



# Hazard Specific Annex 2: Earthquake

County of Riverside  
Riverside County Operational Area (OA)



2024 Update  
County of Riverside  
Emergency Management Department

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# Riverside County EOP Hazard Specific Annex #2: *Earthquake*

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## 1. Purpose

The County of Riverside Earthquake Hazard Specific Annex to the Emergency Operations Plan (EOP) provides an overview of considerations for County response to a major earthquake in the County of Riverside's Operational Area (OA). The primary purpose of this plan is to support effective management of the initial response to a significant earthquake and the subsequent hazards and threats that may occur because of the earthquake, such as fires and dam failure.

## 2. Situation and Assumptions

As demonstrated by past earthquake events, Riverside County and the surrounding region are subject to major earthquakes, such as the 1954 6.4 (Mw) San Jacinto Fault (Arroyo Salada) earthquake, 1948 6.0 (Mw) Desert Hot Springs earthquake, 1918 6.8 (Mw) San Jacinto Fault earthquake and the 1910 6.0 Lake Elsinore earthquake. The largest earthquake within 30 miles of Riverside, CA was a 5.7 magnitude in 1990. **Table 1** shows the hazard analysis for earthquakes, as profiled in **Section 2** of the EOP.

**Table 1: Earthquake Hazard Analysis**

Frequency	Warning Lead Times	Consequences	Population, Area at Risk
High (Annual)	Minutes/none	High (Moderate to high county-wide impact. May require state or federal assistance)	High

Earthquakes result from the release of seismic energy and shifting of rock layers beneath the surface that generally create a shaking motion at the surface. These events are largely unpredictable, providing little to no advance warning, and vary in intensity and duration. Each year, thousands of small, indiscernible earthquakes occur in and around Riverside County. Riverside County has a very high earthquake risk, with a total of 22,385 earthquakes since 1931. The United States Geological Survey (USGS) database shows that there is a 99.47% chance of a major earthquake within 30 miles, within the next 50 years.

Magnitude is the most common measure of an earthquake's size. Magnitude measures the energy released at the source of the earthquake. Intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined from effects on people, human structures, and the natural environment. The Richter scale is a standard scale used to measure the magnitude of earthquakes while the Modified Mercalli Intensity Scale is used to measure the intensity of an earthquake. **Table 2** and **Table 3**



describe how earthquakes are measured. Southwest Riverside County, in particular, is subject to great risk because it lies on the Elsinore Fault and the San Jacinto fault, near the San Andreas fault. USGS scientists have theorized that because the San Andreas fault runs through Riverside County, and parallels other faults like the San Jacinto and Lake Elsinore faults, it may be the state's most dangerous fault for two reasons:

- The San Andreas fault is the longest fault in California that can cause powerful earthquakes—as big as magnitude 8. A large part of the region's population lives within 50 miles of the San Andreas fault and could be exposed to very strong levels of ground shaking in a major earthquake.
- Many other faults, such as the San Jacinto fault, create smaller, yet more frequent earthquakes. Soils in lowland areas away from major faults may be subject to liquefaction. Houses on liquefied soil may settle or even move laterally on gentle slopes. Landslides are possible on steep hillsides.

The **Richter scale** measures the magnitude of an earthquake at the source. It is a logarithmic scale, meaning that the numbers on the scale measure factors of 10. So, for example, an earthquake that measures 4.0 on the Richter scale is 10 times larger than one that measures 3.0. On the Richter scale, anything below 2.0 is undetectable to a normal person and is called a microquake. Moderate earthquakes measure less than 6.0 on the Richter scale. Earthquakes measuring more than 6.0 can cause significant damage. The maximum quake rating ever measured is about 8.9.

The **Modified Mercalli Intensity Scale** uses Roman Numerals from I to XII to describe different earthquake effects.

**Table 2: Modified Mercalli Intensity Scale**

Abbreviated Modified Mercalli Intensity Scale	
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on the upper floors of buildings.
V	Felt by nearly everyone; many awakened. Some dishes and windows are broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, considerable damage in poorly built or badly designed structures, and some chimneys broken.
VIII	Damage is slight in specially-designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage is great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.



<b>X</b>	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
<b>XI</b>	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
<b>XIII</b>	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

The following table gives intensities of different magnitudes that are typically observed near the epicenter of earthquakes.

**Table 3: Magnitude / Intensity Comparison**

<b>Magnitude</b>	<b>Typical Maximum Modified Mercalli Intensity</b>
1.0 - 3.0	I
3.0 - 3.9	II – III
4.0 - 4.9	IV – V
5.0 - 5.9	VI – VII
6.0 - 6.9	VII – IX
7.0 and higher	VIII or higher

Urban areas stand to suffer the greatest amount of damage as population and infrastructure density is higher than that of a rural area. Earthquakes often cause cascading effects such as landslides, utility interruption, hazardous materials releases, dam failure, transportation infrastructure interruption, and fires.

## 2.1 Assumptions

### 2.2 General Planning Assumptions

Refer to the County of Riverside EOP for overarching emergency management assumptions. In addition, the following assumptions have been used to develop this annex:

- The Earthquake Annex to the EOP is based on a “no-notice” catastrophic earthquake.
- Aftershocks will occur following an earthquake and can potentially be as large if not larger than the initial quake. Aftershocks are known to occur for many months past the initial earthquake.
  - The cumulative impact of large aftershocks may cause additional structural damage and necessitate additional safety assessment inspections (for aftershocks over 5.0).



- Residents may be afraid to stay indoors because of the potential for aftershocks.
- The initial earthquake and/or aftershocks may trigger secondary disasters such as fires or dam/levee breaches that may cause significant damage and potentially compromise the safety of response and recovery personnel or degrade the response effort.
- A major earthquake in Riverside County may result in a presidential disaster declaration.
- Within 24 hours after a catastrophic earthquake, the following actions may occur:
  - The County may proclaim a local emergency.
  - The Governor may proclaim a state of emergency and request a presidential declaration.
  - The President may declare a disaster, and the federal government may implement the National Response Framework (NRF).
- Neighboring jurisdictions may suffer the same effects of a catastrophic earthquake and resources might be scarce.
- State and federal assistance might be required to carry out response and short-term recovery efforts to save lives, reduce human suffering, and reduce damage to property. These resources may take longer to arrive than anticipated due to shortages and inability to access the area.
- Normal means of communication, transportation, and infrastructure capability may be severely disrupted in areas within and beyond a catastrophic earthquake's immediate affected area(s).
- Damage to County of Riverside government facilities, such as the Emergency Operations Center (EOC), Department Operations Centers (DOCs), and fire and police stations, may require alternative arrangements for the management of response services.
- Planning for recovery must be immediate. A recovery structure must be implemented to begin coordinating issues of community recovery, business recovery, re-establishing government services, and transition to interim and long-term housing solutions. The Long-Term Recovery Support Annex will serve as a guide for making decisions regarding the recovery structure based on the situation and needs.

### **2.3 Earthquake Impact Assumptions**

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The following assumptions on the effects of an earthquake provide responders with an understanding of the type of preparedness, response, recovery, and mitigation actions that they should implement.

- Many of Riverside County's housing units, mostly apartments and condos, will become uninhabitable. Damage due to shaking will be severe.
  - Structural damage is likely to be worse in areas of soft soils or unconsolidated fill.
  - Thousands of buildings will experience total structural failure.
  - Nonstructural damage will be widespread and cause several buildings to be



unusable even if the structure is deemed sound.

- Thousands of residents, tourists, and commuters may become trapped within the county due to transportation system failure and might require shelter because their dwellings are damaged.
- Depending on the magnitude of the earthquake, hundreds of people may be trapped in collapsed structures.
- Thousands of injuries and deaths may occur. If the earthquake occurs during midday, the number of casualties will likely be greater as the working population is affected.
- Local medical facilities may be damaged. Surviving hospital capacity may be inadequate to treat casualties and other medical emergencies, requiring that some severely injured patients be relocated outside the area
- The earthquake may cause immediate, simultaneous ignitions. Structure fires might ignite throughout the county. Fires may continue to ignite as power is restored, a process that could take several weeks.
- Disruption of vital services such as water, sewer, power, gas, and transportation may occur.
  - Water shortages can become a significant limiting factor for hospitals, jails, and 24-hour care facilities and the general public.
  - Public telephone systems, including wireless systems, may be damaged or overloaded and may take weeks to restore.
- Fatalities may occur in the first 48 hours, but recovery of those buried in debris may continue for weeks.
- Major transportation facilities and systems may be damaged or disrupted and take months or longer to repair. This includes:
  - Major bridges and highways
  - Mass transit systems
  - Airports
  - County/City streets and roads
- A major earthquake will generate debris. Collapsed buildings and other structures may block roads and limit movement for evacuees, response personnel, and vehicles.
- Assistance in the form of convergent volunteers, equipment, materials, and money will continue to flow to the Operational Area (OA), providing urgently needed resources but creating coordination and logistical support challenges.

### 3. Resource Request

Regardless of preparation, the County of Riverside may experience shortages of critical resources necessary to respond to the earthquake. A major earthquake will overwhelm local, operational area, and regional resources. The following are anticipated resource shortages that may be available through the mutual aid system, the state and federal



governments, or the private sector. The County might submit resource requests for these capabilities immediately following a major earthquake.

Personnel	<ul style="list-style-type: none"><li>▪ Teams to support firefighting operations and search and rescue (SAR)</li><li>▪ Law enforcement resources for security</li><li>▪ Medical health professionals, disaster medical assistance teams (DMATs), and National Disaster Medical System (NDMS) resources</li><li>▪ Mental health professionals and counselors</li><li>▪ Building inspectors</li><li>▪ Qualified emergency managers and other staff to support EOC and DOC operations</li><li>▪ Public Information Officers (PIOs)</li><li>▪ Interpreters and translators</li><li>▪ Structural and civil engineers</li><li>▪ Utility restoration teams (power, gas, water, sewer)</li><li>▪ Communication restoration teams (satellite, cellular, wired, voice/data/video)</li></ul>
Services and Transportation	<ul style="list-style-type: none"><li>▪ Vehicles to move first responders, evacuees, and displaced residents</li><li>▪ Vehicles to move the injured and medically fragile</li><li>▪ Air assets for reconnaissance and medical transport</li><li>▪ Additional shelter space outside of the county</li></ul>
Equipment, Supplies, and Commodities	<ul style="list-style-type: none"><li>▪ Bedding, food, water, generators, medical supplies, sanitation supplies, and security for shelters</li><li>▪ Heavy equipment and operators for emergency shoring and debris removal, reduction, transport, and disposal</li><li>▪ Equipment, staff, and supplies for handling fatalities, such as Disaster Mortuary Operational Response Teams (DMORTs) and portable morgue units</li><li>▪ Water, food, supplies, sanitation facilities, and generators to support emergency operations and to support residents</li><li>▪ Fuel</li></ul>





## 4. Concept Of Operations (ConOps)

The County of Riverside's emergency response system is described in the County's EOP. As with any other type of disaster, the County of Riverside will respond in accordance with the Standardized Emergency Management System (SEMS), the National Incident Management System (NIMS), and the Incident Command System (ICS). These key operational concepts can be found in the EOP.

### 4.1 Operational Priorities

The operational priorities as outlined in the EOP will apply. The following response priorities listed below are specifically relevant to an earthquake scenario:

- Damage in high-rise buildings will generate the need to respond to fires on upper floors, people trapped in elevators, people requiring additional or differently delivered evacuation assistance, and injuries in high-rise buildings caused by falling glass and other debris
- It will be necessary to assess and remove debris from critical transportation routes, buildings, and facilities to allow emergency response operations to occur safely
- The priorities for route recovery, including debris clearance of routes, should be as follows:
  - Evacuation routes
  - Routes between the worst impacted areas to operating hospitals and casualty collection points
  - Routes between the worst impacted areas and CalFire Riverside County, response operations
  - Routes that link staging areas for mutual aid resources (including routes to airports and to support other jurisdictional response activities)
  - Routes necessary to allow movement of County of Riverside Transportation Land Management Agency (TLMA) field units to get to their DOC, staging areas, yards, and main shops
- Restoration of Critical Infrastructure (in order of priority):
  - Power Restoration
  - Potable water
  - Wastewater treatment facilities and equipment
  - Telecommunications
- It will be necessary to assess thousands of public and private buildings to determine whether they are safe and to assess requirements for repair
- Reassessment may be needed following aftershocks with a magnitude greater than 5.0
- Resources for debris removal and sanitation will initially be limited as the County mobilizes its own forces and available contractors



- Assessment, debris removal, and sanitation clean up should be conducted in the priority set by the EOC
- Work with the Riverside County Operational Area/ Riverside County Medical Health Operational Area Coordinator (MHOAC) Program to establish casualty collection points for on-scene treatment based on the location of:
  - Concentrations of injured
  - Operational status of local hospitals
  - Available sites and transportation routes
- Work with the Riverside County Medical Health Operational Area Coordinator (MHOAC) Program so they may work with the Regional Disaster Medical Health Coordinators (RDMHS) to implement a plan for regional treatment of mass casualties, including but not limited to:
  - Regionally available resources for treatment
  - Deployment of NDMS assets and DMATs
  - Priorities for evacuation
  - Transportation resources

#### 4.2 Initial Response Actions (First 72 Hours)

In accordance with the County’s operational priorities – life-safety and addressing human needs – the table below shows the initial response objectives for the County following a large earthquake:

Time	Response Actions
<b>First 4 hours</b>	Respond to the immediate known effects of the earthquake: <ul style="list-style-type: none"> <li>• First responders may assist with immediate life-saving rescue operations</li> <li>• Fire crews may focus on fire suppression for existing structure fires and anticipate fire spread based on conditions and historical precedent</li> <li>• Law enforcement may deploy resources to support response activities and maintain law and order</li> <li>• Emergency medical services may be dispatched to major incidents</li> <li>• Casualty collection points may be needed for initial treatment of the injured</li> <li>• Identify potential sites for evacuation centers to accommodate displaced populations while emergency shelters are being opened</li> </ul>



Time	Response Actions
	Send Alert and Warning messaging for evacuations, if warranted, and prepare for accessible transportation of individuals requiring additional or differently delivered evacuation assistance
	Initiate activities to activate and staff the EOC
	Obtain situational awareness of: <ul style="list-style-type: none"> <li>• Situation at critical facilities, including DOCs and cities</li> <li>• Situation in unincorporated areas where damage reporting might not be escalated to the County</li> <li>• Condition of emergency communications systems</li> </ul>
	Begin gathering initial damage assessments of the OA, identifying areas affected, major incidents, and operational status of critical services
	Create a consolidated situation assessment and proclaim a state of emergency
	Recall essential personnel
	Begin public information messaging regarding recommended personal protective actions, safe congregation points, and community assistance needed
<b>First 12 Hours</b>	Assemble resources for sustained response and for providing basic services to the community
	Assess critical resource shortfalls, and if needed, begin requesting support through mutual aid and the Operational Area <ul style="list-style-type: none"> <li>• Consider a 14-day period; assess the transportation system's condition and develop alternatives for moving critical resources into the county</li> </ul>
	Ensure security is functional at critical facilities
	Assess conditions at designated emergency care and reception sites, supply beds, water, food, medical support, generators, sanitation, and facility security, and open the locations to residents and Disaster Service Workers (DSWs)
	Open evacuation centers, if needed
	Identify people with special support requirements, including individuals in the community who may require specialty care facilities
	Designate primary routes and implement debris clearance, route recovery, and traffic control
MHOAC to obtain hospital status from the county's operational area. <ul style="list-style-type: none"> <li>• Monitor and address identified issues regarding patient load balancing between hospitals and the related patient transport system challenges</li> </ul>	



Time	Response Actions
	Assess the need to activate a Joint Information Center (JIC)
<b>Through 24 hours</b>	Consolidate systems for sustaining emergency response operations
	Concentrate the County’s emergency management efforts on supporting ongoing on-scene incident management at major incidents, reinforcing the logistical support being requested.
	Commit resources to support public safety by assisting incoming employees and gathering/distributing convergent resources from less-affected parts of the region and out-of-area state and federal resources
	Designate staging areas and begin planning to accommodate support personnel
	Ensure that an adequate system is in place to fuel and maintain generators providing power to critical facilities
	Coordinate with the OA to establish temporary morgues and support Riverside Sheriff Coroner with the process of decedent affairs, as needed
	Conduct outreach for situation status and resource needs for affected cities, including healthcare facilities, special districts, school districts, transit sites, educational centers, commercial buildings, and sites of historic/cultural significance

### 4.3 Sustained Operations

As the third 24-hour period concludes, the EOC should be supporting three primary areas of operation:

- Ongoing rescue operations and other emergency measures
- Transitioning near-complete response efforts to sustained emergency operations, typically addressing remaining earthquake effects that do not require public safety technical skills
- Preparing for ongoing major recovery efforts focusing on restoration of services

EOC activities for Days 3 through 7 are outlined below. Some of these objectives may occur immediately or in phases; objectives must be identified and prioritized based on the overall need and resources available to respond.



Time	Response Actions
<b>Days 3 - 7</b>	Establish safety assessment task force teams to assess widespread damages to public infrastructure, such as public right-of-way (roads and sidewalks), bridges, tunnels, and retaining walls.
	Establish assessment teams to visit shelters to identify any individuals who require additional support and may need to be relocated to care facilities. This team serves to identify any needed site modifications to accommodate the whole community.
	Evaluate locations for deploying relief supply and food distribution points, such as Commodity Points of Distribution (C-PODs), other than the evacuation centers/shelters.
	Establish a responder mental health support program.
	Establish portable toilet sanitation stations around the county and related cleaning and pumping programs.
	Work with the Riverside County Voluntary Organizations Active in Disaster (VOAD), and other organizations to provide information to support the whole community.
	Begin widespread safety/damage inspections of homes and businesses.
	Produce, regularly update, and distribute a disaster “Fact Sheet” to the media, people in shelters, field response personnel, and residents.
	Evaluate the need to designate specific routes into the county for critical relief supplies. Designating specific lanes for express bus service should also be considered.
	Implement phase re-entry (where safe) for recovery of personal items and mental health counseling for people whose homes have been red tagged.
	Implement public information phone bank operations.

During a major earthquake all emergency support functions will be critical and will be supported by established Emergency Support Functions (ESFs) annexes to the EOP.

## 5. References

The following agreements, procedures, plans, and guidelines apply to the execution of the Earthquake Annex, in addition to references listed in the EOP and ESFs associated with this Annex:

- a. County of Riverside Emergency Operations Plan
- b. County of Riverside ESF Annex