SCAG™

EARTHQUAKE PREPAREDNESS INITIATIVE

Workshop II

EARTHQUAKE PREPAREDNESS INITIATIVE

BUILDING SAFETY | INFRASTRUCTURE REINFORCEMENT | ECONOMIC RESILIENCE

Prepared by
the Dr. Lucy Jones Center
for Science and Society

SCAG

EARTHQUAKE PREPAREDNESS INITIATIVE

BUILDING SAFETY | INFRASTRUCTURE REINFORCEMENT | ECONOMIC RESILIENCE

A regional informational seminar presented by the Southern California Association of Governments and the Dr. Lucy Jones Center for Science and Society

Agenda

1. Welcome and Overview
2. Presentation: What's at stake with the San Andreas Earthquake?
3. Exercise: "At-Risk Ranking"
4. Presentation: Interconnected Cities
5. Exercise: "State of your City"
6. Break
7. Breakout: "Overcoming the Barriers to Earthquake Mitigation"
8. Lunch Exercise: Goal Setting for your City
9. Presentation: Resources and Assistance
10. Exercise: "Doing the Work"
11. Break
12. Exercise: "Crafting the Framework: Next Steps Playbook"
13. Closing

Section 1
Worksheets

At-Risk Ranking

Community Asset	Individual Rank	Your City Rank	Responsible Entity
Water			
Electricity			
Hospitals			
Schools			
Parks and Cultural Venues			
Transportation Infrastructure: Roads/Highways/Transit			
Community Landmarks (official or unofficial)			
Municipal Buildings			
Houses of Worship/Faith Community			
Non-Profit/Community Serving Organizations			
Job Base			
Business Base (Tax Base)			
Economic Stability			
Historical Character			
Public Health			
Housing Stock - Single Family Homes			
Housing Stock - Multi-family/ Rental			
Community Identity / Way of Life			
Other:			

Pitfalls

When tackling a complicated issue like seismic safety, city officials can face unique challenges. There are some common pitfalls that have occurred when addressing this issue and still others that may be unique to your specific jurisdiction. Below, first list the potential pitfalls you may face, and then, suggest ways you can mitigate those challenges:

Pitfalls	Ways to Address Them

Unlikely Supporters

For the groups or organizations below, determine whether they will potentially be supportive or be an obstacle to advancing your seismic safety goals. Put an "S" (supporter), "O" (obstacle), "?" (unsure) or "N/A" (not applicable in your role) in the status column. For the supporters, explain what their role might be; for potential opponents, explain how could they be turned to supporters.

Organization or Group	Status	Potential Role
Homeowners Associations		
Renters Rights Advocates		
Housing Advocates		
Developers		
Apartment Owners		
Utility Operators		
Transit Advocates		
Transit Riders		
Older Adults		
Youth Advocates		
Animal Advocates		
Chambers of Commerce		
Large Business Owners		
Trade Associations		
College Students		
Renters		
Homeowners		
Social Service Nonprofits		
Disability Advocates		
Building Owners		
Structural Engineers Association		
American Institute of Architects (AIA)		
American Planning Association (APA)		

Organization or Group	Status	Potential Role
American Geophysical Union (AGU)		
Urban Land Institute (ULI)		
Property Owners Alliances / Business Improvement Districts (BIDs)		
Animal Welfare Advocates		
Sustainability Advocates		
Hospitals/CA Hospital Association		
Tourism Board		
Small Businesses		
Manufacturers		
Red Cross		
Faith-based organizations/Interfaith councils		
Property Owners		
Preservationists/Historical Society		
Unions		
City Staff		
Local Elected Officials		
State Elected Officials		
Federal Elected Officials		

Your Seismic Safety Priorities

List the top three issues/items you could focus on to increase seismic safety in your jurisdiction.

☐ _____

☐ _____

☐ _____

After listing the priorities, rank them 1, 2, and 3 in the box.

For each priority listed above, what are the main tasks that would need to be completed to increase seismic safety in this area in the short-, mid-, and long-term? Estimate duration it would take to complete them.

PRIORITY 1: _____

Short-Term Tasks (less than 6 months)

TASK	DURATION IN WEEKS OR MONTHS

Mid-Term Tasks (6-12 months)

TASK	DURATION IN WEEKS OR MONTHS

Long-Term Tasks (more than 12 months)

TASK	DURATION IN WEEKS OR MONTHS

PRIORITY 2: _____

Short-Term Tasks (less than 6 months)

TASK	DURATION IN WEEKS OR MONTHS

Mid-Term Tasks (6-12 months)

TASK	DURATION IN WEEKS OR MONTHS

Long-Term Tasks (more than 12 months)

TASK	DURATION IN WEEKS OR MONTHS

PRIORITY 3: _____

Short-Term Tasks (less than 6 months)

TASK	DURATION IN WEEKS OR MONTHS

Mid-Term Tasks (6-12 months)

TASK	DURATION IN WEEKS OR MONTHS

Long-Term Tasks (more than 12 months)

TASK	DURATION IN WEEKS OR MONTHS

Section 2
Resources

Earthquake Glossary

To understand earthquakes, here is a short primer on some of the terms scientists use and what they mean:

Earthquake is the sudden slip of one block of the earth's crust past another that produces shaking as one of its effects. Just like the slip of one finger past another when snapping your fingers produces a sound wave, the slip along a fault produces waves that are perceived as the earth shaking.

Magnitude is a number that represents the total energy released during an earthquake. The smallest earthquake ever recorded is about magnitude -2 (yes, like temperature magnitudes can be negative), and the largest historical event was magnitude 9.5. Although there is no theoretical limit to magnitude, it is unlikely that an earthquake much larger than 9.5 will occur. Each unit of magnitude represents a 32 times increase in the energy released by the fault. So a magnitude 7 earthquake has 32 times more energy than a magnitude 6 earthquake, more than thousand times (32 x 32) more energy than a magnitude 5.0 earthquake, and a million times more energy than a magnitude 3.0 earthquake. There are no "points on the scale". When seismologists say "point" it is to express the decimal point - "magnitude 6 point 5" means magnitude 6.5.

Intensity is a number (written as a Roman numeral) describing the severity of an earthquake in terms of its effects on the earth's surface and on humans and their structures. Several scales exist, but the ones most commonly used in the United States is the Modified Mercalli Intensity scale sometimes written "MMI". Unlike the magnitude, which has one value for each earthquake, the intensity depends on your distance from the earthquake and decreases with distance from the event.

The **fault** is the surface across which two blocks of crust slip in an earthquake. This planar surface may intersect the earth's surface as an identifiable fault trace. Faults vary in size from centimeters to thousands of kilometers long. A fault zone may be a complicated set of fractures up to hundreds of kilometers wide. The magnitude of an earthquake is proportional to the area of the fault that slips and how much it slips. A magnitude 3.0 happens over a fault surface of 1-10 square meters. A magnitude 5.0 requires slip on a fault a few kilometers across, while a magnitude 8.0 needs a fault several hundreds of kilometers long. Big earthquakes occur only on big faults, but a little earthquake could occur on a big fault if only part of it slips. Small quakes may also happen on a little "secondary" fault near a big fault or on a tiny fault.

The **slip** is the amount of movement that occurs between the two sides of the fault surface during an earthquake. The amount of slip can range from a few centimeters for a magnitude 4.0 up to 10 meters or more for a magnitude 8.0. For smaller quakes this slip may all occur miles deep in the earth and not reach the surface.

The **epicenter** is the point on the earth's surface above the hypocenter, which is the point at depth on the fault where the earthquake begins. When an earthquake occurs the slip doesn't happen all at once. The earthquake begins at a point and ruptures across the fault. The rupture moves at about 3 kilometers per second, so a bigger earthquake lasts for a longer time.

An earthquake **cluster**, or earthquake **sequence**, is a group of earthquakes that are close in time and space. Every earthquake changes the stress in the surrounding rock and increases the probability that another earthquake will occur nearby. This probability dies off quickly with both time and distance, so mostly they are near the fault surface that has been moving. A big earthquake is on a big fault and therefore produces more aftershocks.

A **mainshock** is the largest earthquake in a sequence. A **foreshock** is any earthquake that happens near and before the mainshock. An **aftershock** is any earthquake that happens near and after the mainshock. Foreshocks, mainshocks, and aftershocks are all earthquakes and these terms simply describe the relationship between events in a sequence. For example, as a sequence progresses a quake dubbed a mainshock may have its status changed to foreshock if it is followed by an even bigger quake. Sometimes the largest aftershock or largest foreshock is so close in size to the mainshock (exactly the same magnitude or only 0.1 or 0.2 units apart) that the two events are called a doublet. However, generally the largest aftershock is about one magnitude unit smaller than the mainshock.

Triggered earthquakes are earthquakes that occur right after a big earthquake but are too far away from the mainshock fault to be called aftershocks. The first time we observed this clearly were earthquakes triggered by the magnitude 7.3 1992 Landers earthquake, which included a magnitude 5.7 earthquake in Nevada (over 200 miles away).

An **earthquake swarm** is an earthquake cluster that has several earthquakes close to the largest size (rather than a mainshock or a doublet). Unlike typical mainshock/aftershock sequences where the number of quakes dies off rapidly with time swarms may persist for longer periods of time. Swarms are characteristic of certain locations in California, especially volcanic and geothermal areas such as the Imperial Valley and Mammoth Lakes.

Earthquake FAQs

1. When do fault locations matter?

All earthquakes occur on faults but often the faults are too small to be recognized at the surface — or even to extend to the surface at all. But to have a big earthquake, there has to be a big fault. So when an earthquake occurs near a big fault, it could trigger a bigger earthquake on that nearby big fault. The first earthquake need not be on the big fault to trigger another earthquake.

2. How are earthquakes assigned to faults?

The only way to be certain an earthquake occurred on a particular fault is to see actual surface slip on that fault, usually as cracks at the surface. Surface slip is almost never seen in an earthquake smaller than magnitude 5.0 and sometimes not for even larger earthquakes. If no surface slip is observed a focal mechanism can still allow scientists to estimate the orientation and direction of slip on the fault. If that is parallel to a mapped fault and the location is very near that fault, it might be on the fault — or it might be on a secondary fault around the main fault. Without surface slip, it may take quite a bit of research to make the assignment.

**The USGS usually doesn't try to assign a fault for earthquakes below magnitude 5.0.

3. How do you determine the depth of an earthquake?

When an earthquake happens, the seismic waves (what shakes the ground) travel from the earthquake and arrive at seismic stations distributed across southern California. By measuring the time these waves reach each station, we triangulate the location of the earthquake including the depth. Because all our stations are on the surface, we cannot determine the depth as accurately as the horizontal location. To determine the depth accurately, we need to have at least one station as close to the horizontal location as the earthquake is deep. So for the shallowest earthquakes, it can be very difficult to know exactly how deep they are.

4. What's the difference between an earthquake and an aftershock?

Nothing. An aftershock is an earthquake.

5. Can aftershocks trigger another earthquake?

Absolutely. An aftershock is an earthquake and every earthquake makes another one more likely.

6. Are we overdue for a big earthquake?

Earthquakes are not regular enough to talk about "overdue". On the central section of the San Andreas fault, there are intervals as short as 40 years and as long as 400 years between individual events at the same spot.

7. When smaller earthquakes happen, do they release pressure so big ones are less likely?

No. Seismologists have observed that for every magnitude 6.0 earthquake there are 10 of magnitude 5.0, 100 of magnitude 4.0, 1,000 of magnitude 3.0, and so forth as the events get smaller and smaller. This sounds like a lot of small earthquakes, but there are never enough small ones to eliminate the occasional large event. It would take 32 magnitude 5.0's, 1,000 magnitude 4.0's, 32,000 magnitude 3.0's to release the same energy as one magnitude 6.0 event. So, even though there are more small events than large ones, there are never enough to release all the stress in the earth's crust and eliminate the need for the occasional large earthquake.

8. What kind of earthquake can be triggered by a magnitude 3.5 event?

Anything. But most likely the triggered earthquake will be smaller. About five percent of the time the triggered earthquake is bigger than the first earthquake, but even then it is probably only a little bigger. Only one in a thousand magnitude 3.5 earthquakes trigger something as large as magnitude 5.

9a. What is the normal rate for earthquakes in the LA area over the past 80 years?

Since 1932, Los Angeles County had three earthquakes larger than magnitude 6.0 and about 30 larger than magnitude 5.0. (There have been many more earthquakes in adjacent counties which are also felt and have caused damage in LA.)

9b. What is the normal rate for earthquakes in Southern California over the past 80 years?

Since 1932, Southern California has had 3 earthquakes with a magnitude over 7.0 and 16 earthquakes that were between magnitude 6.0 and 7.0.

10. How can you tell if one earthquake is related to another earthquake?

We don't have a definitive way to determine that. We assume it is related when they are very close in time and space and happening at a rate higher than background.

11. How do you determine how "long" an earthquake lasted?

For seismologists, the duration of an earthquake the time it takes the rupture to travel from the hypocenter down the fault until the slip stops. Therefore, the duration depends on the length of the fault rupture, which increases with magnitude. This is the biggest factor that determines how long someone feels the shaking, but the length of shaking experienced at a specific location is also affected by how far that location is from the fault, the local soils and what the person considers strong shaking. For the largest California events, strong shaking can last more than a minute.

12. What is the probability that an earthquake is a foreshock to a larger earthquake?

Worldwide the probability that an earthquake will be followed within 3 days by a large earthquake nearby is just over 6%. In California, that probability is also about 6%. This means that there is about a 94% chance that any earthquake will NOT be followed by a bigger quake. In California, about half of the biggest earthquakes were preceded by foreshocks; the other half were not. There is no way to tell in advance that an earthquake is a foreshock until a larger event follows it. So, foreshocks can only be recognized in retrospect.

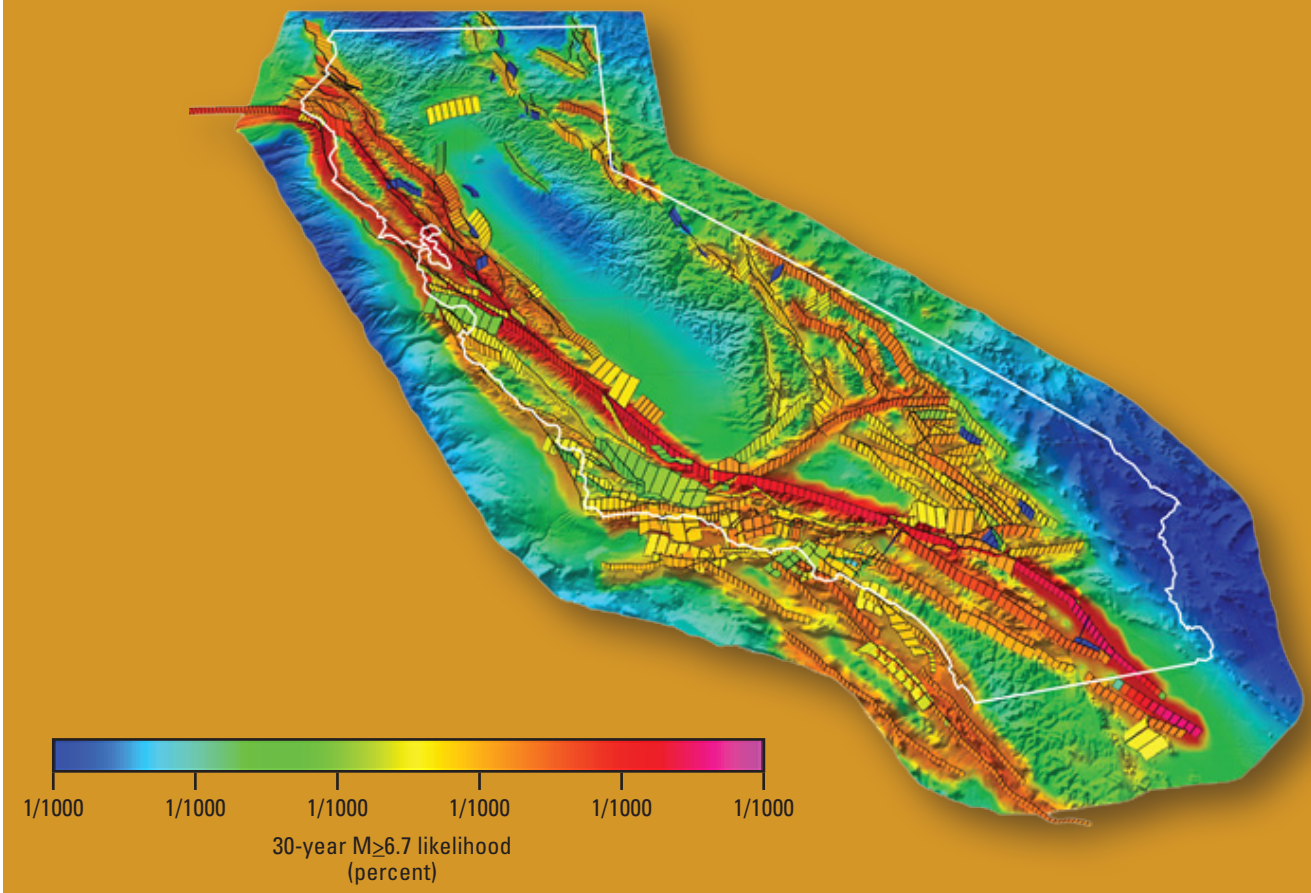
Realities for Southern California

UNIFORM CALIFORNIA EARTHQUAKE RUPTURE FORECAST

This model describes where large earthquakes (at least M6.7) are most likely to originate in California. Each of the little black boxes is a segment of a fault of the right size to produce a M6.7 earthquake. To be a larger earthquake, multiple segments need to move together. The areas with the highest likelihood are dark red where the chance of being part of a big earthquake is better than 50-50 for a 30-year period. This very high probability only occurs on the San Andreas fault which is the fastest moving fault in California.

Scientific Consensus

This model was developed by a large team of scientists working with the U.S. Geological Survey, Southern California Earthquake Center and the California Geological Survey and published in 2015. It compiles all the work scientists have done about faults, where they are and how fast they move, and has been extensively peer reviewed. It is the best estimate of where earthquakes are likely to originate. It does not tell you the chance of getting damaging earthquake shaking.

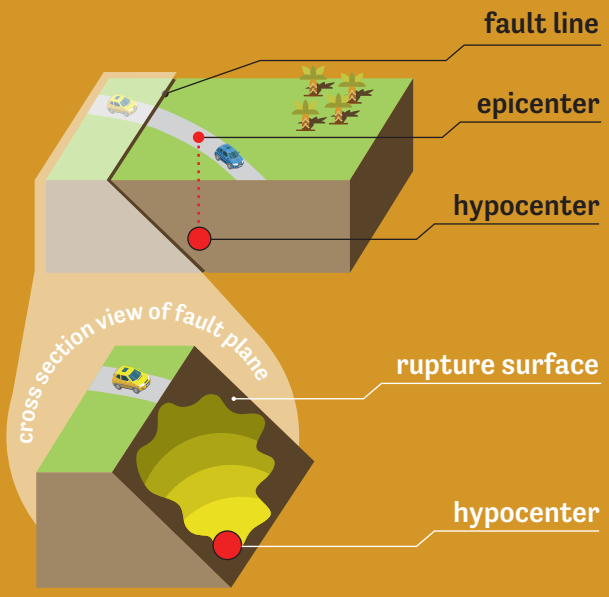


EARTHQUAKE SHAKING

Earthquakes occur when one block of rock moves past another block along a fault, releasing energy in seismic waves, just like snapping your fingers releases sound waves. The waves come off of every part of the fault that moves in the earthquake.

Small earthquakes move a small part of a fault. The length that moves in a M3 earthquake might be only the size of a house. In a M5 event, the fault might be a mile or two long. A big M7.8 on the San Andreas will be at least 200 miles long.

Every point on the fault gives off shaking. The epicenter is only the place where the fault starts to move and doesn't have stronger shaking than anywhere else on the fault that is moving. You could be 200 miles away from the epicenter and still on top of the earthquake – if you are on the fault. If you were 200 miles away from the fault, you would get very little shaking. The shaking is worse in places with thick soils, such as the Los Angeles Basin and the inland valleys of Southern California.

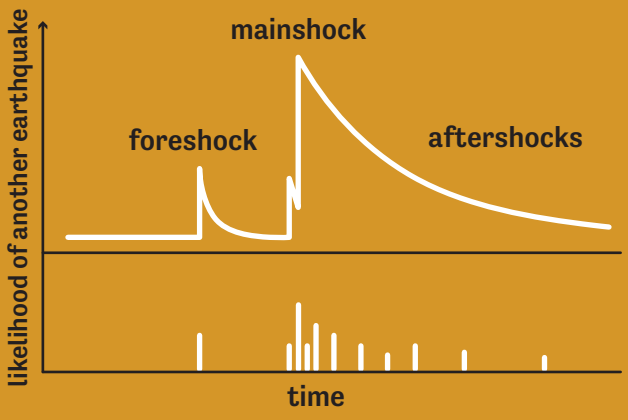


EARTHQUAKE CLUSTERS

When one earthquake happens, it makes other earthquakes more likely. Mostly they are smaller and we call them aftershocks. About 5% of the time in California, the aftershock gets bigger than the mainshock. We then change the names and call the first one a foreshock.

The most likely time for the triggered earthquake is immediately. The chance of another earthquake goes down with time. The chance that the magnitude of a given will be big doesn't change so we often see large, late aftershocks.

The most likely location for an aftershock (or a mainshock after a foreshock) is at the same place and the chance of triggering another earthquake does off very rapidly with distance away from the fault of the first earthquake. We have never seen a foreshock more than 6 miles away from its mainshock. This is why seismologists issue advisories when a small earthquake is very near the San Andreas fault. It is unlikely it will trigger a bigger earthquake, but having the San Andreas nearby makes it more likely. The bigger the first earthquake, the farther away it can trigger events. The biggest earthquakes have triggered aftershocks hundreds of miles away.

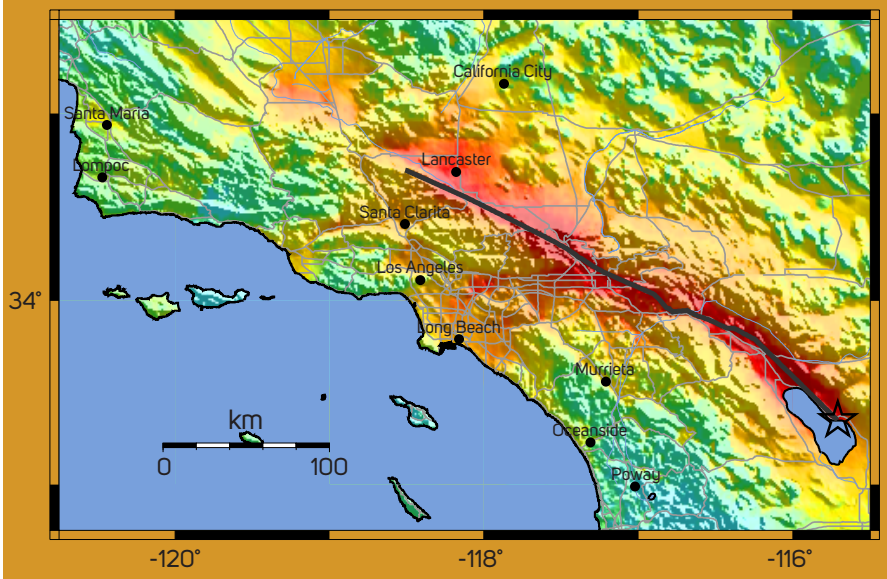


Impacts for Southern California

SHAKEOUT SCENARIO: IMPACT OF A SAN ANDREAS EARTHQUAKE

The U.S. Geological Survey led a large team of experts to model just what was likely to happen when a big San Andreas earthquake finally breaks through the southern part of the fault. This map shows the prediction of what the shaking will be. The black line is the part of the fault modeled to break in this earthquake. Very near the fault receives very strong shaking (red). As you move away from the fault, the level of shaking mostly decreases. But in valleys that have a thick layer (meaning a mile or more deep) of soil, the shaking is amplified and we see strong shaking tens of miles distant from the fault.

MAP A Shaking from a Plausible 7.8 San Andreas Earthquake



PLANNING SCENARIO ONLY -- Map Version 1 Processed 2015-02-27 06:50:17 UTC

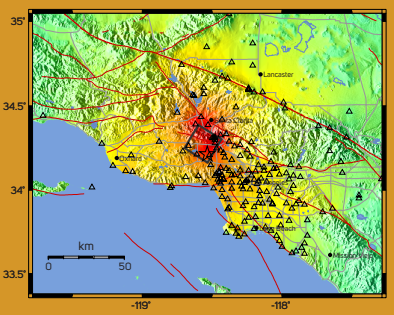
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Source: U.S. Geological Survey

Bottom line: The San Andreas earthquake will give all of southern California the type of strong shaking that only the northwest San Fernando Valley got in the 1994 Northridge earthquake. MAP A shows the shaking from 1994 on the same scale and same colors as the San Andreas map (MAP B).

MAP B Shaking from 1994 Northridge Earthquake



EARTHQUAKE PREPAREDNESS INITIATIVE

BUILDING SAFETY | INFRASTRUCTURE REINFORCEMENT | ECONOMIC RESILIENCE

IMPACTS OF A SAN ANDREAS EARTHQUAKE

- Lifelines crossing San Andreas all destroyed, including water, gas, and transportation
- Strong shaking at many locations up to 1 minute
- 1,500 buildings completely collapsed
- 300,000 buildings red-tagged
- 1,800 dead and 53,000 injured
- 1,600 fires started that will double the losses
- Water losses to whole region. Up to 6 months to restore service.
- Electricity and telecommunications lost for days to weeks
- Debris that exceeds the capacity of all landfills

Photo Credit: Wally Skalij / Los Angeles Times

ACTIONS THAT COULD REDUCE THE LOSSESS

- Mandatory retrofit of the most dangerous buildings, especially soft-first story buildings and non-ductile reinforced concrete
- Increase standard for new buildings from collapse prevention (“life-safety”) to being able to sue them (“immediate occupancy”)
- A program to replace brittle water pipes with seismic resistant pipes
- Coordination program between water and fire departments
- Solar powered WiFi for communication when cell phone service is lost

15 Common Earthquake Myths

1. It's Hot and Dry - Earthquake Weather!

Many people believe that earthquakes are more common in certain kinds of weather. In fact, no correlation with weather has been found. Earthquakes begin many miles below the region affected by surface weather. People tend to notice earthquakes that fit the pattern and forget the ones that don't. Also, every region of the world has a story about earthquake weather, but the type of weather is whatever they had for their most memorable earthquake.

2. Big Earthquakes Always Happen in the Early Morning

This myth may be so common because we want it to be true. Several recent damaging earthquakes have been in the early morning, so many people believe that all big earthquakes happen then. In fact, earthquakes occur at all times of day. The 1933 Long Beach earthquake was at 5:54 p.m. and the 1940 Imperial Valley event was at 8:37 p.m. More recently, the 1992 Joshua Tree earthquake was at 9:50 p.m. and the 2003 San Simeon event was at 11:15 a.m. It is easy to notice the earthquakes that fit the pattern and forget the ones that don't.

3. Beachfront Property in Arizona

The idea of California falling into the ocean has had an enduring appeal to those envious of life in the Golden State. Of course, the ocean is not a great hole into which California can fall, but it is itself land at a somewhat lower elevation with water above it. The motion of plates will not make California sink - California is moving horizontally along the San Andreas fault and up around the Transverse Ranges.

4. And the Earth Opened...

A popular literary device is a fault that opens during an earthquake to swallow up an inconvenient character. But unfortunately for principled writers, gaping faults exist only in novels. The ground moves across a fault during an earthquake, not away from it. If the fault could open, there would be no friction. Without friction, there would be no earthquake.

5. We Have Good Building Codes So We Must Have Good Buildings

The best building codes in the world do nothing for buildings built before that code was enacted. While the codes have been updated, the older buildings are still in place. Fixing problems in older buildings - retrofitting - is the choice of the building's owner, unless ordinances specifically requiring retrofitting have been passed.

6. Head for the Doorway

An enduring earthquake image of California is a collapsed adobe home with the door frame as the only standing part. From this came our belief that a doorway is the safest place to be during an earthquake. True - if you live in an old, unreinforced adobe house. In modern houses, doorways are no stronger than any other part of the house and usually have doors that will swing and can injure you. You are safer under a table.

7. Everyone Will Panic During the Big One

A common belief is that people always panic and run around madly during and after earthquakes, creating more danger for themselves and others. Actually, research shows that people usually take protective actions and help others both during and after the shaking. Most people don't get too shaken up about being shaken up!

8. Earthquakes Only Occur on the US West Coast

Earthquakes can strike any location at any time. But history shows they occur in the same general patterns over time, principally in three large zones of the earth. The world's greatest earthquake zone, the circum-Pacific seismic belt, is found along the rim of the Pacific Ocean, where about 81 percent of the world's largest earthquakes occur. That belt extends from Chile, northward along the South American coast through Central America, Mexico, the West Coast of the United States, the southern part of Alaska, through the Aleutian Islands to Japan, the Philippine Islands, New Guinea, the island groups of the Southwest Pacific, and to New Zealand. The second important belt, the Alpide, extends from Java to Sumatra through the Himalayas, the Mediterranean, and out into the Atlantic. This belt accounts for about 17 percent of the world's largest earthquakes, including some of the most destructive. The third prominent belt follows the submerged mid-Atlantic ridge. The remaining shocks are scattered in various areas of the world. Earthquakes in these prominent seismic zones are taken for granted, but damaging shocks occur occasionally outside these areas. Examples in the United States are New Madrid, Missouri, and Charleston, South Carolina. Many centuries, however, usually elapse between such destructive shocks.

9. The 1906 San Francisco Earthquake Was the Deadliest Ever

Though well known, the magnitude 7.8 San Francisco earthquake and ensuring fire killed 3,000 and razed large sections of the city. It was the most deadly in U.S. history, but that doesn't make it the worst the world has seen, by far. The deadliest earthquake in recorded history struck Shensi province in China in 1556, killing about 830,000 people. The 1976 magnitude 7.8 earthquake which struck Tangshan, China killed somewhere between 250,000 and 700,000 people. In 2003, the magnitude 6.5 earthquake in Bam, Iran killed more than 40,000 people. The earthquake in Chile on May 22, 1960, is the strongest in the world with magnitude 9.5, and killed more than 4,000. For the record, the largest U.S. earthquake occurred on March 28, 1964, in Alaska. It was a magnitude 9.2 quake and took 131 lives.

10. Nuclear Explosions Can Start Earthquakes

Scientists agree that even large nuclear explosions have little effect on seismicity outside the area of the blast itself. Around the blast area the explosions do trigger small aftershock events, however these earthquakes are much smaller than the explosion itself. The largest underground thermonuclear tests conducted by the United States were detonated at the western end of the Aleutian Islands. The largest of these, the 5 megaton test code-named Cannikin on November 6, 1971, that did not trigger any earthquakes in the seismically active Aleutian Islands. On January 19, 1968, a thermonuclear test, code-named Faultless, took place in central Nevada. The code-name turned out to be a poor choice because a fresh fault rupture some 4,000 feet long was produced. Seismograph records showed that the seismic waves produced by the fault movement were much less energetic than those produced directly by the nuclear explosion. Scientists looked at the rate of earthquake occurrence in central California, not far from the test site, at the times of the tests and found nothing to connect the testing with earthquakes in the area.

Earthquakes can be induced by human activity when we increase the pressure in groundwater. This can happen either from building a reservoir where a new deep lake increases the pressure in the groundwater below it, or when fluids are injected into deep wells for waste disposal and secondary recovery of oil. The largest human-caused earthquake was a M6.5 event in Soviet Central Asia under a large reservoir. The largest earthquake caused

15 Common Earthquake Myths cont.

by wastewater disposal, so far, was a M5.8 in Oklahoma in 2016. Since 2014, Oklahoma has had more earthquakes than California. The rate of wastewater injection has recently been restricted and the number of earthquakes is going down.

11. People Can Stop Earthquakes

We cannot prevent earthquakes from happening (or stop them once they've started). However, we can significantly mitigate their effects by characterizing the hazard (e.g., identifying earthquake faults, unconsolidated sediment likely to amplify earthquake waves, and unstable land prone to sliding or liquefying during strong shaking), building safer structures, and preparing in advance by taking preventative measures and knowing how to respond.

12. We Can Predict Earthquakes

Earthquake prediction is the holy grail for earthquake scientists, but there currently is no accepted method to accomplish the goal of predicting the time, place and magnitude of an impending quake. Research into earthquake prediction continues, although many scientists are coming to believe that the time of a big earthquake may be random - and fundamentally unpredictable. The USGS approach has been to focus on providing long-range forecasts of the likelihood locations and impacts of damaging earthquakes. For example, scientists estimate that over the next 30 years the probability of a major EQ occurring in the San Francisco Bay area is 62% and 60% in Southern California. Scientists are also able to predict the type of ground motion to expect based on the geology and the history of earthquake activity of the region. Engineers and building code developers use these models of site response to improve the safety of structures, thereby reducing the ultimate earthquake risk.

13. Animals Can Predict Earthquakes

Changes in animal behavior cannot be used to predict earthquakes. Even though there have been reported cases of unusual animal behavior prior to earthquakes, a reproducible connection between a specific behavior and the occurrence of an earthquake has never been made. Because of their finely tuned senses, animals can often feel the earthquake at its earliest stages before the humans around it can. This feeds the myth that the animal knew the earthquake was coming. But animals also change their behavior for many reasons, and given that an earthquake can shake millions of people, it is likely that a few of their pets will, by chance, be acting strangely before an earthquake.

14. The Position of the Moon or the Planets Affect Seismicity

The moon, sun, and other planets have an influence on the earth in the form of perturbations to the gravitational field. The relative amount of influence is proportional to the object's mass, and inversely proportional to the square of its distance from the earth. No significant correlations have been identified between the rate of earthquake occurrence and the semi-diurnal tides when using large earthquake catalogs. There have, however, been some small but significant correlations reported between the semi-diurnal tides and the rate of occurrence of aftershocks in some volcanic regions, such as Mammoth Lakes.

15. Earthquakes Cause Volcanoes

While the same physical properties that cause earthquakes cause volcanoes, earthquakes themselves are not the cause of volcanoes. Earthquakes may occur in an area before, during, and after a volcanic eruption, but they are the result of the active forces connected with the eruption, and not the cause of volcanic activity.

Resource Organizations

American Institute of Architects/National Institute of Building Sciences: https://www.brikbase.org/

AIA provides technical support via reports on the Building Research Information Knowledgebase (BRIK), an online information portal where you will find curated, professionally-reviewed research on all facets of the built environment, from building performance and materials to large-scale infrastructure and systems. BRIK is a collaborative effort of AIA and the National Institute of Building Sciences.

Contact Person: Will Wright, will@aialosangeles.org (locally)

Earthquake Country Alliance: www.earthquakecountry.org

The Earthquake Country Alliance (ECA) is a public-private partnership of people, organizations, and regional alliances that work together to improve preparedness, mitigation and resiliency.

ECA provides information and resources to help everyone who lives, works, or travels in earthquake country get prepared to survive and recover quickly.

Contact Person: Mark Benthien, benthien@usc.org

Southern California Earthquake Center: www.scec.org

Southern California Earthquake Center advances earthquake science through three basic activities: (a) gathering information from seismic and geodetic sensors, geologic field observations, and laboratory experiments; (b) synthesizing knowledge of earthquake phenomena through modeling; and (c) communicating this information of seismic hazards to reduce earthquake risk and promote community resilience.

Contact Person: Mark Benthien, benthien@usc.org

Structural Engineers Association of Southern California: http://www.seaosc.org/Safer-Cities-Advisory-Program

The Safer Cities Advisory Program provides pro bono technical insights and creative minds from their membership to have an independent, qualified review of a jurisdiction's draft ordinances and programs and provide expert advice from their qualified and vetted members.

Contact Person: Dianne Ochoa, seaosc@seaosc.org

Thriving Earth Exchange: thrivingearthexchange.org

Thriving Earth Exchange (TEX) helps communities leverage Earth and space science to build a better future for themselves and the planet. TEX does this by bringing together Earth and space scientists and community leaders and helping them combine science and local knowledge to solve on-the-ground challenges related to natural hazards, natural resources, and climate change.

Contact Person: Natasha Udu-gama, nudu-gama@agu.org

Urban Land Institute: http://uli.org/research/centers-initiatives/urban-resilience-program/

The Urban Land Institute provides leadership in the responsible use of land and in creating and sustaining thriving communities. As a nonpartisan organization, the Institute has long been recognized as one of America's most respected and widely quoted sources of objective information on urban planning, growth, and development.

Contact Person: Jonathan Nettler, jonathan.nettler@uli.org

US Green Building Council: http://www.resilience.la/

USGBC's Los Angeles Chapter is creating the Building Resilience: LA system for property owners and organizations ready to incorporate resilience into management, operations and maintenance.

Contact Person: Heather Rosenberg, hrosenberg@usgbc-la.org

US Resiliency Council: www.usrc.org/

The US Resiliency Council's mission is to establish and implement meaningful rating systems that describe the performance of buildings during earthquakes and other natural hazard events, to educate the general public to understand these risks, and to thereby improve societal resilience.

Contact Person: Evan Reis, evan.reis@usrc.org

Sample Seismic Ordinances

Jurisdiction	Topic	Description	Reference
City of Burbank	Single Family Wood Frame Retrofit - amendment	Amendment requires following Chapter A4 on their voluntary program for the retrofit of existing wood frame residential buildings with soft, weak, or open front walls	Ordinance 9-1-7-A400
City of Burbank	Non-ductile concrete buildings	Amendment requires following Chapter A5 on their voluntary program to retrofit existing non-ductile concrete residential buildings	Ordinance 9-1-7-A500
City of Berkeley	Single Family Wood Frame Retrofit	Property transfer tax to use up to ⅓ toward seismic retrofit	Chapter 7.52.060
City of Berkeley	Soft Story Inventory and Retrofit	Establishing an inventory of potentially hazardous building containing soft, weak or open front stories and adopting Chapter A4 of the International Existing Building Code with amendments	Chapter 19.39
City of Fremont	Soft Story Inventory and Retrofit	An ordinance amending city code regarding the retrofit of soft or open front walls in wood frame, residential, soft-story buildings	Ordinance 10-2007
City of Fremont	Unreinforced Masonry Retrofit	Ordinance amending city code regarding tilt-up and masonry building deleting exception and modifying timetable	Ordinance 2449
City of Los Angeles	Soft story buildings	Mandatory retrofit of soft story buildings was passed and signed into law on October 9, 2015 and requires that approximately 13,500 soft story buildings with 4 or more residential units be retrofit within 7 years or receiving an order.	Ordinance 183893
City of Los Angeles	Non-ductile reinforced concrete buildings	Mandatory retrofit of non-ductile reinforced concrete buildings was passed and signed into law on October 9, 2015 and requires that approximately 1,500 concrete buildings be retrofit within 25 years or receiving an order.	Ordinance 183893
City of Los Angeles	Fortify cellular towers	Stronger telecommunications standards were passed and signed into law in the summer of 2015 that require new cell towers to be built to more than a life safety standard, consistent with other critical infrastructure.	Ordinance 183580

Jurisdiction	Topic	Description	Reference
City of Los Angeles	Cost-sharing of mandatory retrofits	The cost sharing ordinance limits the proportion of costs related to the mandatory seismic retrofitting can be passed from owners to their tenants to 50 percent of the total cost of the work required to implement the seismic retrofit mandate. The ordinance was passed in February, 2016.	Ordinance 184080
City of Los Angeles	PACE financing	In 2015 five Pace Providers (Alliance NRG, California First, OnDemand PACE, Ygrene, and E3) are now able to provide seismic PACE within the City of Los Angeles.	CF:14-1697-S2
City of Los Angeles	Substantial damage	An Ordinance mandating evaluation and retrofit of buildings that experience substantial damage at low levels of shaking was passed by City Council on March 29, 2016	Ordinance 184169
City of Oakland	Emergency Management Board and Disaster Preparedness Council	Establishing of an Emergency Management Board and Disaster Preparedness Council that will assist during a disaster as well as for day-to-day operations	Chapter 8.50
City of Oakland	Soft Story Inventory and Retrofit	An ordinance amending the municipal code adding mandatory seismic screening of certain multi-story residential buildings	Ordinance 12966
City of Oakland	Unreinforced Masonry Retrofit	An ordinance mandating retrofit of unreinforced masonry buildings constructed prior to 1948 with minimum life safety standards	Chapter 15.28
City of San Francisco	Soft Story Inventory and Retrofit	An ordinance amending the municipal code adding mandatory seismic retrofit program for wood-frame building of 3 or more stories and the building has not been seismically strengthened	Ordinance 66-13

Prototype Ordinance for Soft First Story Retrofit

From the City of Los Angeles

MANDATORY EARTHQUAKE HAZARD REDUCTION IN EXISTING WOOD FRAME

BUILDINGS WITH SOFT, WEAK OR OPEN WALLS

Ordinance No. _____, Effective_____

I. PURPOSE

The purpose of this Ordinance is to promote the public welfare and safety by reducing the risk of death or injury that may result from the effects of earthquakes on existing wood-frame buildings with soft, weak or open walls. In the Northridge Earthquake, many multi-story wood frame buildings with tuck under parking performed poorly and collapsed. These types of buildings were shown to be vulnerable to loss of human life, personal injury and property damage during past earthquakes. Common deficiencies of this building type have been identified to be soft, weak or open walls. This Ordinance creates minimum standards to mitigate hazards from these deficiencies. When fully followed, these minimum standards will improve the performance of these buildings but will not necessarily prevent all earthquake-related damage.

II. SCOPE

The provisions of this Ordinance shall apply to all existing commercial and residential buildings of wood frame construction, except residential buildings with 3 units or less, having all the following:

1. Two or more stories,

2. Determined by the Department to have been built and issued a Certificate of Occupancy before January 1, 1980, and

3. Ground floor portion of the wood frame structure contains parking or other similar open floor space that causes soft, weak or open wall lines.

III. DEFINITIONS

The following definitions shall apply for the purposes of this Ordinance:

CRIPPLE WALL is a wood-framed stud wall extending from the top of the foundation wall to the underside of the lowest floor framing of the building.

GROUND FLOOR is any floor within the wood frame portion of a building whose elevation is immediately accessible from an adjacent grade by vehicles or pedestrians. The ground floor portion of the structure does not include any level that is completely below adjacent grades.

OPEN WALL LINE is an exterior wall line with vertical elements of the lateral force resisting system which requires tributary seismic forces to be resisted by diaphragm rotation or excessive cantilever beyond parallel lines of shear walls. Diaphragms that cantilever more than twenty-five percent of the distance between lines of lateral force resisting elements from which the diaphragm cantilevers shall be considered excessive. Exterior exit balconies of six feet or less in width shall not be considered excessive cantilevers.

RETROFIT is an improvement of the lateral force resisting system by alteration of existing structural elements or addition of new structural elements.

SINGLE FAMILY DWELLING is any building which contains living facilities, including provisions for sleeping, eating, cooking and sanitation, as required by this code, for not more than one family.

SOFT WALL LINE is a wall line whose lateral stiffness is less than required by story drift limitations or deformation compatibility requirements of this Ordinance. In lieu of analysis, this may be defined as a wall line in a story where the story stiffness is less than 70 percent of the story above for the direction under consideration.

STORY is as defined in the building code, including any basement or underfloor space of a building with cripple walls exceeding four feet in height.

STORY STRENGTH is the total strength of all seismic resisting elements sharing the same story shear in the direction under consideration.

WALL LINE is any length of a wall along a principal axis of the building used to provide resistance to lateral loads.

WEAK WALL LINE is a wall line in a story where the story strength is less than 80 percent of the story above in the direction under consideration.

IV. COMPLIANCE REQUIREMENTS

Priority designation. Buildings within the scope of this Ordinance shall be recognized with the priority designation as follows:

I. Residential Buildings with 16 units or more.

II. Buildings with 3 stories or more (other than buildings under Priority I).

III. All others

The owner of each building within the scope of this Ordinance shall cause a structural analysis to be made of the building by a civil or structural engineer or architect licensed by the state of California, and if the building does not meet the minimum earthquake standards specified in this Ordinance, the building shall be structurally altered to conform to such standards or be demolished within the time limits stated in this Ordinance.

Service of order. When the Department determines that a building is within the scope of this Ordinance, the Department shall issue an order to the owner of the building with the minimum time period for service of such orders. The minimum time period for the service of such orders shall be measured from the order effective date.

Buildings not served an order to comply with this Ordinance shall not invalidate any proceedings hereunder as to any other person duly served or relieve any such person from any duty or obligation imposed by this Ordinance. This Ordinance does not require existing electrical, plumbing, mechanical or fire systems to be altered unless they constitute a hazard to life or property. Unless expressly stated herein, this Ordinance is not intended to amend, repeal, or supersede provisions of the Los Angeles Municipal Code. In any specific section or case where there is a conflict within or between or among provisions, the most restrictive which prescribes and establishes the higher standard of safety or public benefit shall prevail and control.

Time limit.

A. The owner of a building within the scope of this Ordinance shall comply with the requirements set forth above by submitting to the Department for review and approval within one (1) year after the service of the order:

1. A structural analysis and plans which shall demonstrate the building, as is, meets the minimum requirements of this Ordinance, or

Prototype Ordinance for Soft First Story Retrofit cont.

2. A structural analysis and plans for the proposed structural alteration of the building necessary to comply with the minimum requirements of this Ordinance, or

3. Plans for the demolition of the building.

B. Obtain all necessary permits, within two (2) years after receipt of the order, for rehabilitation or demolition.

C. All construction or demolition work under all necessary permits shall be completed within four (4) years after receipt of the order.

Appeal from order. The owner or person in charge or control of the building may appeal the Department's initial determination that the building is within the scope of this Ordinance to the Board of Building and Safety Commissioners. Such appeal shall be filed with the Board within 60 days from the service date of the order. Any such appeal shall be decided by the Board no later than 60 days after the date that the appeal is filed. Such appeal shall be made in writing upon appropriate forms provided therefor by the Department, and the grounds thereof shall be stated clearly and concisely.

Appeals or requests for slight modifications from any other determinations, orders or actions by the Department pursuant to this Ordinance shall be made in accordance with the procedures established in Section 98.0403.2 of the Los Angeles Municipal Code.

Recordation. At the time that the Department serves the aforementioned order, the Department shall file with the Office of the County Recorder a certificate stating that the subject building is within the scope of this Ordinance. The certificate shall also state that the owner thereof has been ordered to structurally analyze and to structurally alter or demolish the building when the Department determines the building is not in compliance with this Ordinance.

If the building is either demolished, found not to be within the scope of this Ordinance, or is structurally capable of resisting minimum seismic forces required by this Ordinance as a result of structural alterations or an analysis, the Department shall file with the Office of the County Recorder a certificate terminating the status of the subject building as being classified within the scope of this Ordinance.

Enforcement and penalty. If the owner or other person in charge or control of the subject building fails to comply with any order issued by the Department pursuant to this Ordinance within any of the time limits, the Department may order that the entire building or a portion thereof be vacated and that the building or a portion thereof remain vacated until such order has been complied with. If compliance with such order has not been accomplished within 90 days after the date the building has been ordered vacated or such additional time as may have been granted by the Board, the Superintendent may order its demolition in accordance with the provisions of Section 8903 of Building Code.

Notwithstanding any other provision of this Code to the contrary, it shall be unlawful for any person, firm, or corporation to maintain, use, or occupy any building within the scope of this division which does not meet the minimum earthquake standards specified in this division.

Any person who violates, causes or permits another person to violate this provision is guilty of a misdemeanor. Any person includes an owner, lessor, sublessor, manager or person in control of a building subject to this ordinance. This term shall not include any person who is merely a tenant or other individual occupying any dwelling unit, efficiency dwelling unit, guest room or suite in a building. The legal owner of a building is that person, firm,

corporation, partnership or other entity whose name or title appears on the record with the Office of the County Recorder, as well as all successors or assignees of these persons.

EXCEPTION: This section shall not apply to any building on which work is proceeding in compliance with any extensions of time granted by the Department; or any action, order or determination made by the Department in the implementation of this ordinance

Occupant and tenant advisory. The property owner shall advise all current and prospective residential occupants and non-residential tenants of the building in a method and written format approved by the Housing and Community Investment Department.

Historical buildings. Qualified historical buildings shall comply with requirements of the California Historical Building Code established under Part 8, Title 24 of the California Code Regulations.

V. ENGINEERING ANALYSIS

Scope of analysis. This Ordinance requires the alteration, repair, replacement or addition of structural elements and their connections to meet the strength and stiffness requirements herein. The lateral-load-path analysis shall include the resisting elements and connections from the wood diaphragm immediately above any weak or open wall lines to the foundation. Stories above the weak wall line shall be considered in the analysis but need not be modified.

Design base shear and design parameters. The design base shear in a given direction shall be 0.20 W, where W is the tributary mass of the structure above the soft story and W shall be as defined in ASCE 7 Section 12.14.8.1.

Lateral Vertical Systems. Strengthening systems with concrete walls or masonry walls, or steel braced frame shall be not be permitted.

Horizontal Structural Irregularities in buildings with 3 or more stories. Structures with 3 or more stories having horizontal structural irregularities of either type 2, 3, 4, or 5 listed in ASCE 7 Table 12.3-1, shall be designated to meet the additional requirements of those sections referenced in the table 12.3-1 for the entire story with weak or open wall lines.

Alternate analysis, base shear and design parameters. The Department may approve alternate design methodologies that improve the whole first story seismic performance that are equivalent to the life safety objectives in this ordinance.

Additional anchorage requirements for buildings on hillsides. Where any portion of a building within the scope of this Ordinance is constructed on or into a slope steeper than one unit vertical in three units horizontal (33-percent slope), the lateral-forceresisting system shall be analyzed for the effects of concentrated lateral forces at and below the base level diaphragm shall also be analyzed for the effects of concentrated lateral loads caused at the building base from the hillside conditions and comply with the provisions of Chapter 94 of the Los Angeles Building Code.

Story drift limitations. The calculated story drift for each retrofitted story shall not exceed the allowable deformation compatible with all vertical load-resisting elements and 0.025 times the story height. The calculated story drift shall not be reduced by the effects of horizontal diaphragm stiffness but shall be increased when these effects produce rotation. Drift calculations shall be in accordance with ASCE 7-10 requirements.

Pole structures. The effects of rotation and soil stiffness shall be included in the calculated story drift where lateral loads are resisted by vertical elements whose required depth of embedment is determined by pole

Prototype Ordinance for Soft First Story Retrofit cont.

formulas. The coefficient of subgrade reaction used in deflection calculations shall be based on an approved geotechnical investigation conducted in accordance with approved geotechnical engineering reports.

P-Delta effect. The requirements of the Los Angeles Building Code shall apply, except as modified herein. All structural framing elements and their connections not required by the design to be part of the lateral force resisting system shall be designed and/or detailed to be adequate to maintain support of design dead plus live loads when subject to the expected deformations caused by seismic forces. The stress analysis of cantilever columns shall use a buckling factor of 2.1 for the direction normal to the axis of the beam.

Ties, continuity and collectors. All parts of the structure included in the scope of analysis shall be interconnected and the connection shall be capable of resisting the seismic force created by the parts being connected as required per the Los Angeles Building Code.

VI. REQUIRED INFORMATION ON PLANS

General. For existing and new construction, the plans and specifications shall be of sufficient clarity to indicate the nature, design methodology, and extent of the proposed work and to show in detail that it will conform to the provisions of this

Ordinance and the Los Angeles Building Code.

Engineer's or architect's statement. The responsible engineer or architect shall provide the following statements on the approved plans:

1. "I am responsible for designing this building's seismic strengthening in compliance with the minimum regulations of the mandatory Wood

Section 3
Building Your Plan

What You Can Do in Your City

Complete this questionnaire as specifically as possible keeping in mind your jurisdiction.

1. Based on the previous worksheets, what seismic issue are you planning to address?

2. What are the mitigation actions you plan to take (implementing a policy or program, a directive to staff, etc.)? Be specific.

   a.

   b.

   c.

3. Who is affected by these actions?

   a.

   b.

   c.

4. Who would be supportive? Who would be opposed?

   Supportive:

   Opposed:

5. What's at risk by not acting?

How to Build Your City-Wide Resilience Team

GOAL: To build a cross-discipline team, also known as a public-private partnership, consisting of representatives at all levels of the community that will work together with you on resilience initiatives

You may be a veteran or new to seismic safety, but it is important to understand you are not alone. There are others within and outside of your agency, including outside of your city boundaries, that would not only be great partners but are also willing to participate in creating solutions to make the community safer. Government alone cannot solve these issues, as they are too great. Collectively and collaboratively the approaches to address your city's risk are at your fingertips. Partners just need to be invited to join your initiative. Together you can choose areas of focus and how to solve them.

Who are your local partners?

The only way to not be successful here is to not cast a wide enough net. Be open to why and how individuals, or organizations, want to join your team. Do not allow your perceptions or beliefs about potential partners limit what they can really to do help make your community safer. Invite motivated representatives who are interested in working collaboratively and willing to "roll up their sleeves" especially as some of what you are trying to address will take some time to accomplish. Partners should also be representative of the full fabric of your community.

Potential Partners: (Consider what resources each of these representatives, or their organizations, would bring to the table)

- Government: local, regional, state, regional, federal
- Businesses
- Chambers, associations and trade groups
- Scientists, subject matter and technical experts
- Non-profit organizations
- Universities and colleges
- Community/Civic groups
- Faith-based organizations
- Neighborhoods
- Academicians
- Researchers
- Educators and trainers
- Media
- Others

How can your team members/partners help your seismic safety effort?

These people, and/or their organizations, are the "worker bees" to establish and accomplish significant elements of your seismic safety initiative. Under your leadership, and the guidance of a chair to focus on the step-by-step tasks, your team of motivated subject matter experts and interested stakeholders will enable you and your city to create tangible measurable results in areas not yet addressed. You will work together and engage critical connections that will further specific programmatic areas. For example, a building official on your team may engage engineers and architects in a sub-committee to develop prescriptive plan sets for residential retrofit in order to streamline quality control and ease compliance - this may not have been an initial goal of your efforts but becomes a key element to address one that was. If established well, your team and all your partners will be the stepping stones to achieving your community's overall resilience.

What resources or solutions do partners bring to this effort?

The most invaluable resources provided by partners are their: time, expertise, access or connections to others, and sometimes funds, which may be direct, in-kind, or both. All of these are essential contributions. However, initiatives can flounder or fail by not recognizing the great value of non-monetary donations to the effort. Also, how or what partners contribute may be very different than what one may expect - it essential to not limit partners so they can determine what makes the most sense for them and their organization. For example, your city might see an insurance company's involvement would include something insurance-specific, when how they can contribute is to provide a free community meeting space for events, providing in-kind materials for the initiative made in their print-shop, etc. Contributions of all types will need to be relevant to the initiative which will be guided by the team, especially the chair. In the end, you will have a collective, collaborative team working towards shared goals of your seismic safety initiative.

Steps to Build Your Team

1. Determine a pool of key stakeholders to bring together
2. Create a small leadership team to get started identifying potential partners to join the effort
3. Invite key stakeholders to the table for a kick-off meeting to discuss your initiative. Make sure all sectors and levels are represented to get good representation of the community, fostering grassroots participation
4. Conduct your first meeting to get to know the potential partners, as well as who is missing, and discuss with them in what areas they want to focus the initiative (e.g. residences, schools, codes, infrastructure)
5. Encourage partners to suggest possible programs, then vote on desired priorities
6. Guide the process by choosing a person to chair the partnership (can be from any sector, including someone from the city, that works well with partners, is collaborative, a good communicator, and can manage projects well)
7. Organize the initiative into program(s) or committees where partners can focus their participation
8. Determine goals, objectives, and timelines for the initiatives and individual programs
9. Schedule regular meetings to accomplish goals on the timeline
10. Set benchmarks and celebrate milestones
11. Recognize partners for the efforts, commitment, participation, contributions, and successes
12. Invite new partners to foster the development of new ideas and energy, which can help keep interest and momentum moving forward
13. Institutionalize the initiative and partnership to continue good work for long-term success

You can call this group of people your team, partnership, steering committee, etc. What you call it is not as important as your commitment to support their efforts with staff time and expertise as well as to help make their developed programs public, so they can be used widely to protect lives.

How to Engage Your City-Wide Resilience Team

In order to address seismic safety issues in your community, it is recommended to engage a city-wide resilience team to facilitate the process and achieve results. This public-private partnership needs to represent the full fabric of the community, at all levels, and include individuals and organizations interested in developing solutions to address the earthquake hazard.

The way to engage committed people is to develop an initiative that they can: 1) be inspired to be a part of, 2) have their time and contributions be respected and appreciated, 3) make a difference, save lives, and 4) also meet at least one need of their own organization.

As public sector officials for your city, how do you engage members to join your team? Here are a few steps to get you started:

1. First, decide that you want to accomplish the goal of making your city more resilient
2. Create a small leadership team of three to four people who are interested in the subject, have cross-sector connections, and who can help identify stakeholders in the community. Don't limit invitees to only those in your jurisdiction as some expertise, interest, and resources can come from outside
3. Meet with your leadership team to accomplish two items:
    - Share your high-level approach or vision and get their buy-in and feedback
    - Develop a list of types of partners (e.g. business, non-profit) and list names of potential people. If you do not know names yet, then list the organizations that make the most sense or would be good strategic partners. Have more than one name per type of partner, especially where you plan to have more than one organization represented, such as businesses
4. Set a date to hold your first city-wide resilience team meeting
5. Have your leadership team begin inviting potential members to the 1st meeting
    - Share the high-level approach or vision
    - Gage their interest
    - Get them to agree to attend the meeting, or send a representative if they are unavailable
6. Plan meeting agenda and logistics
    - Meeting should be set up with everyone around a central table, facing each other, and foster interaction between attendees
    - Agenda should begin with introductions of each attendee, cover the hazard, any necessary history, your high-level approach, and program ideas discussion. Have a scientist or technical expert available to answer specific hazard questions so partners fully understand why this is so important
    - Share some basic goals and objectives you'd like your team to accomplish, discuss with attendees to refine (but not necessarily finalize yet)

- Encourage attendees to discuss how or in what areas they want to address the earthquake risk in your community. Maintain environment as a respectful, brainstorming discussion. Staff should take detailed notes and list each idea on a flip chart pad
- Review each idea to make sure it represents the concepts correctly
- After all the ideas have been documented, post the flip chart sheets around the room and give each attendee 5 or so stickers to vote for those ideas of interest. You can even have 1 specific sticker that is worth more points (2 or 5 pts)
- Invite all attendees to go around the room and place their stickers on the ideas they would most like work on and support
- Tally results and share the top 5-8 ideas
- Set date for next meeting, as a recurring monthly event to get on everyone's calendars

7. Recruit new potential members based on progress to date and fill any gaps
8. Hold 2nd meeting
   - Introductions around the room
   - Start each meeting reviewing goals of the city-wide resilience team. Refine if needed to get full agreement
   - Review 5-8 program ideas. Discuss each one. Prioritize them by importance, impact, and time to accomplish. Consider for this first group of programs to pick one that has "low hanging fruit" as you want to show what the team can accomplish, plus you want to foster enthusiasm for and on your team.
   - Decide on your top 3
9. Continue reaching out to partners, especially to fill any gaps for your top 3 program ideas
10. Hold 3rd meeting
    - Introductions around the room
    - Start each meeting reviewing goals of the city-wide resilience team. Refine if needed to get full agreement
    - Review 3 program ideas and select a chair, or co-chairs, for each
    - Ask each team member to select which of the 3 program(s) they want to work on
    - Have chairs now take leadership to begin holding committee meetings separate from the city-wide resilience team meetings where they will provide progress updates
11. Maintain and institutionalize team and programs
12. Laud team members who go above and beyond. Recognize partner contributions to the initiative (verbally, online, publically) and celebrate milestones
13. Educate the public on the programs and available resources
14. Document progress and share successes

EARTHQUAKE PREPAREDNESS INITIATIVE

Prepared by the Dr. Lucy Jones Center for Science and Society

Timeline for Next Steps

Task #	Description	Person Responsible	Due Date

Notes

Notes

Notes

Notes

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Additional updates on the workshop and
presentations from previous seminars are available at:
http://www.scag.ca.gov/programs/Pages/EarthquakeInitiative.aspx

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