk.

FEMA News Photo

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Vulnerabilities can be minimized

The hazard at a given location cannot be changed but you can limit your vulnerability.

Vulnerabilities include:

- Older buildings that are not up to the current code
- Heavy objects that can fall
- Improper utility hooks ups that can start fires if they are damaged

We're going to learn how to mitigate the risk from some of these vulnerabilities.

Construction plays a role…

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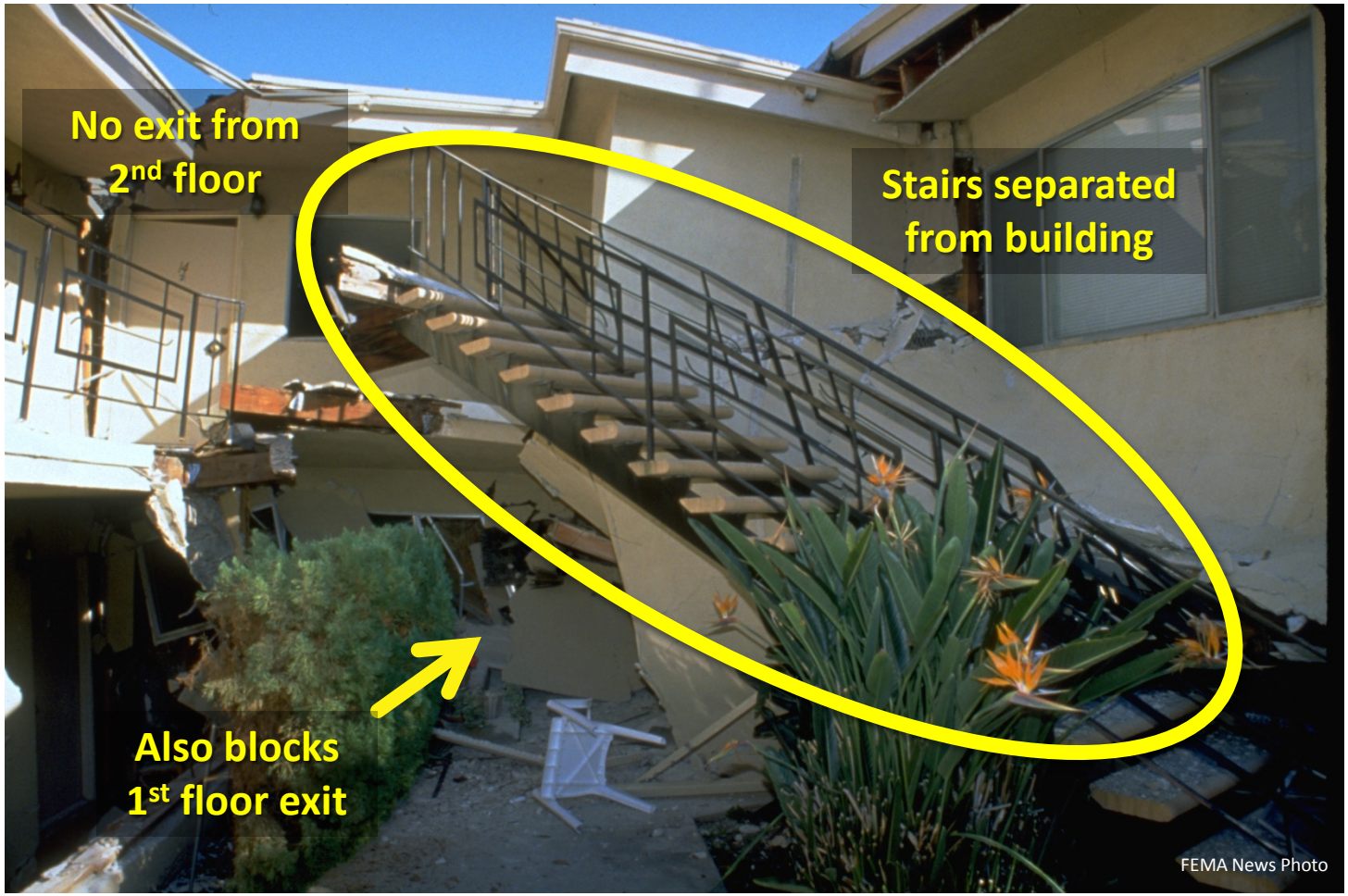
Construction plays a role…



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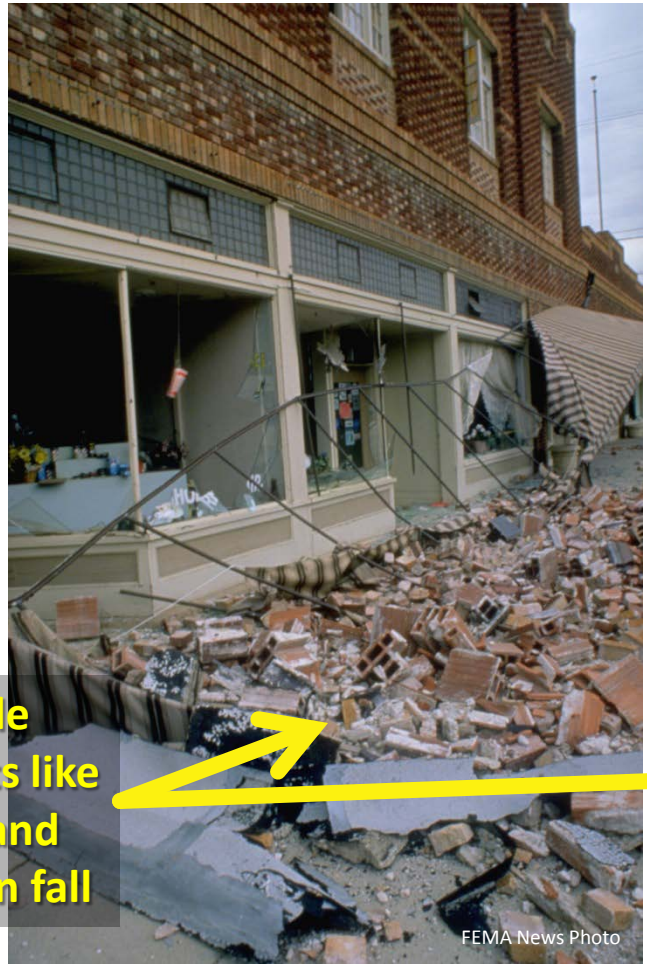
Construction plays a role…



Brittle elements like brick and glass can fall

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Location, location, location

Ground motions can induce sliding

A hillside is a vulnerable location in an earthquake

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Risk = Hazard x Vulnerability

Your total risk is the combined effect of your

- Earthquake **hazard** (likelihood that an earthquake will strike)
- **Vulnerability** (what happens if that earthquake occurs)

The hazard at a given location cannot be changed, but

You can change your level of vulnerability

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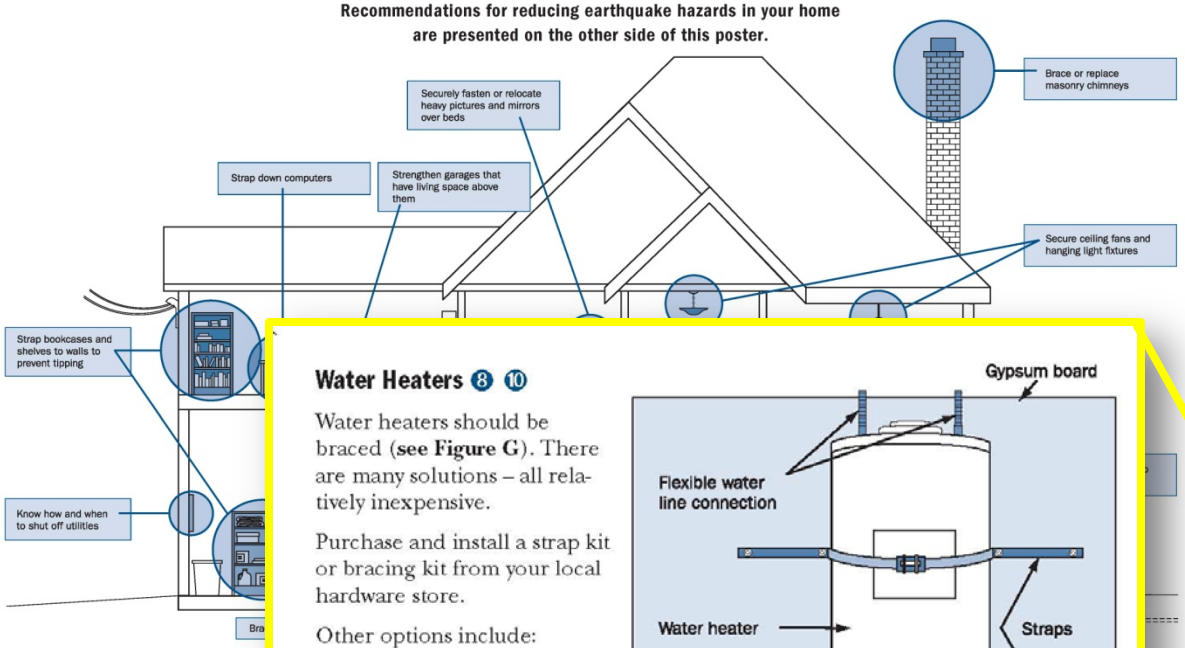
Earthquake Home Hazard Hunt

FEMA 528 9/2005

Recommendations for reducing earthquake hazards in your home are presented on the other side of this poster.



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Water Heaters ⑧ ⑩

Water heaters should be braced (**see Figure G**). There are many solutions – all relatively inexpensive.

Purchase and install a strap kit or bracing kit from your local hardware store.

Other options include:

- Have a licensed plumber strap your water heater according to code.
- Use heavy metal strapping and screws to secure the water heater to the wall studs.

The gas and water lines should have flexible connector pipes. These are safer than rigid pipes during an earthquake. Be sure to check the straps once a year. They may come loose as a result of vibrations or other causes.

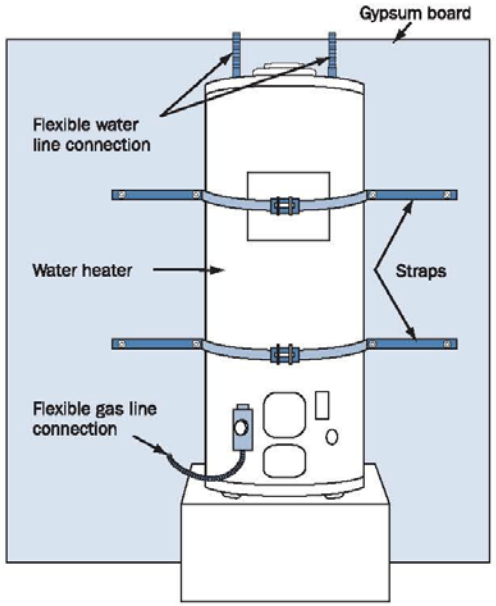

Figure G. Securing water heaters.

Take Action To Protect Yourself and Your Family From Earthquakes

Create and Practice Your Disaster Preparedness Plan

An emergency preparedness plan includes life-critical actions, life saving training, and the advance plans to enable you to respond to earthquakes and potential physical injuries and hazards no matter where you are.

Life-Critical Actions – Learn how to:

- Drop, cover, and hold.
- Signal for help, if you are trapped somewhere. Teach children and adults to use an emergency whistle and/or to knock three times repeatedly if trapped. Rescuers searching collapsed buildings will be listening for sounds.

Life Saving Training – Consider training in:

- First Aid
- CPR
- How to use a fire extinguisher
- How to shut off gas, water, and electricity

Your Disaster Preparedness Plan Should Include:

- Disaster Supplies Kits for home, workplace, and car
- Practicing Drop, Cover, and Hold
- Financial Plan
- Family Communications Plan that each family member understands
- Needs for all family members, including children, seniors, and pets

Financial Plan

You should store your family's documents, such as insurance policies, deeds, property records, birth certificates, and other important papers, in a safe place away from your home (e.g., safety deposit box). Make copies of important documents for your disaster supplies kit.

Consider saving money in an emergency savings account that could be used in any crisis. Back up critical files on your computer and keep a copy in a safe place away from your home.

Create Your Disaster Supplies Kit

Because you don't know where you and your family will be when an earthquake occurs, prepare a Disaster Supplies Kit for your home, workplace, and car. For detailed information about the items that should be included in your disaster supplies kit, refer to FEMA 526, *Earthquake Safety Checklist*.

Family Earthquake Drill

It's important to know where you should go for protection when your house starts to shake. By planning and practicing what to do before an earthquake occurs, you can condition yourself and your family to react correctly and spontaneously when the first jolt or shaking is felt. An earthquake drill can teach your family what to do in an earthquake.

- Each family member should know safe spots in each room.
- Safe spots: The best places to be are under heavy pieces of furniture, such as a desk or sturdy table; under supported archways; and against inside walls.
- Danger spots: Stay away from windows, hanging objects, mirrors, fireplaces, and tall, unsecured pieces of furniture.
- Reinforce this knowledge by physically placing yourself in the safe locations. This is especially important for children.
- In the days or weeks after this exercise, hold surprise drills.
- Be prepared to deal with what you may experience after an earthquake — both physically and emotionally.
- Following the drop, cover, and hold procedure is the best way to be safe during an earthquake.
- Take cover under a sturdy desk, table, or bench and hold on to the desk or table leg so that desk or table stays on top of you. Hold on until the earthquake shaking stops.
- Family members should practice drop, cover, and hold in the safe spots that you and your family have identified.

Further Information

For more information about earthquake preparedness and safety, refer to the following publications, which are available from the FEMA Distribution Facility at 1-800-480-2520. As noted, some are available for download from the FEMA website.

After Disaster Strikes: How to recover financially from a natural disaster, FEMA 292. Available in both English and Spanish.

Are You Ready? An In-depth Guide to Citizen Preparedness, IS-22, August 2004. Full publication and individual sections available online in both English and Spanish at http://fema.gov/preparedness/prepare_guides_links.shtm.

Before Disaster Strikes: How to make sure you're financially prepared to deal with a natural disaster, FEMA 291, May 1997. Available in both English and Spanish.

Earthquake Safety Checklist, FEMA 526, August 2005.

Earthquake Safety Guide for Homeowners, FEMA 530, September 2005.

Food and Water in an Emergency, FEMA 477, August 2004. Available online in both English and Spanish at http://fema.gov/preparedness/prepare_guides_links.shtm.

Preparing for Disaster for People with Disabilities and Special Needs, FEMA 476, August 2004. Available online in both English and Spanish at http://fema.gov/preparedness/prepare_guides_links.shtm.

Visit the FEMA website at http://www.fema.gov/hazards/earthquakes/ for information about the National Earthquake Hazards Reduction Program (NEHRP) and more ways to address earthquake risks.

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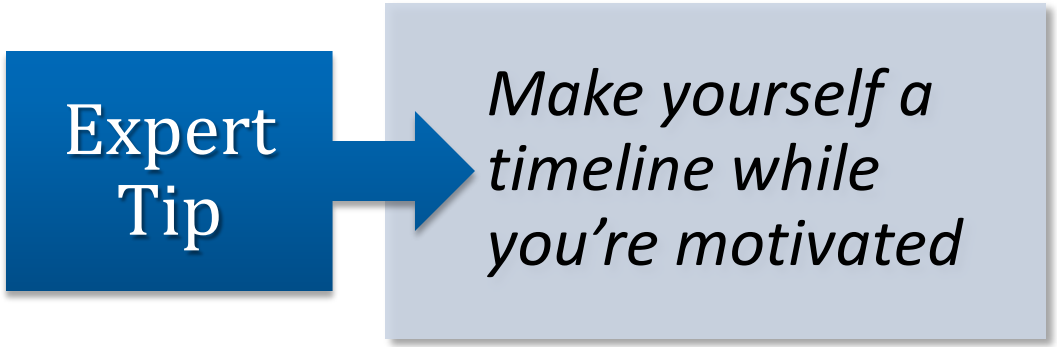
Make a plan

- Determine the relative importance of your vulnerabilities based on **risk** and **cost**.
- Decide what you're going to do and what you're going to hire someone to do



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Importance of Vulnerabilities

Life Safety

- Could anyone be hurt by this component in an earthquake?

Property Loss

- Could a large property loss result?

Functional Loss

- Could the loss of this component cause an outage or interruption?

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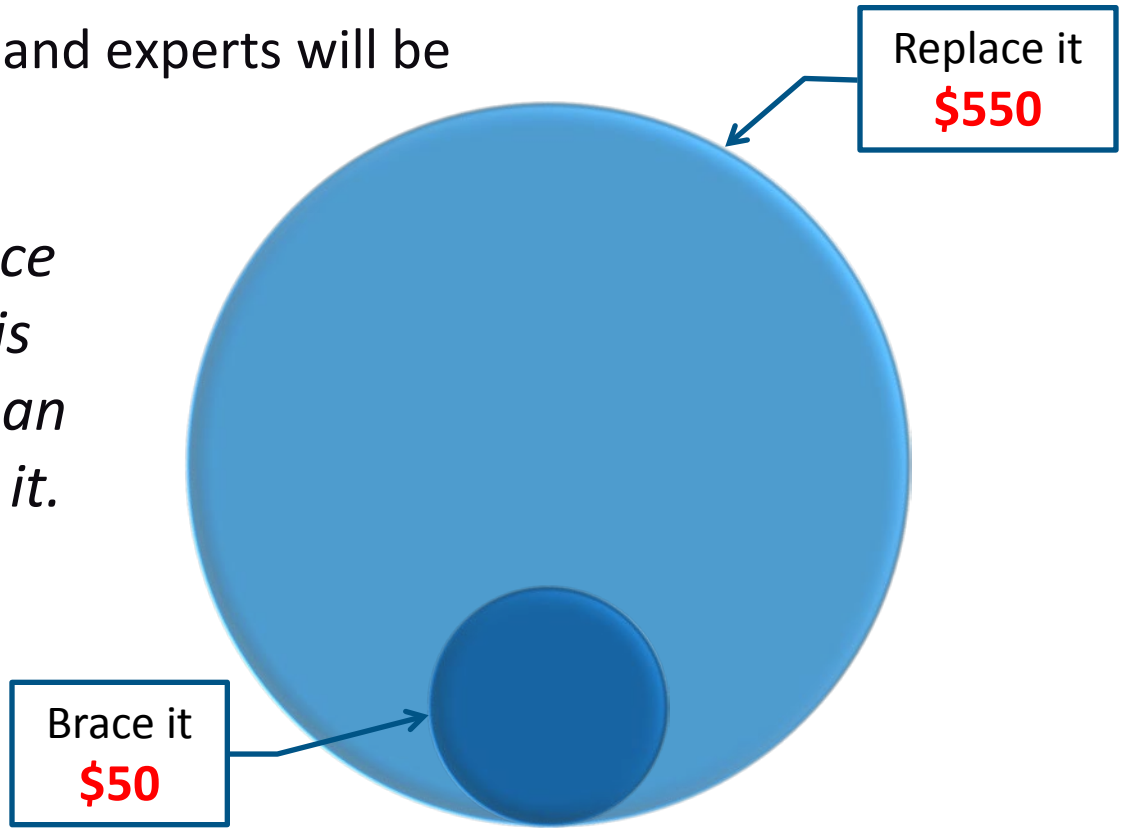
Brace it or replace it?

- Retrofitting before an earthquake is cheap
- Repairs are expensive, and experts will be busy after an event

*The cost to replace a water heater is **10 times** more than the cost to brace it.*



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What can I do myself?

- Brace suspended ceilings
- Secure bookshelves
- Brace a water heater
- Anchor TVs, computers, and other appliances
- Secure heavy furniture
- Reinforce foundation anchorage and strengthening cripple walls
- Anchor demountable partitions (cubicles)

Expert Tip → *FEMA posts free resources on their website*

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When do I need a professional's help?

- Installing flexible gas lines
- Anchoring boilers and furnaces
- Bracing unreinforced masonry
- Anchoring solar panels
- Securing transformers, switch gear, and emergency generators
- Anchoring industrial storage racks
- Securing HVAC equipment

Take Action

START NOW! There are two easy things you can do **today**:

1. Move heavy furniture such as bookcases away from beds, couches, desks, and other places where people sit or sleep
2. Make sure that exit paths are clear of clutter

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Find more info on hazards in your area:

- Central United States Earthquake Consortium
  (Central and Southern States)

  www.cusec.org
- Western States Seismic Policy Council

  www.wsspc.org
- Cascadia Region Earthquake Workgroup (Pacific Northwest)

  www.crew.org
- Northeast States Emergency Consortium

  www.nesec.org

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Mitigation Example Resources

- LBL-9143 – Seismic Safety Guide
- FEMA 154/155 – Rapid Visual Screening of Buildings for Potential Seismic Hazards
- ASCE/SEI 31-03 – Standard Seismic Evaluation of Existing Buildings
- ASCE 41-06 – Standard for the Seismic Rehabilitation of Buildings

QuakeSmart Toolkit

- QuakeSmart is a FEMA NEHRP initiative to help businesses in at-risk earthquake communities implement earthquake mitigation actions.

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FEMA Resources

- FEMA E-74: Reducing the Risks of Nonstructural Earthquake Damage
- FEMA 412: Installing Seismic Restraints for Mechanical Equipment
- FEMA 413: Installing Seismic Restraints for Electrical Equipment
- FEMA 414: Installing Seismic Restraints for Duct and Pipe
- FEMA 530: Earthquake Safety Guide for Homeowners

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Earthquake Publications
FEMA offers a variety of earthquake-related information resources. In addition to the content provided on its earthquake web pages, these resources range from reports, handbooks, guides, and manuals to posters, software, web-based tools, and instructional materials. Looking for a specific publication? Visit the Index of Earthquake Publications.
Below are the main categories of FEMA earthquake publications and tools.
Publications for
Individuals and Families
Practical guides and checklists describing how you can prepare yourself, your family, and your home to reduce the likelihood of damage or injuries during earthquakes and the risk of hardships and disruptions following disasters.
Teachers and Kids
Interactive lessons and other instructional materials that engage students in learning about earthquakes and earthquake safety; also practical preparedness information for child care providers.
Public Policy Makers and Planners
Reports, handbooks, case studies, and tools for use in planning, promoting, developing, and implementing seismic risk-reduction policies and programs at state and local levels.
Building Designers, Managers, and Regulators
Technical guidance focusing on the evaluation, design, and construction of earthquake-resistant structural and nonstructural elements for new and existing buildings, lifelines, and other structures; includes the latest NEHRP recommended provisions for seismic design standards.
Contacts
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Please provide the title, item number, short number, and quantity of each publication, along with your name, address, zip code, and daytime telephone number.
Fast Facts
FEMA E-74 Now Available!
Reducing the Risks of Nonstructural Earthquake Damage—A Practical Guide, Fourth Edition

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Review

- Earthquake mitigation reduces damage and losses
- Earthquake risk is influenced by the combination of the earthquake hazard and your vulnerability.
- There are three steps to mitigating the earthquake risk in your home or business:
  1. Identify Your Risk
  2. Make a Plan
  3. Take Action
- You can take action today!

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Quiz

1. Along with Hazards, what else needs to be considered when evaluating risk?
2. Identify three potential hazards in a typical home.
3. True or False: In the United States, a person is more likely to be injured by falling objects than dying in a collapsed building in an earthquake.
4. Name the three steps homeowners and small business owners can take to mitigate their risk from earthquakes.
5. Why should a water heater's rigid gas lines be replaced with flexible lines?
6. Who usually pays for earthquake damage?
   a. The government
   b. Insurance
   c. The homeowner
7. True or False: In the United States, large earthquakes only occur in California.
8. True or False: Seismic risk increases with population density and urbanization.

FEMA Photo/ Kenneth Tingman

PART 3 – HANDS ON

Leif Skoogfors/FEMA

Adding Foundation Bolts

Earthquakes moved this house two feet from its foundation

$200 in bolts can save *thousands of dollars* in earthquake damage

Adam DuBrowa/FEMA

Is my home bolted to my foundation?

Find out if your home has adequate anchorage.

1. Go down into the crawl space or unfinished garage.
2. Look for bolts that fasten the sill plate to the foundation.


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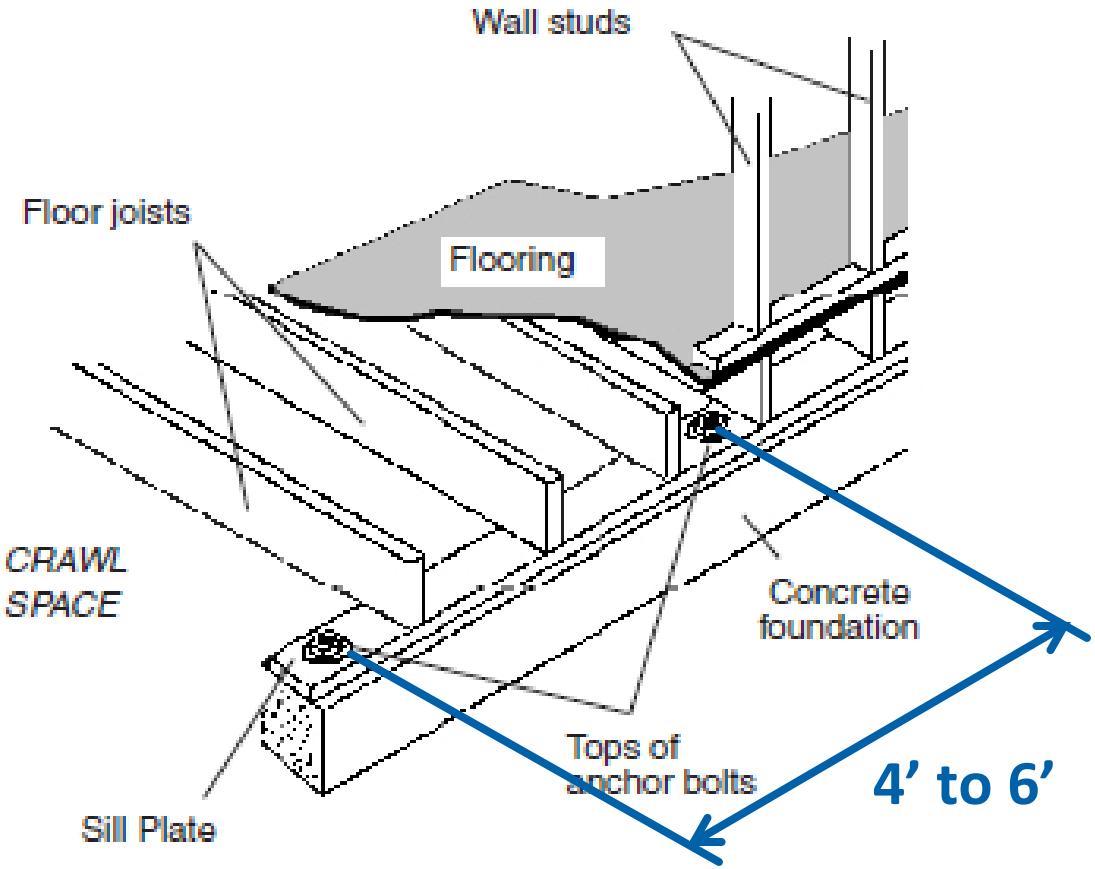
What's a sill plate?



- The sill plate is the wooden board that sits directly on top of the foundation
- Bolts should be 4' to 6' apart
- If you don't see any bolts, or if they're spaced too far apart, install additional bolts.

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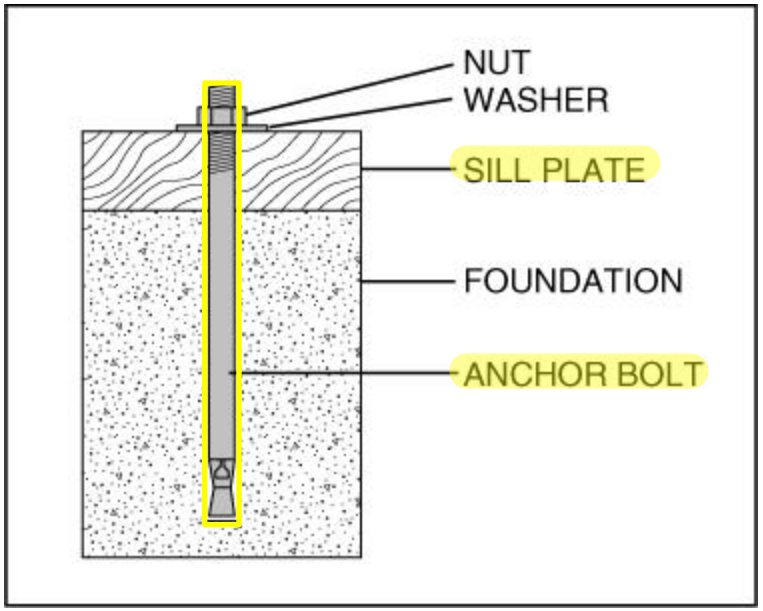
Checklist:

- ½” or ⅝” expansion or adhesive anchor bolts with nuts and square plate washers
- Rotary hammer drill with a ½” or ⅝” by 9” carbide tip drill bit
- Adjustable wrench
- Measuring tape
- Torque wrench
- Dust mask and goggles
- Short handled sledge hammer for setting expansion bolts
- Respirator, air blower, and nylon brush for adhesive anchors

How to bolt your home to your foundation

1. Mark the places for each bolt on the sill plate.
2. Drill the holes
3. Clean the holes
4. Install the anchor bolts

Project Cost	Cost to Repair After a Quake
$250 to $5,000	$25,000 up to total value of home



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Bracing a water heater

Unsecured water heaters can easily fall

Potential consequences include:

- Broken gas lines and gas leaks that can start a fire
- Broken water lines and flooding
- Loss of emergency water source

The unbraced water heater in this home fell during an earthquake; the resulting fire destroyed the home.

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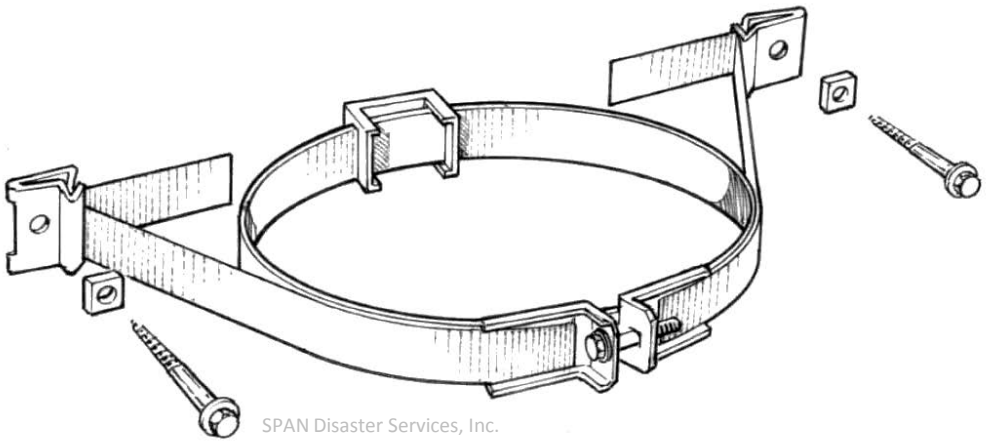
Water heater = emergency water

- The water in your water heater is a great source of emergency water
- If your water heater falls over, you will also lose your supply of fresh water
- Protect this resource by securing your water heater

Bracing kits make it simple

Kits are available for about $20 at some plumbing and hardware stores and through major retailers online

- Secure both the top and the bottom of the water heater tank with heavy-gauge metal strapping
  - Plumber's tape is not recommended. Many water heaters in past earthquakes broke through the plumber's tape.
- Install flexible natural gas and water line connectors



SPAN Disaster Services, Inc.

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Checklist:

- ❑ Strapping Kit with heavy-gage straps and fittings
- ❑ Drill
- ❑ Drill bit
- ❑ Adjustable wrench
- ❑ Hammer
- ❑ Lag screws
- ❑ Wood blocking
- ❑ Flexible natural gas and water line connectors

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How to secure your water heater

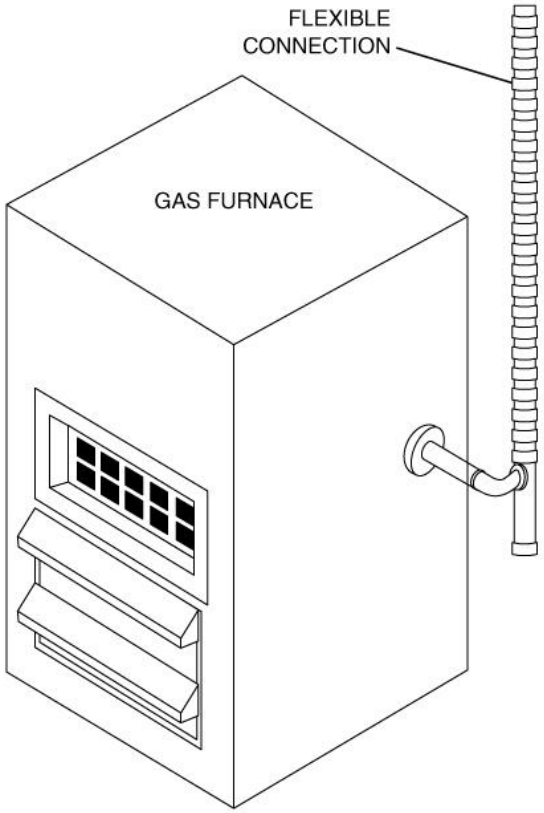
1. Get a bracing kit with heavy-gauge metal strapping
2. Make sure there is no more than 2” of space between the wall and your water heater.
3. Secure the strapping to the wall studs or concrete.
4. Have a plumber replace all rigid piping with flexible natural gas and water line connectors.

Project Cost	Cost to Repair After a Quake
$20 to $200	$500 up to total value of home

Flexible Gas Lines

Installing flexible lines helps to prevent:

- Tearing of gas and water lines from their connections
- Serious damage to a structure
- Fires or explosions
- Injuries to occupants



Expert Tip

Changes to gas lines must be done by a licensed contractor

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Anchoring office filing cabinets

NGDC

Locate cabinets away from exits and windows

FEMA News Photo

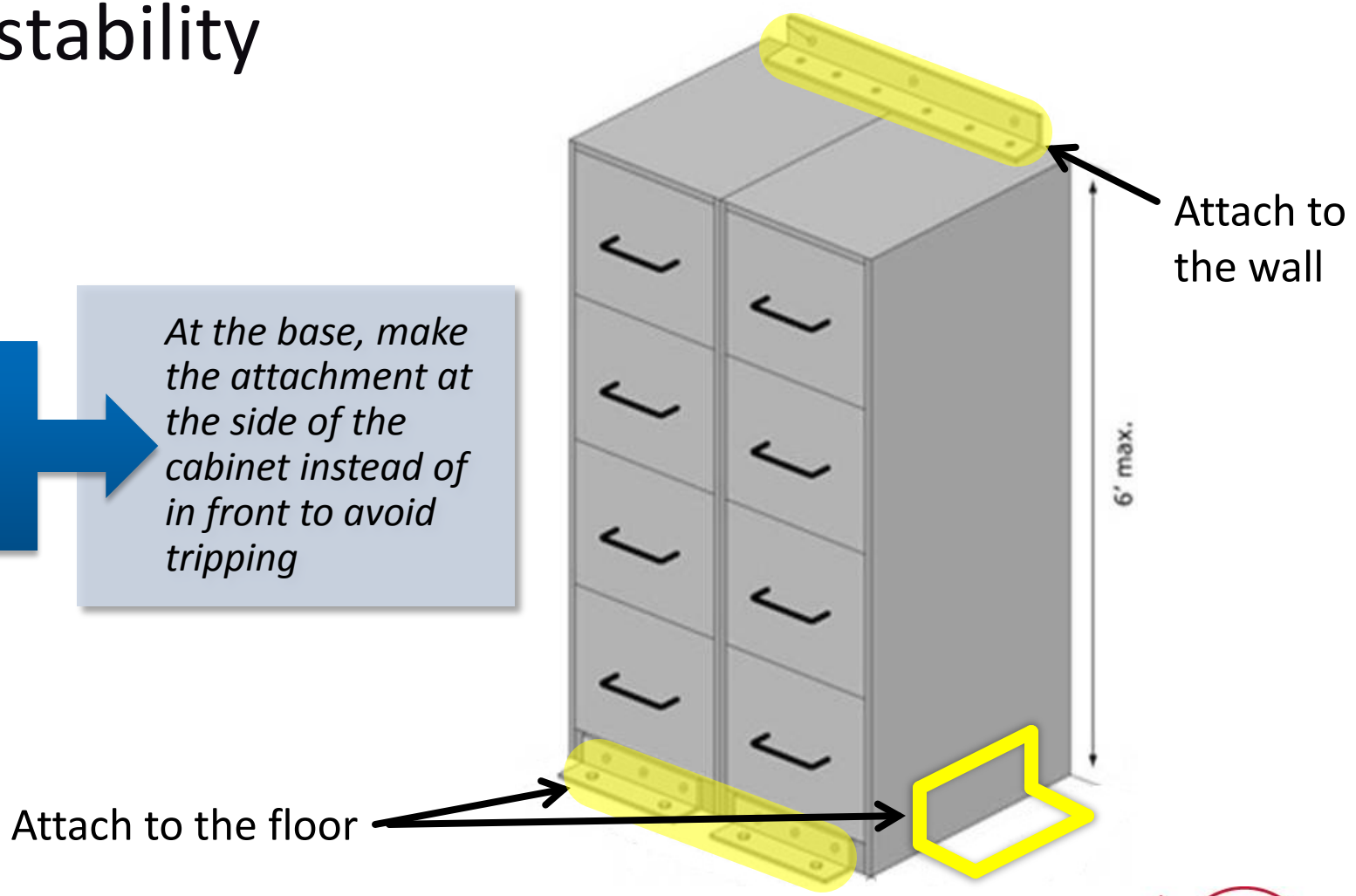
Wiss, Janney, Elstner Associates

Provide strong latches so drawers don’t slide open

Attach adjacent file cabinets together for more stability

Expert Tip

At the base, make the attachment at the side of the cabinet instead of in front to avoid tripping



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Checklist

- ❑ Clip angles— 2½” x 2½” x 3/16“
- ❑ Top clips—2" x 3/32"
- ❑ Latches for drawers
- ❑ Measuring tape
- ❑ Dust mask and goggles
- ❑ Drill with 1/4” drill bit
- ❑ #10 sheet metal screws
- ❑ Machine bolts – 1/4” diameter

For wood walls and floors:

- ❑ Stud finder
- ❑ Lag screws— 1/4” diameter x 2"

For concrete walls:

- ❑ Expansion anchor bolts – 3/8" diameter x 2”
- ❑ Rotary hammer drill with a 3/8” by 3” carbide tip drill bit
- ❑ Adjustable wrench
- ❑ Torque wrench
- ❑ Short handled sledge hammer for setting bolts

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How to brace a file cabinet

1. Anchor file cabinets to the wall and floor with clip angles.
   - Use at least one angle at the top
   - Use at least two angles at the bottom, one on each side
2. Attach the clip angles to the file cabinet with at least 2 sheet metal screws
3. Bolt the clip angles to the wall or floor.
   - Use lag bolts for wood walls or floors
   - Use expansion bolts for concrete walls or floors
4. Connect adjacent cabinets together with machine bolts, at least 2 at the front and 2 at the rear.
5. Install latches for the file cabinet drawers.

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Anchoring TVs and monitors

Secure wall hanging monitors with brackets

- Proprietary brackets are available for screens of all sizes
- Look for brackets that are seismically rated

Can I hang my TV or monitor myself?

- The TV or monitor should weigh less than 110 lbs and have a 60” diagonal screen size or smaller.
- Check to make sure framing studs behind the drywall are not more than 24” apart.

Expert Tip

Hire a professional for TVs over 110 lbs or if your studs are more than 24” apart

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Checklist

- ❑ Stud finder
- ❑ Drill with 1/8”, 1/4” and 3/8” drill bits
- ❑ Wood board – 3/4” x 12” x 28” (minimum)
  - Size is based on the size of the bracket
  - Use plywood or solid wood; NOT oriented strand board (OSB) or particle board

<u>For wood stud walls:</u>

- ❑ #14 or 1/4” diameter x 3” wood screws

<u>For metal stud walls:</u>

- ❑ 1/4” diameter x 2” sheet metal screws or 5/16” diameter x 1”carriage bolts with flat washers and lock washers or lock nuts

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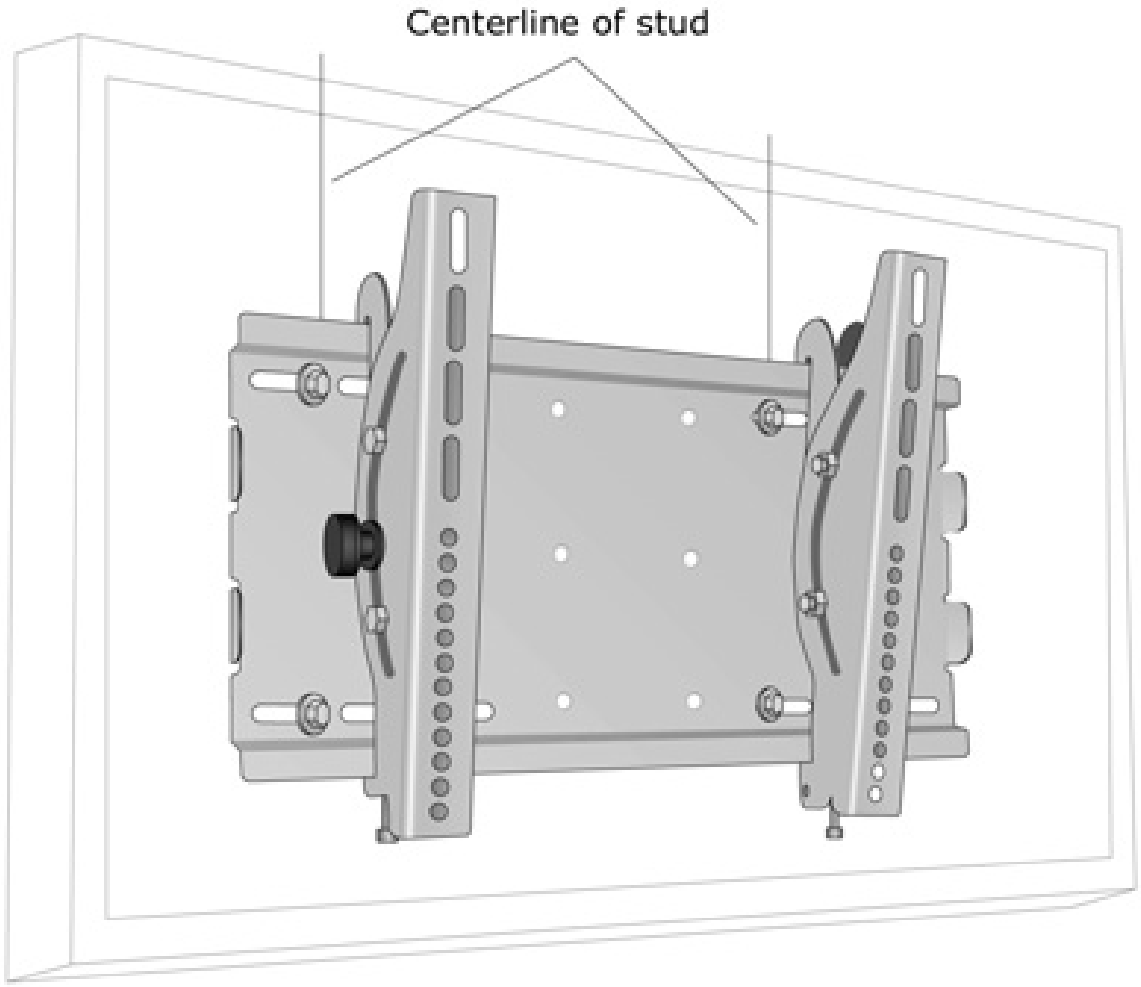
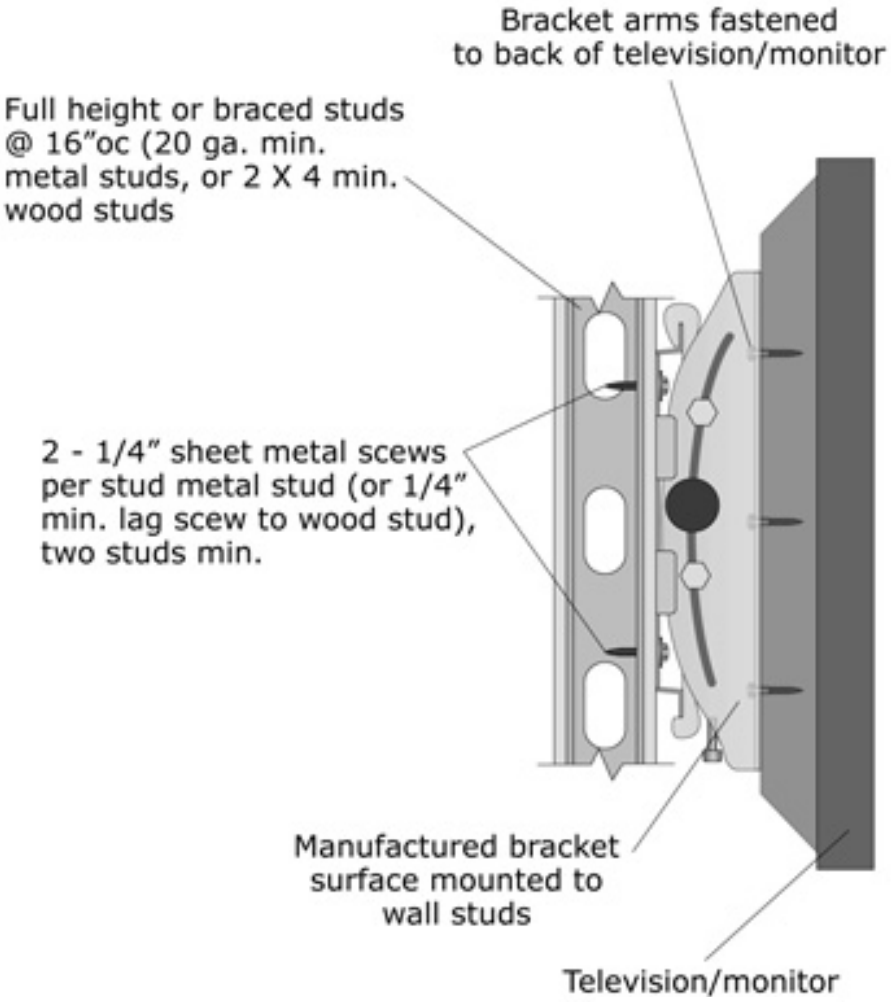
How to anchor a TV or monitor to a wall

1. Locate wall studs
2. Measure the bracket and cut the wood board at least two inches greater than the bracket on each side
3. Pre-measure and pre-drill the wood board
4. Attach the bracket to the wood board
5. Attach the wood board to the wall
6. Attach the TV or monitor to the bracket

Attach the bracket to wall studs



Then attach the monitor to the bracket



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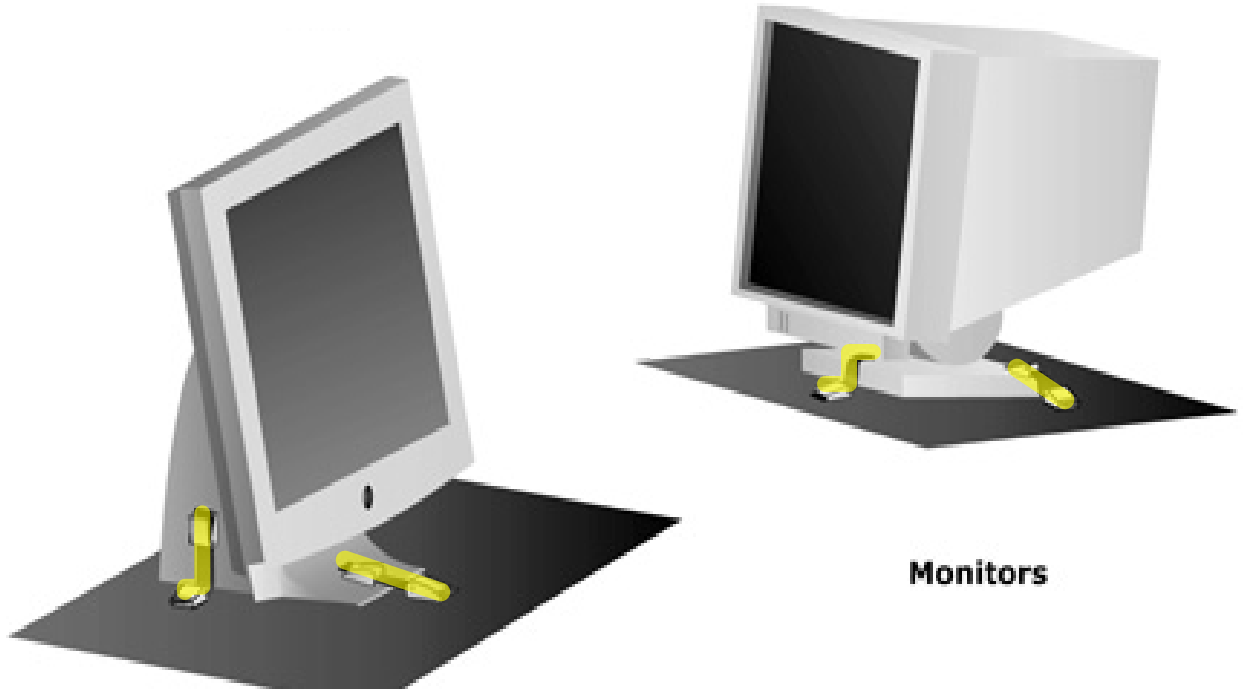
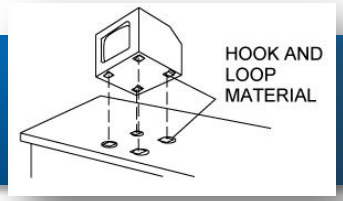
Secure desktop monitors with straps

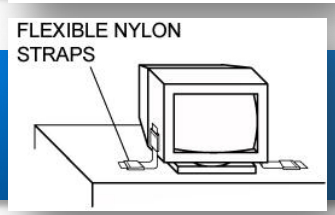
- Proprietary adhesive straps are available
- There are many options…



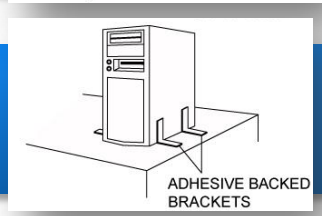
Other options include:



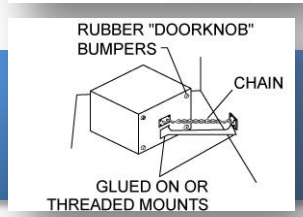
Velcro



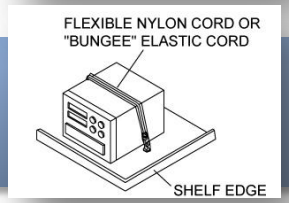
Flexible Nylon Straps



Adhesive Brackets



Chain and Bumpers



Bungee Cord

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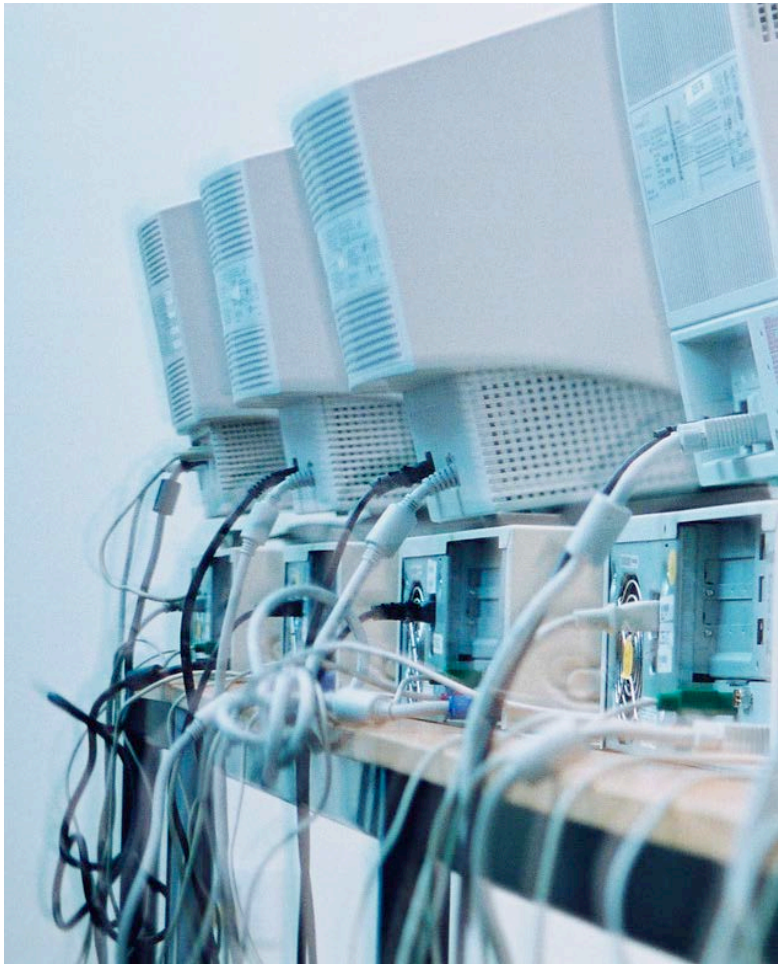
Keep your electrical cables organized

- Ensure that electrical cords and cables have sufficient slack to allow the item to travel to the end of any tether
- Tangled cords and cables attached to one item that falls may pull other items down



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Securing a Hanging Ceiling

Bill Holmes, Rutherford & Chekene

Add compression struts and diagonal bracing

Checklist

- ❑ 12 gage hanger wire
- ❑ Compression strut
  - ❑ 1” diameter conduit for heights up to 6 feet
  - ❑ 1⅝”x 1¼” metal studs for heights up to 10 feet
- ❑ #12 sheet metal screws

<u>For wood structures:</u>

- ❑ #12 screw eyes

<u>For concrete structures:</u>

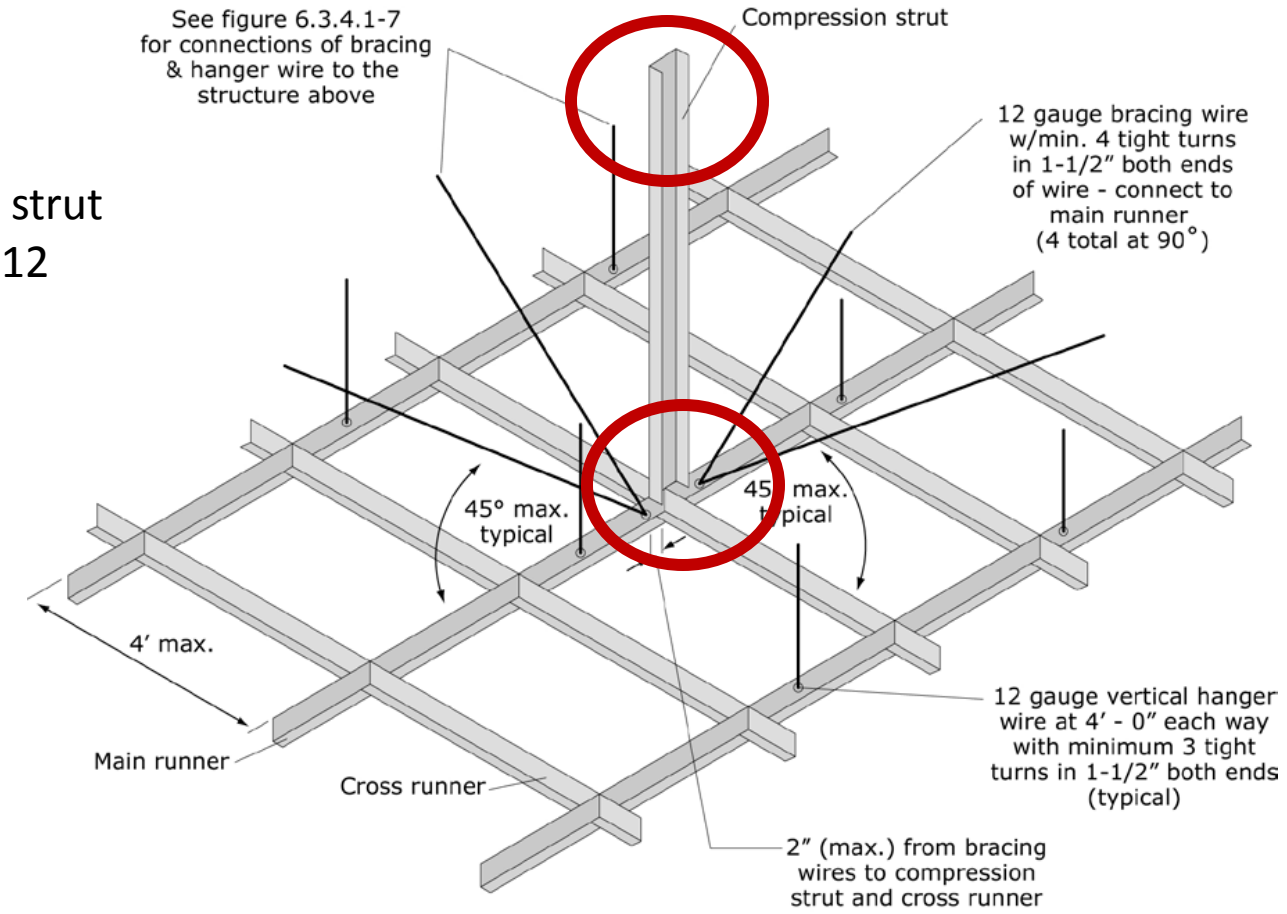
- ❑ Expansion anchor bolts – 5/16” diameter x 2”
- ❑ Rotary hammer drill with a 3/8” by 3” carbide tip drill bit
- ❑ Adjustable wrench
- ❑ Torque wrench
- ❑ Short handled sledge hammer for setting bolts
- ❑ Ceiling clips – 13 gage x 13”
- ❑ Metal straps – 12 gage x 1”

How to Secure a Suspended Ceiling

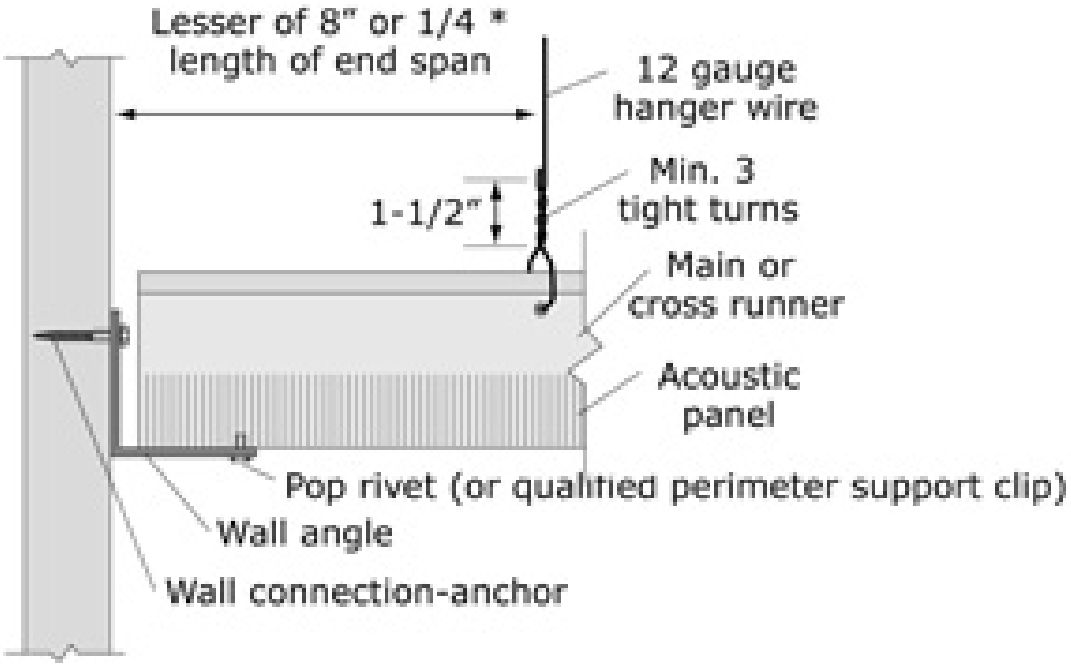
1. Install hanger wire
   - No more than 8” from the face of the wall
   - Spaced at 4 feet in both directions
2. Install compression struts
   - No more than 6 feet from the face of the wall
   - Spaced at 12 feet in both directions.
3. Install bracing wire at 45° at each compression strut
4. Secure fluorescent lights

Compression strut and diagonal bracing

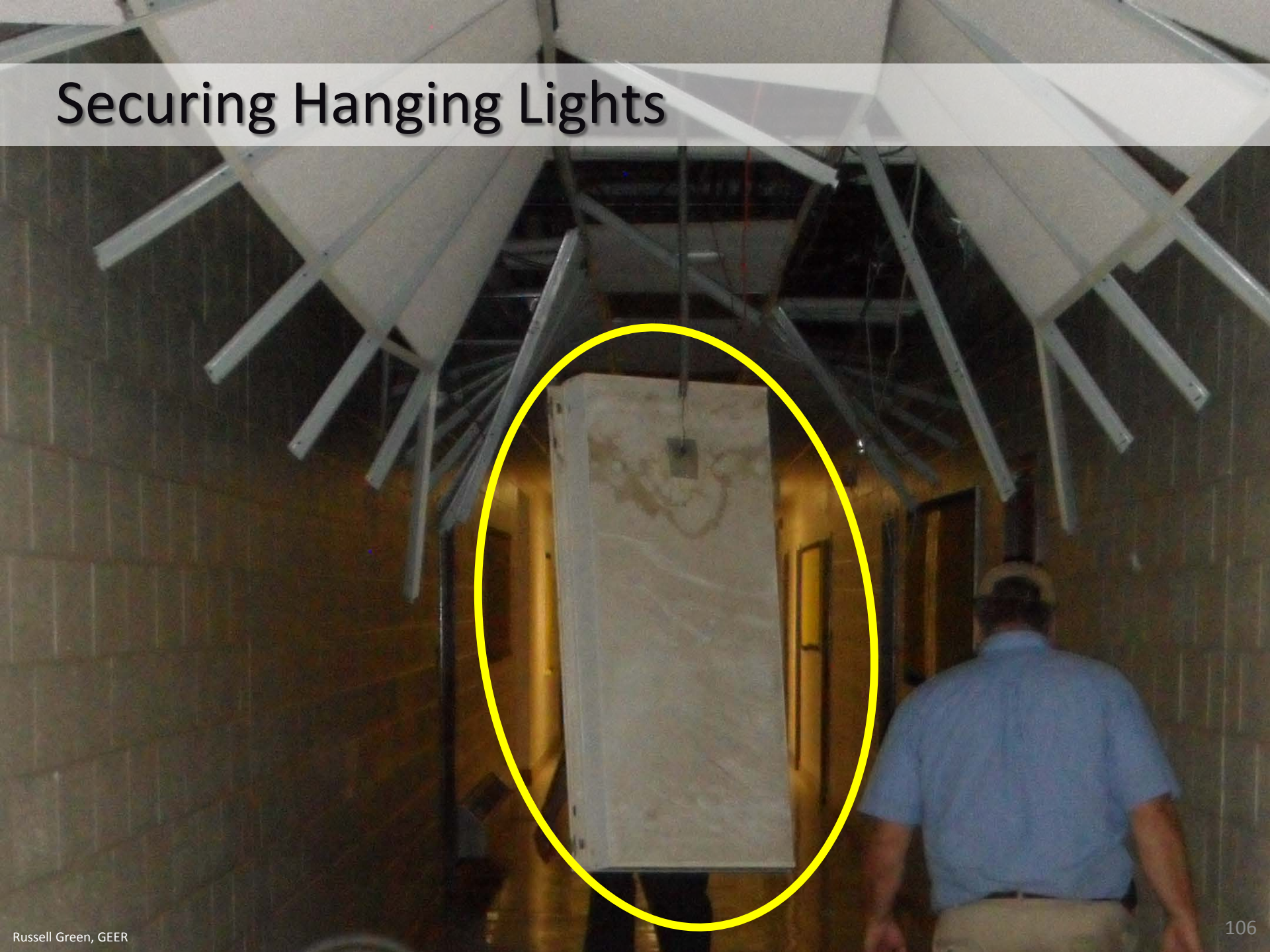
- Attach the compression strut to the runner with (2)-#12 sheet metal screws
- Attach the compression strut to the structure with a clip angle and (2) #12 wood screws or an expansion anchor bolt.



Hanger wire – Edge condition

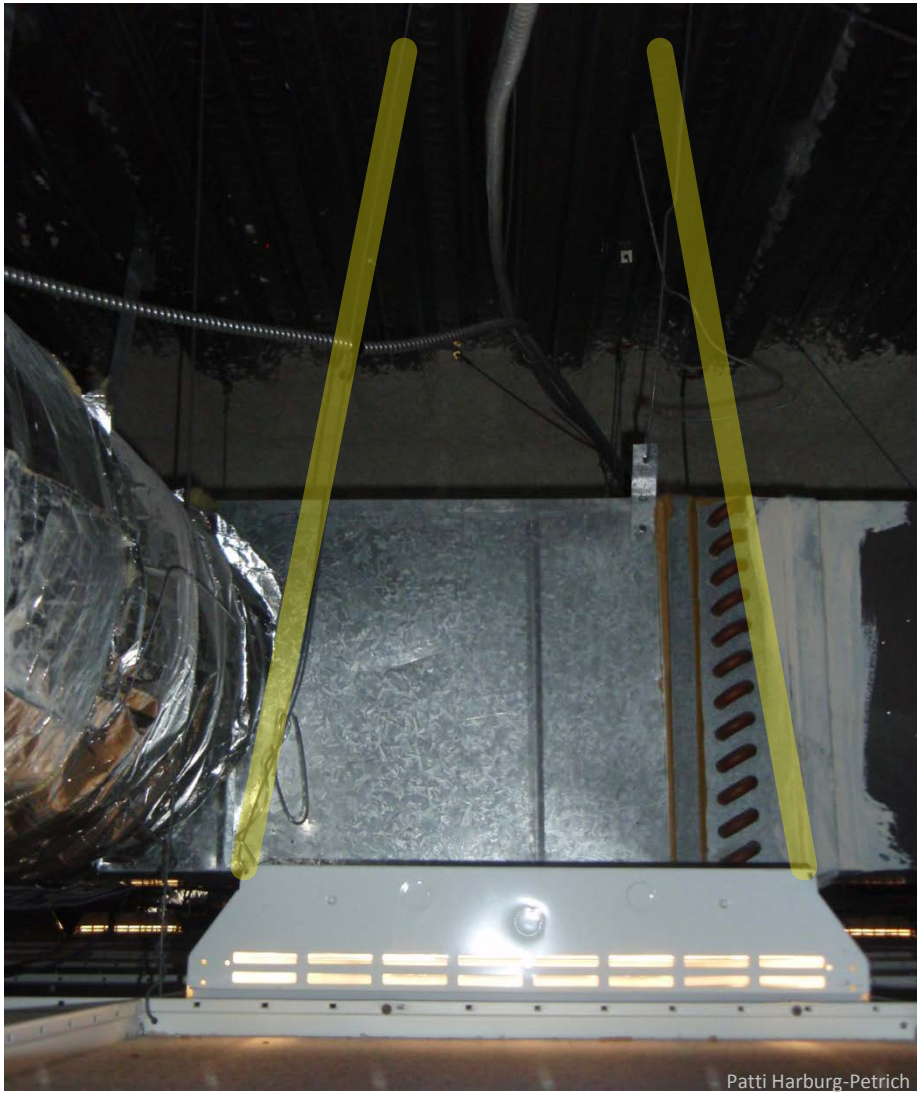


Securing Hanging Lights



Russell Green, GEER

Use 14-gage wire at each corner



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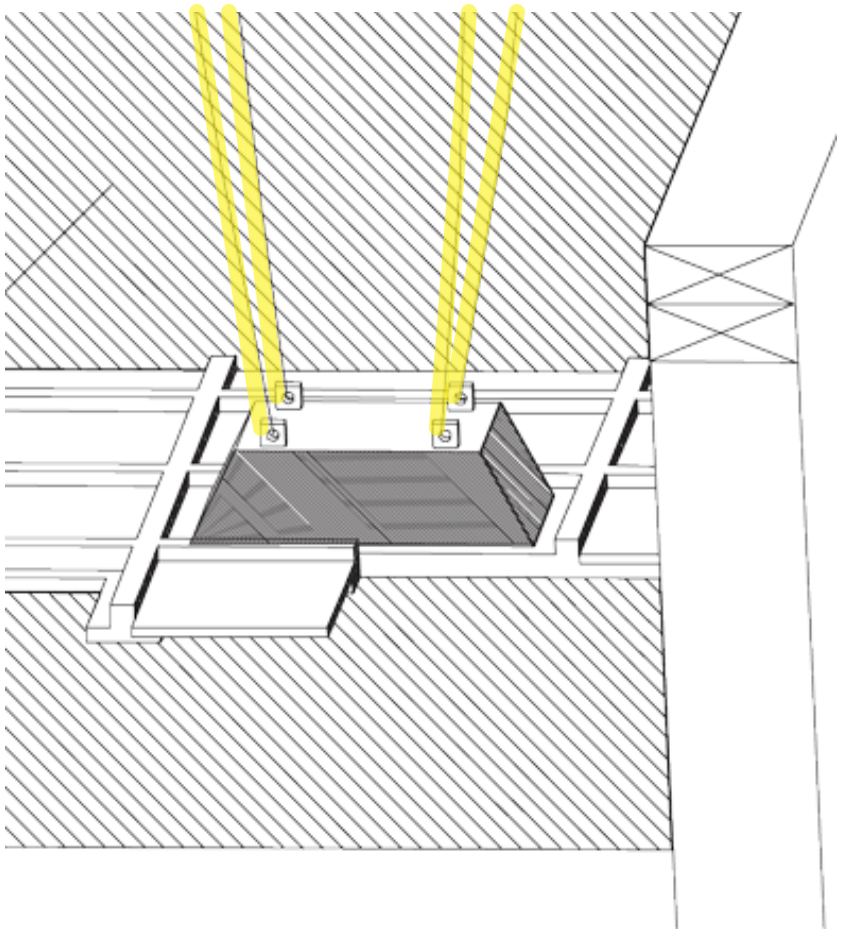
Securing Fluorescent Lights

- Add extra cross runners on each side
- Use chain straps or 14-gage wire at each corner
- Install plastic tubes over the light bulbs If they are not shatter resistant. This will help contain the glass if they fall and break.



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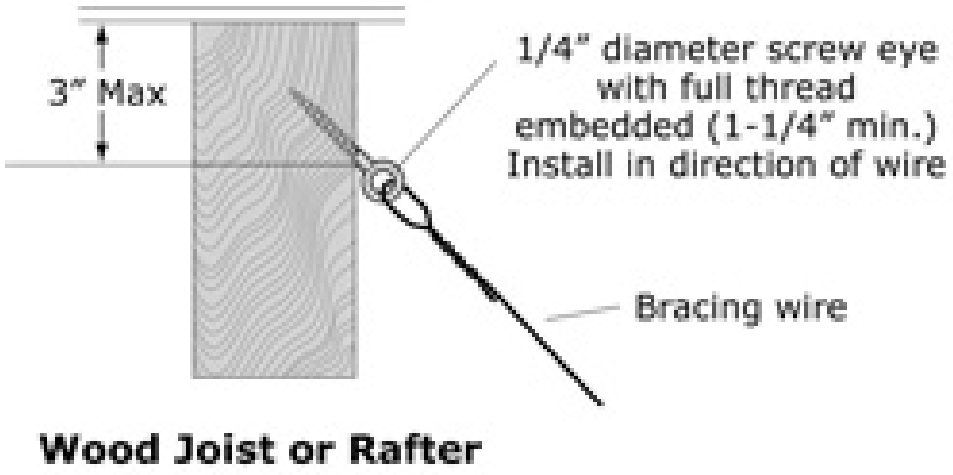
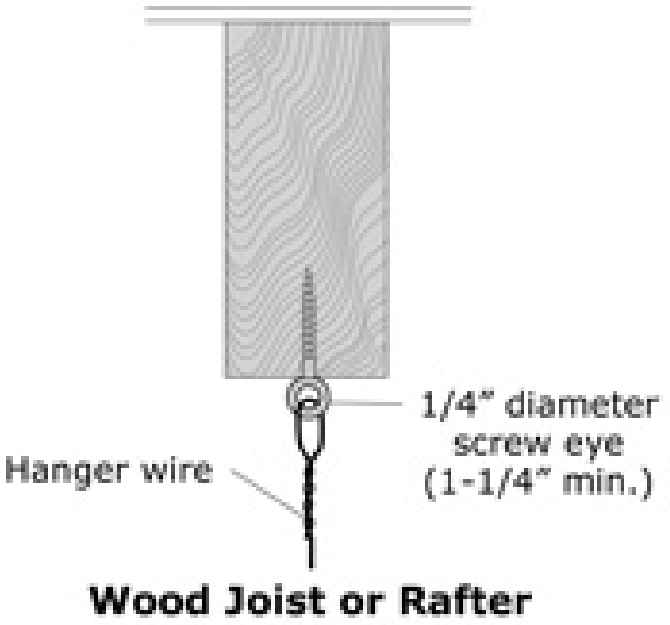
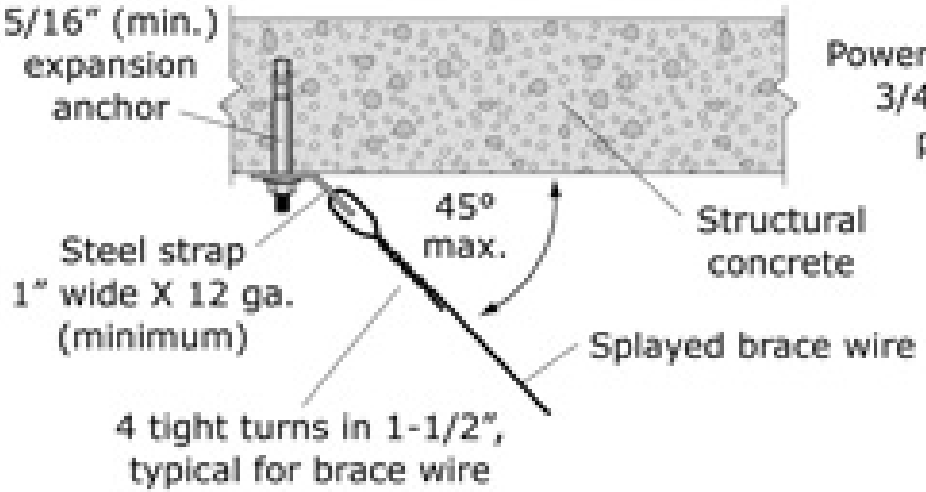
Overhead connections - wood

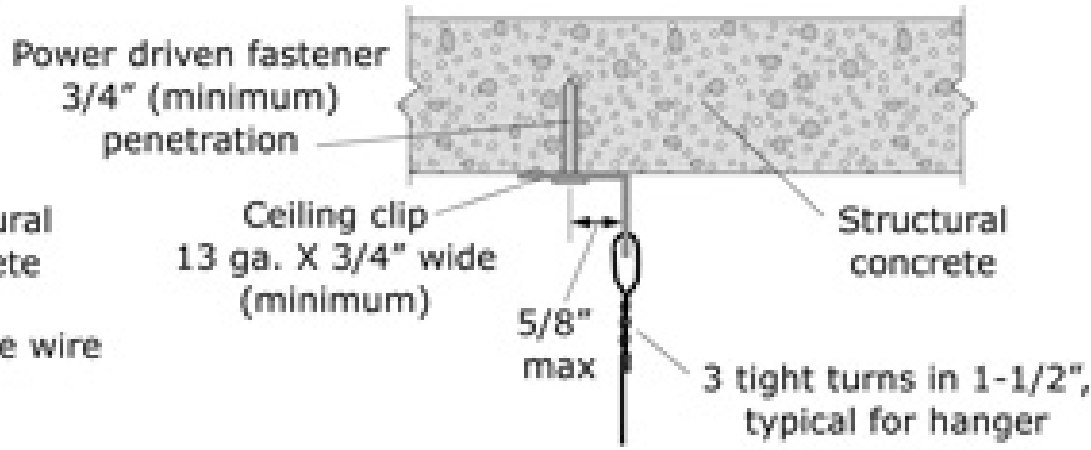




Overhead connections – concrete



Splayed Bracing Wire Attachment at Concrete Floor/Roof



Vertical Hanger Wire Attachment at Concrete Floor/Roof

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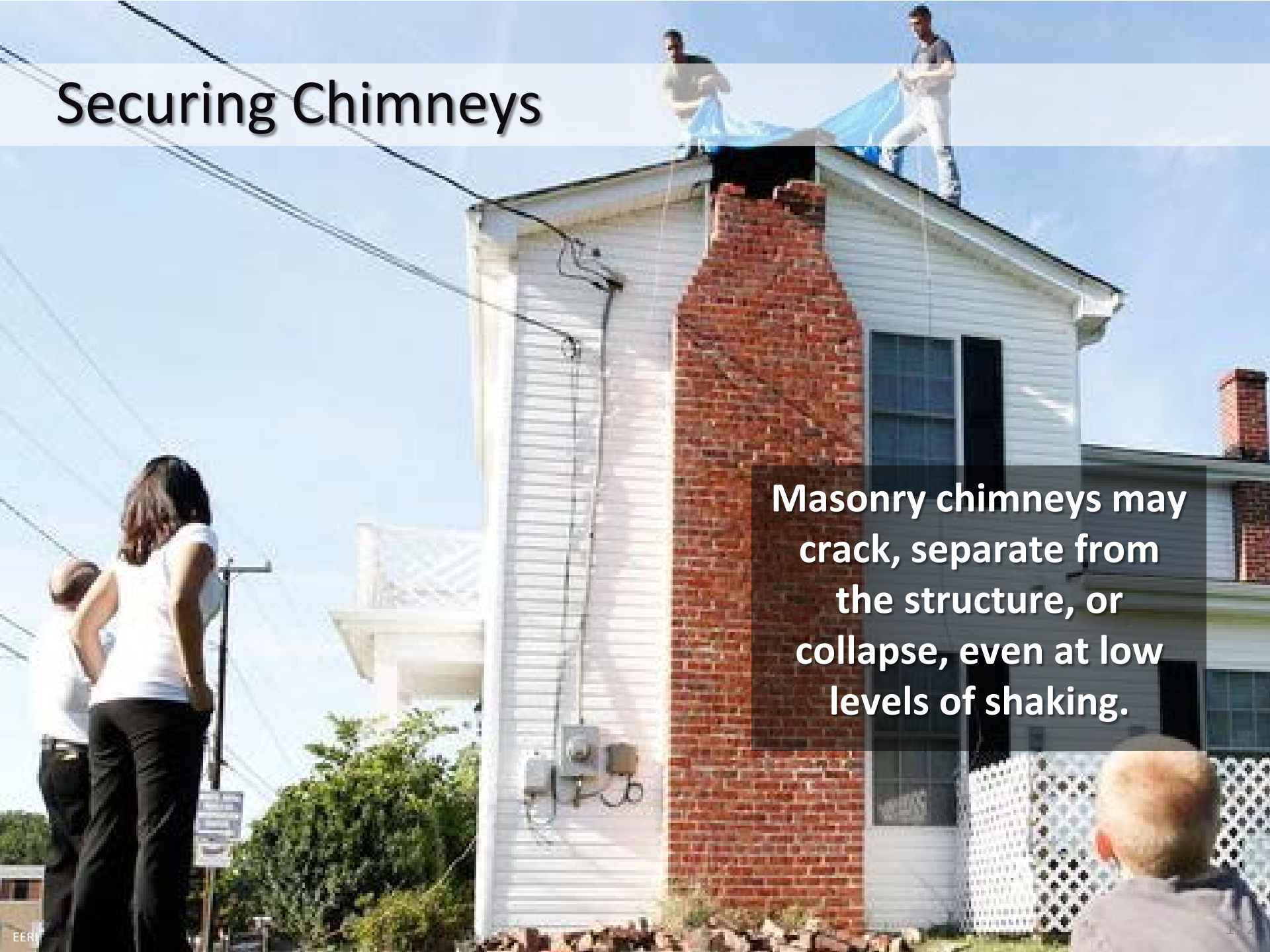
Unreinforced Masonry

- Masonry refers to brick or concrete block (i.e., “cinderblock”)
- It’s considered “unreinforced” if there is no steel rebar in the wall
- These structures can be retrofitted by a professional

FEMA News Photo by Kevin Galvin

Securing Chimneys



Masonry chimneys may crack, separate from the structure, or collapse, even at low levels of shaking.

Add bracing to stabilize chimneys

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Wiss, Janney, Elstner Associates

Securing Windows

- Install safety glass if possible
- As an alternative, use an adhesive plastic film on existing glass. This is typically less expensive.

Securing Industrial Storage Racks

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- Storage racks can collapse or overturn
- Goods stored on the racks can topple or spill
  1. Anchorage should be designed by a professional engineer and installed by a licensed contractor
  2. Restrain the contents on the racks with chains or netting

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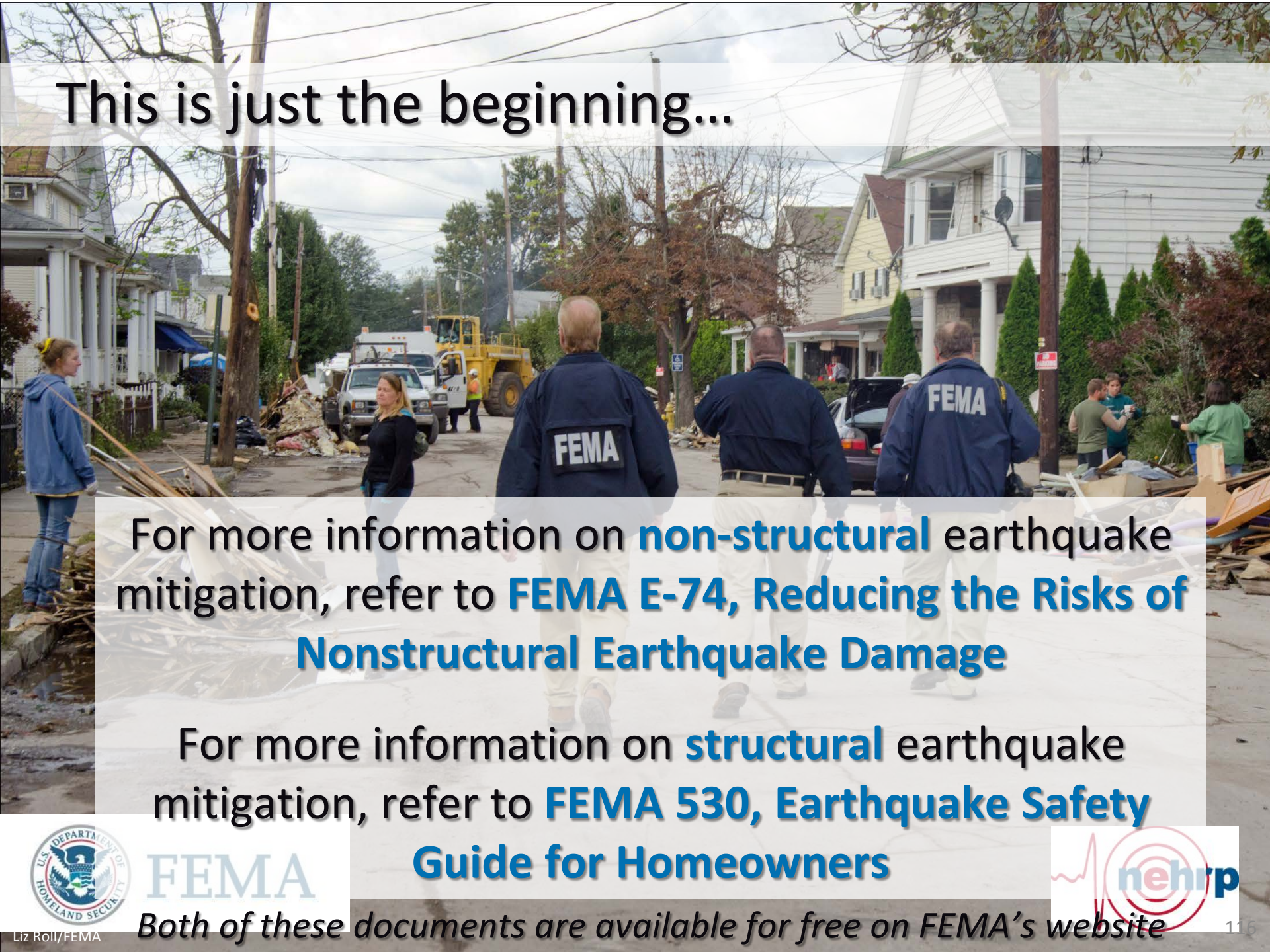
This is just the beginning…



For more information on **non-structural** earthquake mitigation, refer to **FEMA E-74, Reducing the Risks of Nonstructural Earthquake Damage**

For more information on **structural** earthquake mitigation, refer to **FEMA 530, Earthquake Safety Guide for Homeowners**

Both of these documents are available for free on FEMA's website

QUESTIONS?