## Western Australia

# Earthquake Preparedness Guide

**How ready is your family and property?**

GOVERNMENT OF WESTERN AUSTRALIA
DFES Department of Fire & Emergency Services
Australian Government Geoscience Australia
Geological Survey of Western Australia

This guide was produced as a part of the Earthquake Community Awareness project 2021-2023. This project acknowledges the funding contribution of the Commonwealth Government of Australia and support from the WA State Emergency Management Committee.

Cover page: Extensive damage to a commercial property during the magnitude 6.5 Meckering  earthquake in 1968 (Photo source: State Library of Western Australia).

# CONTENTS

# Do earthquakes happen in WA?

**Each year, nearly half of Australia's earthquakes occur in Western Australia.**

**Unpredictable in nature, earthquakes are natural hazards that have the potential to devastate communities. More common in WA than you may think, when they occur close to the built environment, they can impact communities in a number of different ways, including:**

- Structural collapse due to non-earthquake-resistant construction or poor maintenance.
- Damage or collapse of verandahs, parapets, chimneys, and roofs.
- Fires caused by ruptured gas lines or fallen power lines.
- Damage to communication and essential services infrastructure and road networks.
- Damage to critical infrastructure such as power, water and sewage networks.
- Coastal impacts due to earthquake-generated tsunamis.
- Landslides and rockfalls on hill-slopes and road cuttings.
- Structural collapse due to construction in vulnerable areas such as alluvial soils, reclaimed land, and water saturated sands and silts.
- Injuries and loss of life.
- Displacement from home due to damage to property and basic services.
- Isolation of communities due to damage to critical infrastructure.
- Loss of employment and income due to community disruption and building damage.
- Long-term mental health impacts and trauma.

Luckily, the impacts of an earthquake can be reduced with the right preparation and planning. That involves a structural assessment by a professional builder, appropriate mitigation measures and knowledge of what to do in an earthquake.

You can find more resources at dfes.wa.gov.au.





## Meckering 1968

Meckering's magnitude 6.5 earthquake is the most damaging ever recorded in WA and was felt throughout the state's southern half. The earthquake caused extensive damage in Meckering, York, and Northam, with lesser impacts felt in the Perth Metropolitan area. The estimated cost of the damage surpassed $1.5 million in 1968, which would be equivalent to $60 million today. The very shallow hypocentre formed a 37-km-long fault scarp with a vertical ground displacement of up to 2-metres still recognisable today.

Extensive damage was caused to the Meckering Township, resulting in injuries to the community and the loss of most of its historic buildings (Figure 1). The railway buckled, and massive cracks appeared on the highway, while the town's water source, the Golden Pipeline, and communication lines with the Eastern States were rendered unusable. A newspaper report described some of the impacts in and around the community: "Seventeen people from Meckering and three people from York, with injuries ranging from broken legs to concussion, cuts, bruises, and shock, were admitted to hospitals at Cunderdin, York, and Perth. At York, 40km from Meckering, three people were injured when the balcony of the two-storey Imperial Hotel collapsed in the town's main street. In Perth, buildings cracked walls, and ceilings collapsed amid a deep rumbling pierced by the crashing of plate glass."

**Can you imagine what could happen if a 6.5 magnitude earthquake occurred in WA today?**


*Figure 1: Damage resulting from the 1968 magnitude 6.5 Meckering earthquake. Damage to the Meckering Town Hall (photo to the left: State Library of Western Australia); McDonald Building at the corner of Barrack and Murray St, Perth CBD (photo at the centre: © WEST AUSTRALIAN NEWSPAPERS LIMITED); and rail lines bent due to deformation of the ground surface (photo to the right: Johnston and White, 2018).*

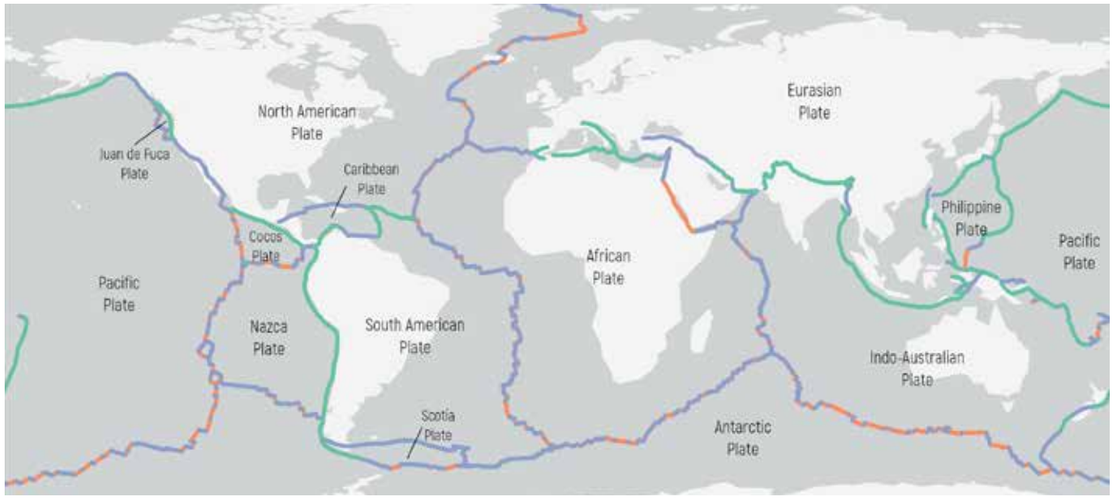
# Understanding earthquakes

## Plate tectonics and earthquakes

### What is an earthquake and what causes it?

Earthquakes occur when fault planes within the Earth's crust move, releasing energy, causing the ground to shake.

The Earth's crust is the solid outermost layer of the Earth, which is comprised of large, fractured pieces referred to as "tectonic plates" (Figure 2). These plates can move apart, generating new crust (divergent boundaries), slide against each other (transform boundaries), or collide with other plates (convergent boundaries or subduction zones). When pressure builds up between boundaries, they can suddenly give way, generating seismic waves that travel long distances through the Earth's crust. These waves are perceived as earthquakes.




- Divergent boundary where the plates move apart, generating new crust
- Transform boundary where plates slide past each other
- Convergent boundary where plates collide with other plates

*Figure 2: The Earth's crust is composed of pieces called tectonic plates. Australia is located away from plate tectonic boundaries, in the middle of the Indo-Australian Plate, in an area known as the intraplate tectonic setting. (Tectonic plate boundaries modified from usgs.gov/programs/earthquake-hazards/google-earthtmkml-files)*





## Cadoux 1979

The 1979 magnitude 6.1 earthquake near Cadoux is the second-most damaging earthquake in WA's recorded history. The earthquake was felt extensively across the southwest part of WA, and caused damage all the way through to the Perth Metropolitan area and Rottnest Island.

As a result of the earthquake, a 15-km-long fault scarp formed with up to 1.4-metre vertical ground displacement. One person was injured, approximately 32 houses in Cadoux were damaged or destroyed, and roads, railways, pipes and power lines were affected over a 400 km$^2$ area. Further damage was reported in Perth, and a mercury spillage occurred at the Rottnest Island lighthouse. The damage estimated reached $3.5 million at the time, equivalent to $41.5 million today.

This area continued to be seismically active after the main earthquake, accounting for 231 of the 326 quakes measured in WA in 1979 and 77 of the 160 measured in 1980.

*Figure 3: House damaged during the Cadoux earthquake in 1970. Photo source: © WEST AUSTRALIAN NEWSPAPERS LIMITED.*

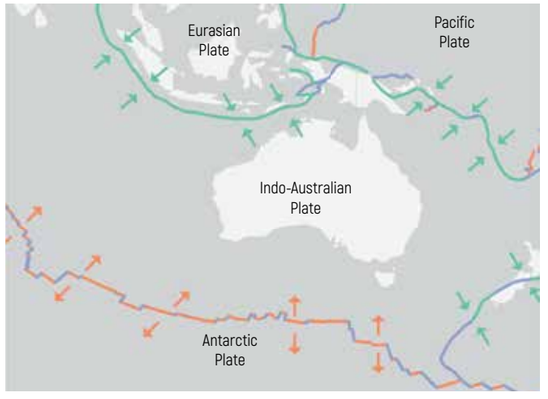



*Figure 4: Australia is part of the Indo-Australian Tectonic Plate, located in what is called the intraplate setting. Earthquakes in Australia are caused by stresses built up on distant active margins.*

Most earthquakes in the world happen around active tectonic plate margins. However, Australia sits in the middle of the Indo-Australian tectonic plate (Figure 4).

Large earthquakes are relatively rare in such "intraplate" locations compared to active boundaries. Even so, monitoring records show that an average of 100 intraplate earthquakes of magnitude 3.0 and above are recorded in Australia each year. Potentially damaging magnitude 5.0 earthquakes occur once per year, and a magnitude 6.0 or above is expected every ten-years.

Fault scarps and folds mark the positions of large pre-historical earthquakes in the landscape and show that potentially damaging, extremely infrequent events are possible anywhere within Australia.

It is estimated that a magnitude 6.0 or greater event can produce a 2-metre high fault scarp; hence, it is possible to estimate the magnitude of pre-historical events.

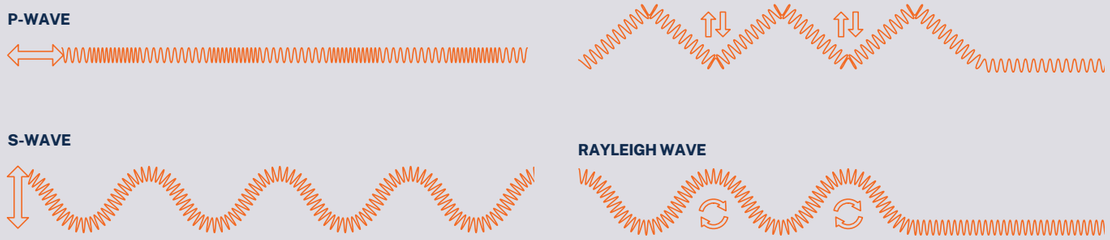
The damage caused by intraplate earthquakes can affect larger areas than those on active margins. Several studies have shown that seismic energy propagates more efficiently through cold, relatively homogeneous continental crust such as that which makes up much of Australia.

The intraplate nature of Australian earthquakes also presents challenges for both the community and emergency services. Due to the unpredictability of Australian earthquakes and the fact that they don't follow easily identifiable patterns, preparedness and emergency planning become incredibly difficult. The general lack of community awareness and preparedness can be attributed to the fact that earthquakes are relatively rare occurrences.

## Seismic Waves

During an earthquake, ground shaking caused by the interaction between blocks of rock on each side of a geologic fault generates seismic waves that travel away from the area of fault movement. While several types of seismic waves exist, the two more important types are the body and surface waves:

- Body waves can travel through the Earth's inner layers. These are composed of the P-waves (a compressional wave) and the S-waves (a shear wave).
- Surface waves (like Love or Rayleigh waves) move along the Earth's surface, much like ripples on water.




The P-wave is faster than the S-wave and is the first signal recognised by seismographs and, sometimes, people. The P-waves movement compresses the ground back and forward in the same direction as the wave. Unlike S-waves, P-waves are not usually linked to impacts on the built environment.

S-waves have a shear component in their movement that shakes the ground in a direction perpendicular to the wave's movement. These waves have a larger amplitude than P-waves and are consequently more destructive, often impacting buildings and critical infrastructure.

Surface waves travel more slowly across the Earth, even slower than S-waves, and are easily distinguished on a seismograph. These waves have a much larger wave amplitude and are often the most destructive type of seismic wave.





## Australian National Seismic Hazard Assessment

The 2018 National Seismic Hazard Assessment (also known as NSHA18), developed by Geoscience Australia (GA), is the most recent assessment of earthquake hazard in Australia. Figure 5 shows a map of peak ground acceleration (PGA, as a proportion of the acceleration due to gravity, or 'g') with a ten per cent probability of being exceeded in the next 50 years. Engineers use this assessment to identify areas more prone to damaging ground shaking, which helps to ensure buildings and infrastructure are built appropriately. The hazard map also helps identify communities that would benefit from hazard awareness education.

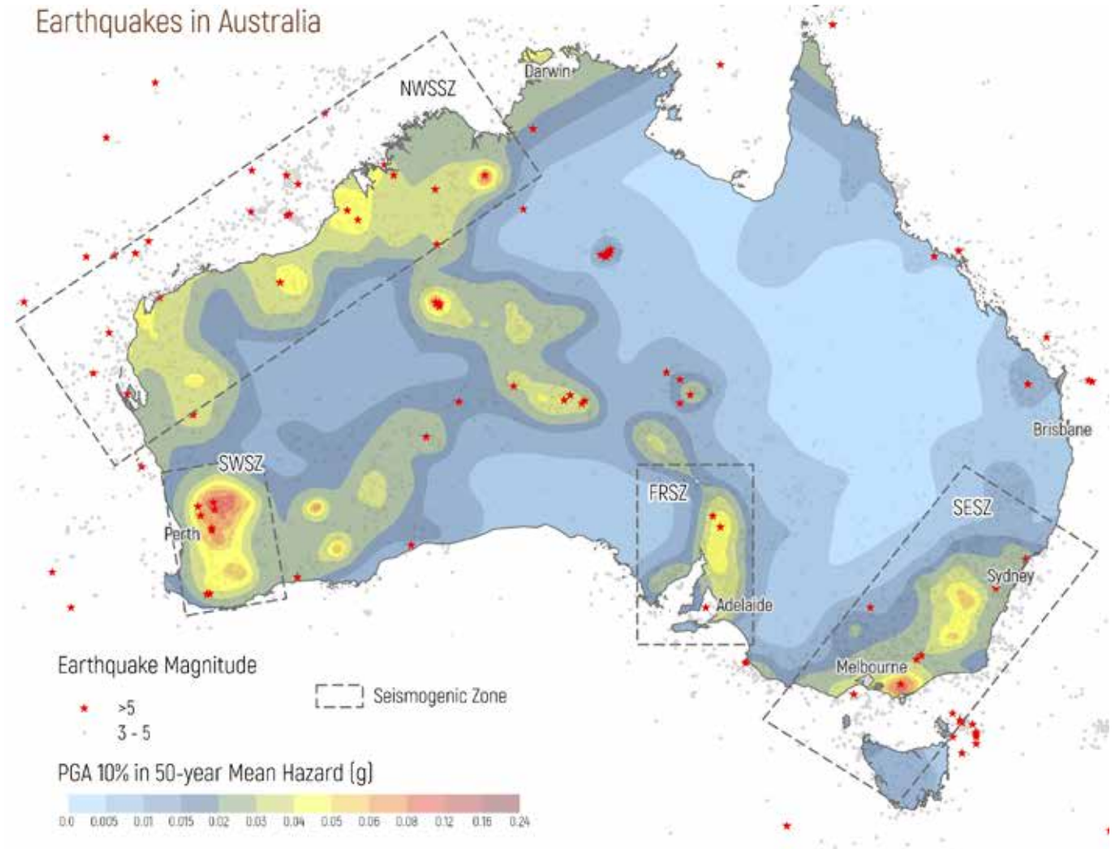



*Figure 5: Seismic overview and hazard levels in Australia. The colour scale represents Australia's National Seismic Hazard Assessments (NSHA18). Warmer colours indicate a higher calculated seismic hazard. Concentrations of historical earthquakes define four seismogenic zones in Australia. These are the Northwest Shelf Seismic Zone (NWSSZ) and the Southwest Seismic Zone (SWSZ) in Western Australia; the Flinders Ranges Seismic Zone (FRSZ) in South Australia; and the Southeast Seismic Zone (SESZ) in New South Wales-Victoria.*

# Measuring earthquakes

The size of earthquakes can range from barely noticeable tremors to violent shocks, with some lasting only a few seconds while others several minutes. Different measurement scales are used to classify an earthquake from a seismic or impact perspective:

## Magnitude (ML, Mw, M)

Magnitude is the measure of the energy released at the source of an earthquake, and it is determined from measurements recorded on seismographs. There is only one magnitude value per earthquake event corresponding to the highest magnitude recorded during the length of the earthquake. Magnitude is a logarithmic scale, meaning that an increase in magnitude by one unit represents more than 30 times the amount of energy the event releases (Figure 6).

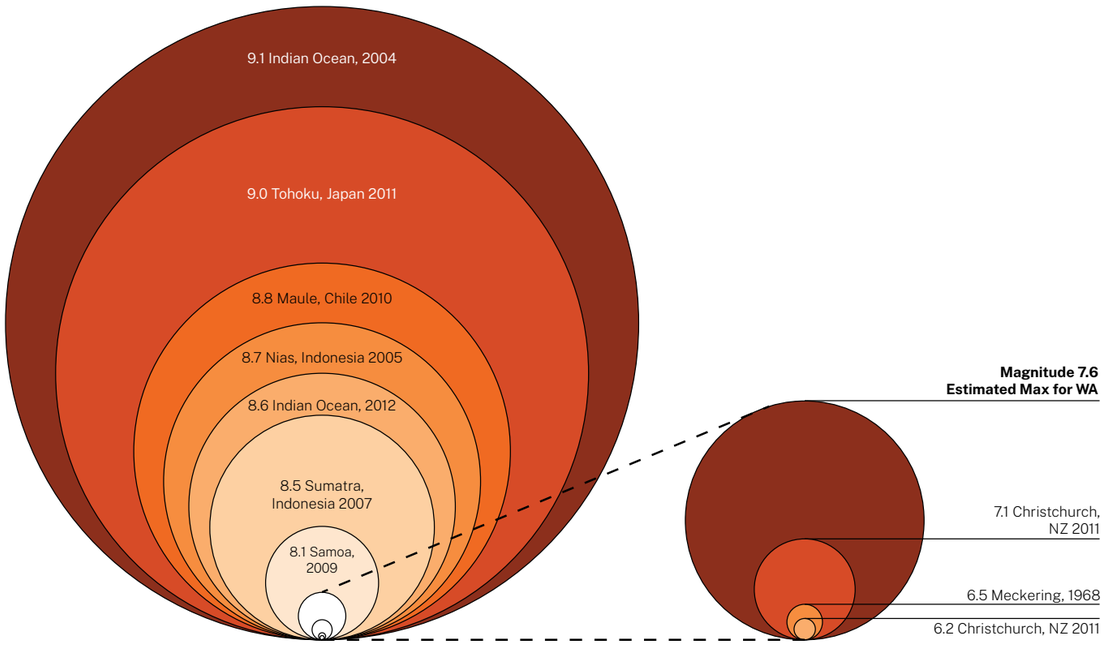



*Figure 6: Comparison of the energy released by recent earthquakes of large to moderate magnitude. The strongest earthquake expected for the Australian tectonic setting could reach a magnitude of 7.6, even larger than the earthquakes that devastated Christchurch in New Zealand in 2011. Whilst very rare, an event of magnitude 7.6 in Western Australia would cause widespread extensive damage if it occurred near population centres.*





The magnitude scales generally used in Australia are:

**ML** the Local Magnitude (ML), is the traditional measure based on the original Richter scale. This scale measures only the largest vertical ground movements recorded by a seismometer for a single event.

**Mw** the Moment Magnitude (Mw) is used for events of magnitude above 5, which is the standard measure worldwide. This scale estimates the total energy released in the earthquake and is more reliable for large earthquakes.

**'M'** While there are differences between ML and Mw, this guide will not distinguish between them and will adopt the term 'magnitude' or 'M' throughout.

## Intensity (MMI & PGA)

Intensity scales describe the effects of an earthquake in a given location. These may vary significantly over small distances due to changes in ground conditions, building type, and what people are doing at the time. The intensity level generally increases with magnitude and decreases with distance from the earthquake source. In Australia, two intensity scales are routinely used to refer to earthquakes:

**MMI** the Modified Mercalli Intensity scale (MMI) measures the level of damage produced by an earthquake and how it is perceived by the community. (Table 1 on page 10); and

**PGA** the Peak Ground Acceleration (PGA) is an instrumental measure of ground motion and is measured as a fraction of the gravitational acceleration, g (1 g = 9.81 m/s$^2$). This parameter is important for earthquake engineering and building codes, as the damage to buildings and infrastructure is related closely to ground motion.

As both PGA and MMI scales measure intensity, these can be correlated, as shown in Table 1. This relationship is only for reference, as it is not absolute because damage may vary depending on many factors.

**Table 1 – The relationship between PGA and MMI intensities**

| Shaking | PGA (g) | MMI | Felt Sensation | Expected Damage |
|---|---|---|---|---|
| Not felt | <0.0005 | I | Not felt. Recorded by seismographs. | Negligible. |
| Weak | 0.0005 – 0.003 | II-III | Rarely felt. Usually felt only on top floors of high buildings or indoors. Vibration is similar to the passing of a truck. | Negligible. |
| Light | 0.003 – 0.027 | IV | Felt indoors by many. | Windows, dishes, and doors rattle. Walls make a cracking sound. Sensation like passing a train. |
| Moderate | 0.027 – 0.062 | V | Felt by nearly everyone. | Small objects move. Windows may crack. |
| Strong | 0.062 – 0.115 | VI | Felt by all; many frightened. | Heavy furniture may move. Books fall off shelves. Isolated building damage. Isolated rock falls. |
| Very Strong | 0.115 – 0.215 | VII | Felt by all; some people lose balance. | Considerable damage in poorly designed or maintained buildings; slight to moderate in well-built ordinary structures. Widespread landslides, rockfalls and liquefaction. |
| Severe | 0.215 – 0.401 | VIII | Felt by all; difficult to stand. | Great damage in poorly designed or maintained buildings; partial collapse in well-built ordinary structures. Fall of chimneys, factory stacks, columns, monuments, walls. |
| Violent | 0.401 – 0.747 | IX | Felt by all; general panic. | Considerable damage to well-engineered structures. Buildings shifted off foundations. Ground cracking. |
| Extreme | 0.747 – 1.39 | X+ | Felt by all; damage total. | Most masonry buildings collapse. Moderate to severe damage to earthquake-resistant buildings. Rails bent. |





# Tectonics in Western Australia

**Did you know that shallow earthquakes occurring in Western Australia can break, displace and deform the ground, causing severe damage to roads, railways and pipelines?**

## Seismogenic zones in WA

Studies of the historical record of earthquakes have defined two main seismogenic zones in Western Australia (Figure 5): the Southwest Seismic Zone (SWSZ) east of Perth and the Northwest Shelf Seismic Zone (NWSSZ) on the northwest coast. These zones are where future earthquakes are more likely to occur.

The concentration of epicentres in the SWSZ occurs in the crust of the Archean Yilgarn Craton (Figure 5). Earthquakes in this region are typically shallow, with the majority of events occurring within the upper 5km of crust. Shallow seismic sources mean that relatively small events can rupture the Earth's surface, causing damage to the surroundings. The SWSZ has produced five surface-rupturing earthquakes in the last five decades. The largest of these, the 1968 magnitude 6.5 Meckering earthquake, is calculated to have initiated at 1.5km depth and ruptured both upwards to the surface and down to ~6km depth. Surface-rupturing earthquakes are the cause of scarps on the surface.

Located on the northwest coast of the state, the NWSSZ is one of the most seismogenic regions of Australia (Figure 5). Earthquakes in this zone appear to have sources much deeper than in the SWSZ, with almost half of events occurring at depths greater than 10km. While these are sometimes large enough to be damaging, most earthquakes in the NWSSZ are located offshore and sometimes cause minor damage. The 2019 magnitude 6.6 offshore Broome earthquake is the largest historical earthquake recorded in Western Australia and is estimated to have initiated at 20km under the surface.

**Studies have estimated that future earthquakes in Western Australia could reach magnitudes up to 7.6.**

Can you imagine the impact an earthquake of that magnitude could have on a densely populated area of WA, such as Perth or Karratha?

Earthquakes can generate substantial social and economic disturbances, with an earthquake being one of the four most costly natural disasters recorded in Australia. In December 1989, a magnitude 5.6 earthquake struck Newcastle in NSW causing widespread damage to over 50,000 buildings, including 40,000 homes. It also damaged infrastructure such as roads, bridges, and power lines. 13 lives were lost, with a further 160 people injured, and the estimated insured losses surpassed 4 billion Australian dollars today.

## Kalgoorlie-Boulder 2010

The magnitude 5.0 earthquake that hit Kalgoorlie-Boulder on 20 April 2010 was the strongest recorded in the Goldfield Midlands Region for 50 years. The event's location was estimated to have occurred directly beneath the southern margin of Boulder, with the earthquake felt across much of southwest WA, including Perth, and as far north as Carnarvon.

Despite the modest magnitude of this earthquake, two people sustained minor injuries and as many as 70 buildings were significantly damaged, many of which were older unreinforced masonry structures. A number of heritage buildings were also extensively damaged, several of which had to be demolished. Local mining pits had to close temporarily due to hazards associated with possible aftershocks, including the Kalgoorlie Consolidated Gold Mines (KCGM) 'Super Pit', Australia's second-largest open-cut gold mine. The estimated cost of this event surpassed $33 million in 2010, equivalent to $35.6 million today.

The impacts of this earthquake could also have been much worse. Had the earthquake occurred just half a km further east, it could have severely impacted the Super Pit. If the epicentre had been just a few km further south, it would have hit the more populous Kalgoorlie business district, an area also containing buildings of corresponding age, type, and heritage value. Had it occurred between 15 and 30 minutes later, children would have been on their way to school, and the shops on Burt Street would have been trading. Any of these scenarios had the potential to significantly exacerbate this event's human, social and economic impacts.

*Figure 7: Damage from the magnitude 5.0 Kalgoorlie-Boulder earthquake in different structures located in Boulder. Photo source: DFES – Goldfields-Midlands.*





## Meeberrie 1941

The 1941 Meeberrie earthquake was known as Australia's most powerful onshore earthquake, initially reported as a magnitude 7.2 based on personal accounts of those who felt its effects. However, through an improved understanding of Australia's seismicity and modern techniques, GA has recently downgraded the magnitude to 6.3, ranking it as equal fifth largest in Australia.

The earthquake was felt over a wide area of WA from Port Hedland in the north and Albany and Norseman in the south. Damage was minor due to the low population density in the epicentral region. However, the shaking at the Meeberrie homestead was very severe, cracking all the walls, bursting several rainwater tanks and causing widespread ground cracking. Minor nonstructural damage was reported in Perth, more than 500 km away from the epicentre.

## Offshore Broome 2019

On 14 July 2019, a magnitude 6.6 earthquake occurred 210km off the coast of Broome – the largest recorded event in Australia's history. The shaking was reported for up to one minute, with a roaring noise accompanying the first seconds of the earthquake. It was widely felt in WA and neighbouring areas, from Darwin to Esperance. No substantial damage, death or injuries were reported, but there was some non-structural damage, such as objects falling from supermarket shelves and minor damage to ceilings.

Initially, the earthquake was deemed 'potentially tsunamigenic', but the alert was later downgraded to "No Threat" by the Joint Australian Tsunami Warning Centre. Nevertheless, some beaches in Broome were closed, and several coastal areas self-evacuated, including the Bidyadanga Community, located 180km south of Broome and closest to the epicentre. Self-evacuation was triggered by observations of rapid tide retreat, long and strong ground movement, and oral tradition that recalls a 35-km inundation tsunami on the Kimberley coast during the 17th century.

### Important

**If you feel an earthquake you can help scientists understand its impacts by reporting what you felt. This helps them calculate the intensity of the earthquake and helps emergency services understand potential damage.**

**When you are safe report your experience at earthquakes.ga.gov.au/**

# Earthquake swarms

Earthquake swarms are a sequence of moderate magnitude events, in a localised area. Each moderate-magnitude event has its own aftershock sequence, but there is no clear main shock event. Rarely damaging beyond the immediate source area they are a characteristic component of Western Australian seismicity, as they can represent a large percentage of events in earthquake catalogs, particularly in cratonic regions. There are numerous examples of swarm events in WA, including:

## Arthur River Swarm 2022

On 5 January 2022, a magnitude 4.0 earthquake was felt by WA's Southern Wheatbelt residents. The earthquake was located close to the community of Arthur River. Felt reports received by GA indicated minor damage to structures (e.g., cracks in masonry), corresponding to a moderate to strong shaking intensity or MMI V to VI.

Within days of the main shock, the Geological Survey of WA installed Rapid Deployment Kits (RDK) around Arthur River, including seismometers and accelerometers. A magnitude 4.8 earthquake, stronger than the initial event, was recorded on 24 January 2022. This earthquake was felt across much of southwest WA, including Perth, Albany, and Margaret River. Over the next three weeks, 94 events were recorded by the Australian National Seismograph Network, while over 950 earthquakes with M<3 were identified using the RDKs in a cluster west of Arthur River until the end of January 2022.

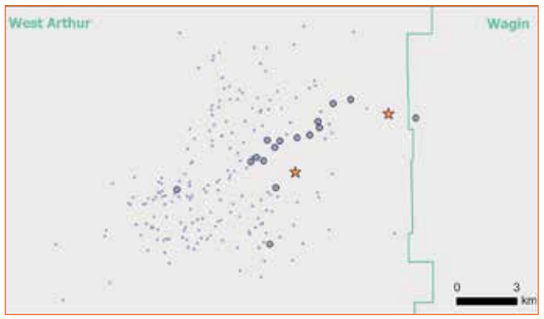



*Figure 8: January to mid-May 2022 earthquakes, showing the cluster of events of the Arthur River Swarm.*

## Koorda Swarms 2021

Swarms of small earthquake events are not unusual for the Koorda region, with at least five different earthquake swarm centres recorded since 2000, with earthquakes M>5 happening occasionally. Residents in the area report the sounds of these earthquakes like a train or heavy truck rumbling straight towards you, passing by and then going off into the distance.

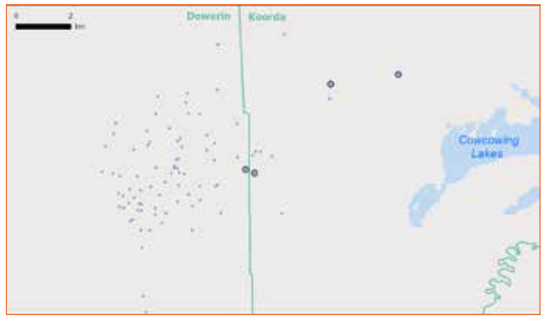



*Figure 9: Distribution of earthquakes of the Koorda Swarm recorded in 2021.*

One of the most recent swarms was recorded during July and August 2021, when the Koorda region experienced a swarm of events totalling nearly 100 in 2 months (Figure 9). The largest was magnitude 3.5, and the seismic activity reduced to normal levels of one or two monthly events for the rest of the year.





## Lake Muir Swarm 2018

On 16 September 2018, a magnitude 5.3 earthquake was recorded near Lake Muir, southeast of Manjimup, with the tremors felt across the South West and Perth metropolitan area. The earthquake resulted in the formation of a 3-km-long surface rupture near the epicentre, and surface deformation approximately 7-km-long was observed from satellite imagery. Localised damage occurred to structures near the fault scarp and epicentre.

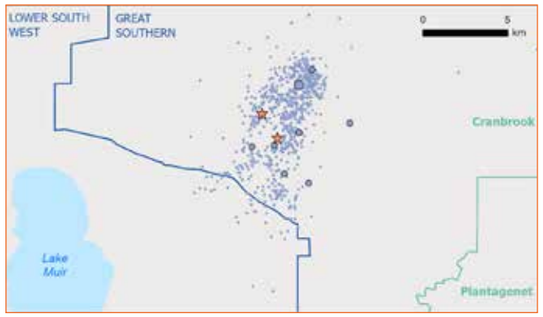



*Figure 10: Earthquakes recorded during 2018, showing the cluster of events of the Lake Muir Swarm.*

Rapid Deployment Kits, including seismometers and accelerometers, were installed within days of the main shock and began live-streaming data back to the GA Operations Centre in Canberra. Over 700 aftershocks were located, including a magnitude 4.6 in October 2018 and a magnitude 5.2 in November 2018.

## Lake Tobin sequence 1970

The Lake Tobin, or East Canning Basin, sequence commenced on 24 March 1970 with a magnitude 6.1 event near Lake Tobin in the East Pilbara region. The event was followed by seven magnitude 5 events in the subsequent three years and dozens of magnitude 4-5 events during the 1970s. Occasional events of magnitude 4-5 occurred up until the early 1990s (Figure 11).

The main earthquake was felt widely in WA, with felt reports recorded as far away as the Perth metropolitan area. The highest intensity was reported at Fitzroy Crossing (MMI 5), about 500 km from the epicentre, and an MMI 2 was reported by people in tall buildings in Perth, 1500 km from the epicentre. Damage from the event was negligible as the epicentral area was mainly uninhabited.

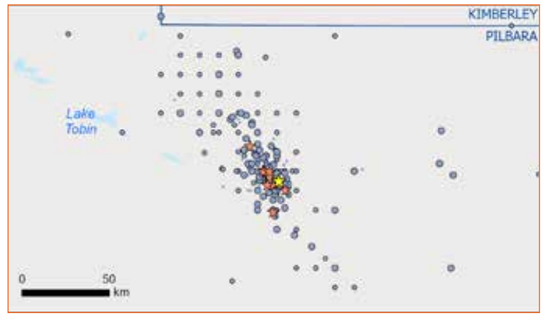



*Figure 11: Earthquakes recorded from January 1970 to December 1990, showing the cluster of events of the Lake Tobin sequence.*

## Monitoring Earthquakes

### Important

**It is impossible to predict earthquakes.**

However, we now have tools to recognise earthquake-prone areas, such as Australia's National Seismic Hazard Assessments (NSHA-18) developed by Geoscience Australia (Figure 5). Using these tools, we can assess the likelihood of large earthquakes in any region. With this information, we can learn how to prepare for and react to an event and best mitigate damage to homes through strategies such as seismic retrofitting.

Geoscience Australia (GA) monitors seismic activity across the Australian continent, with the Geological Survey of Western Australia (GSWA) specifically monitoring seismic activity within Western Australia. These agencies collect and analyse data from nearly 100 stations that form the Australian National Seismograph Network and deploy temporary seismometers to measure aftershocks following significant earthquake events. The analysis is performed in near real-time, 24 hours a day, 365 days a year, at GA's National Earthquake Alerts Centre (NEAC; Figure 12). Further seismic data is incorporated from overseas seismic networks operated by countries such as New Zealand, Indonesia, Malaysia, Singapore, China, the USA, Japan, Germany, and France.

Earthquakes with a magnitude 3.5 and higher are located by an automated system and reviewed by a seismic analyst within 20 minutes of occurring. The information generated includes magnitude, origin time and date, and the hypocentral coordinates of the earthquake. Felt earthquakes of magnitudes under 3.5 are published on GA's "Earthquakes@GA" webpage (earthquakes.ga.gov.au/) and are reviewed by seismic analysts the following business day. GA generally does not report low magnitude earthquakes (M≤2); however, GSWA is using these event records to study earthquake frequency across certain parts of WA.

*Figure 12: The National Earthquake Alerts Centre at Geoscience Australia (Image provided by Geoscience Australia).*



*Damage in school during the Cadoux earthquake (1979)*
*© WEST AUSTRALIAN NEWSPAPERS LIMITED.*

# Before
# During
# After
## an earthquake

# Before an earthquake

## Prepare your home and family

Decrease the likelihood of damage or injuries with some simple actions you can take before an earthquake occurs. It is important to regularly review these measures and practice the emergency survival methods with family members at least once a year.

### Identify and secure hazards at home

Did you know that most earthquake-related injuries occur due to falling objects or furniture? (Figure 13). Luckily, you can follow several simple, low to no-cost methods to mitigate potential hazards inside your home. Start by securing heavy or tall furniture that can be easily overturned during an earthquake, injuring people or blocking emergency exits. These include shelves, cabinets, bookcases, refrigerators, storage racks, racking systems in warehouses, etc. Depending on the material, it may be suitable to attach household items to the wall using L-brackets. Chains or wires can attach hanging fixtures to the ceiling, and safety straps can secure furniture's doors and drawers.

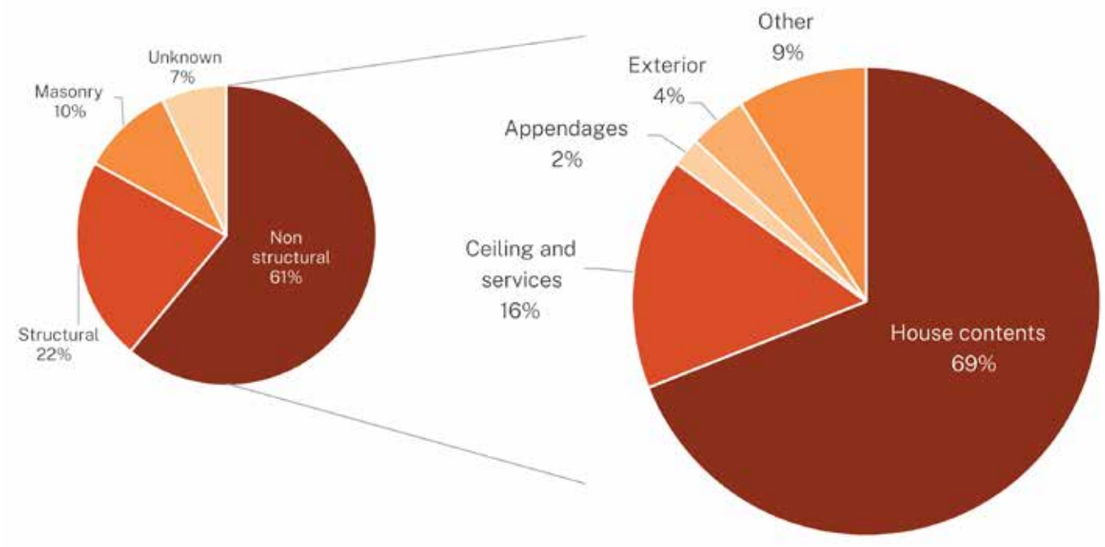



*Figure 13: A large portion of people are injured during an earthquake due to non-structural damage, such as falling objects or furniture. In the 2010 Darfield earthquake in New Zealand, over 60% of injuries were caused by non-structural damage, 69% of which was caused by unsecured household contents.*





- Secure heavy or tall furniture because earthquakes can overturn them, injuring people or blocking emergency exits. These include:
  - Shelves, cabinets, bookcases
  - Refrigerators
  - Storage racks, racking systems in warehouses
  - Gym equipment
- Store heavy or fragile items on low shelves (under 1.5 meters) as earthquakes may cause them to fall. Items that need attention include:
  - Televisions and monitors
  - Picture frames and glassware
  - Hanging mirrors and plants
- Pay special attention to rooms where you spend most of your time, such as the kitchen, bedrooms, and dining rooms.
- Pay attention to objects near heaters, as they may fall and start a fire.
- Keep an in-date fire extinguisher readily accessible in case a fire starts during or after the earthquake.
- Keep the emergency exits and paths clear.

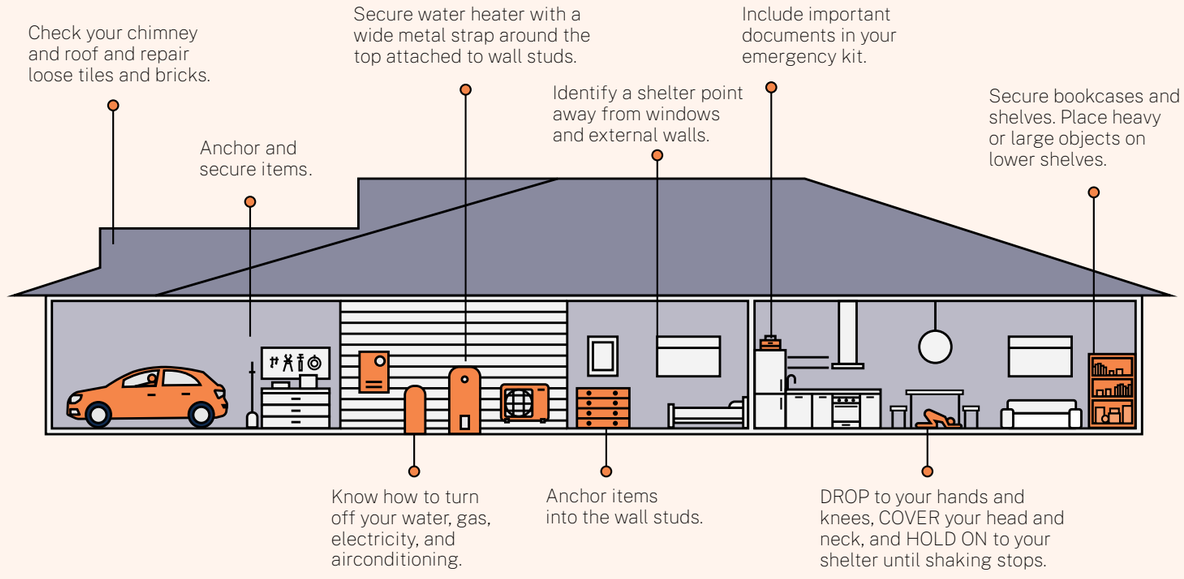



*Figure 14: Identify and secure hazards at home. The above image illustrates how low-cost and straightforward solutions can reduce threats. Find other recommendations in this Guide.*

## Make a plan

Earthquakes occur without warning and can affect people at home, office, school, or outdoors. The following list presents the basics for developing an earthquake plan, but should be modified according to your circumstances.

**1** Learn and practice **Drop, Cover, and Hold On**. If a member of your household has a disability or has special needs, practice "Drop, Cover, and Hold On" modified for each person.

Done! ☐

How to Drop, Cover and Hold On – Page 26

**2** Identify safe spots at home and other frequented buildings, schools, offices, etc, such as sturdy tables or desks.

| Safe spot at: |
|---|
| Home: |
| School: |
| Office: |

**3** Designate a meeting point for your household in case the home is damaged. For example the letterbox if safe.

| Meeting point: |
|---|

**4** Record and update important emergency numbers and addresses.

| Emergency contact: |
|---|
| Name: |
| Phone: |
| Address: |

Jump to Checklists – Page 41





**5** If your home, office, school or other frequented location is close to the coast, learn about what to do in a tsunami.

| Where would you go: |
|---|
| Home: |
| School: |
| Office: |

Learn what to do if you are in a coastal zone – Page 28

**6** Consider pets in the emergency plan. Your pets should have up to date collar tags, microchips and registration details.

Done! ☐

**7** Prepare an emergency kit (see details on page 22).

| Done! ☐ |
|---|
| Stored at: |

**8** Learn where and how to shut off home power, gas, and water supplies. Record it on your Family Emergency Plan found at the end of this document.

| Power: |
|---|
| Gas: |
| Water: |

**9** Review and practice the emergency plan annually.

| Family emergency plan | | | | | |
|---|---|---|---|---|---|
| Year | | Reviewed | ☐ | Practiced | ☐ |
| Year | | Reviewed | ☐ | Practiced | ☐ |
| Year | | Reviewed | ☐ | Practiced | ☐ |

Jump to Checklists – Page 41

**10** Identify evacuation centres close to home, and the best route you can take to get there on foot.

| Evacuation Centre: |
|---|

# Prepare and maintain an emergency kit

**Emergency supplies will help a family during an earthquake if utilities and basic services are cut or if their home becomes severely damaged. The following emergency kit is designed for three days to one week and must consider all family members and pets. According to capability and budget, supplies can be gathered over time.**

- [ ] Water: five litres of water per day per person for at least three days to one week. Consider storing water purification tablets.
- [ ] Food: store non-perishable food, such as dehydrated or canned foods. Include a manual can opener for canned items. Include food for those with dietary needs.
- [ ] First aid kit: find a list with the essentials at healthdirect.gov.au/first-aid-kits.
- [ ] Medical Supplies: prescription and over-the-counter medications required by anyone in the household. Keep a copy of prescriptions in case of evacuation.
- [ ] Torches and portable AM/FM radio, with spare batteries.
- [ ] Charged power bank or solar battery chargers for mobile devices.
- [ ] A whistle, combination pocket knife, gloves, small hand saw, small crowbar and rope.
- [ ] Matches in a waterproof container.
- [ ] Extra set of car keys.
- [ ] Cash.
- [ ] Blankets, and clothing according to your regional climate.
- [ ] Copies of documents, such as driver licenses, passports, immunisation records, and insurance policies.
- [ ] Several rolls of toilet paper, bar soap in a plastic container, plastic bags (large and small), and hand sanitiser.
- [ ] Consider your pets. What do they need? Food, water, bowls, bedding, medication or special requirements, registration/ microchip information, lead.

› Store emergency kit in a central, dry, and easily accessible area.
Stored at

› Replace stored food and water every six months.
Date





# Prevent significant impact to your property

**There is no such thing as an earthquake-proof property but you can put measures in place to prevent and reduce potential damage during an event. By understanding how ground shaking impacts your property during an earthquake, you can plan to maintain and protect it, reducing the likelihood of damage and keeping your family safe.**

## Check and upgrade your property

In large earthquakes, building collapse accounts for up to 80% of the victims. Thankfully, it is possible to decrease risks by upgrading and retrofitting key areas where earthquakes cause the most damage.

### Important

A thorough inspection and maintenance of key structural elements by a building professional should be undertaken for all properties, particularly when:

› your property has not been inspected in years, or

› after any hazard, such as an earthquake or cyclone, that has damaged buildings in your community.

For heritage properties, ensure your building practitioner is familiar with historic buildings and that you understand the need for heritage approvals prior to undertaking any work.

## Building collapse risk

There are some well-known weaknesses in building that can cause damage or collapse during an earthquake. Fill in the table to identify weaknesses in your property, and engage with a qualified building practitioner to inspect your property and address solutions.

| The building | Yes | No | Inspected |
|---|---|---|---|
| › has extensions built over the original design. | ☐ | ☐ | ☐ |
| › has a section of a wall or column that has been removed. | ☐ | ☐ | ☐ |
| › has suffered damage from previous events, such as earthquakes, fire, or severe storms. | ☐ | ☐ | ☐ |
| › is located on reclaimed land, swampy lowland, or an alluvial plain. | ☐ | ☐ | ☐ |
| › is built on a hillside, using an anchorage foundation. | ☐ | ☐ | ☐ |
| › has a foundation made of unreinforced concrete. | ☐ | ☐ | ☐ |
| › has windows that make up a whole wall. | ☐ | ☐ | ☐ |
| › has an uneven shape, such as L- or T-shapes. | ☐ | ☐ | ☐ |
| › has areas built over pillars, posts, or piers. | ☐ | ☐ | ☐ |
| › has a large atrium. | ☐ | ☐ | ☐ |
| › has living space over a garage or soft storey. | ☐ | ☐ | ☐ |
| › has doors and windows poorly fitted, or tilted pillars or floor. | ☐ | ☐ | ☐ |
| › has cracks in the wall. | ☐ | ☐ | ☐ |
| › has a verandah or balcony that shows evidence of damage, such as cracks or rotten timber. | ☐ | ☐ | ☐ |
| › has unreinforced masonry chimneys and/or parapets. | ☐ | ☐ | ☐ |

## Asbestos

Buildings constructed before the 1990s are likely to have asbestos materials that can generate public risks when damaged or disturbed by disasters such as earthquakes or fires. During an emergency, the presence of asbestos will need special treatment and could increase the time for you to return home. Seek advice from a building professional if your home has any asbestos-containing products. Find more information about asbestos at health.wa.gov.au/Articles/A_E/About-asbestos





## Fire risk

Prevent earthquake-caused fire from occurring or spreading with the following advice:

- Have fire extinguishers at home. Make sure that the maintenance date printed on the tag is before expiry.
- Install and maintain smoke alarms.

- Learn where and how to shut off power and gas supplies at home.
- Look into installing flexible connections where gas lines connect to gas-fired equipment to prevent a leak and potential fire.

## Check your insurance policy

Insurance can help support families in recovering from a disaster. In Australia, some insurance companies include disaster protection on general covers, such as fire, flood, storm, earthquake, or tsunami. However, this is not always the case. Reviewing what is and what is not included in each cover is essential. Pay attention if the insurance cover considers rebuilding your home and replacing its contents. Consider acquiring covers against different disaster types if you are in a multi-hazard-prone area.

If a property is damaged during an earthquake or other disaster, you'll be required to describe the contents to the insurance company. Here are some tips to save time and avoid additional stress during a disaster:

- Consider having a household inventory. It looks tedious now, but it will be helpful in the event of a disaster. Find a checklist on this website: understandinsurance.com.au/calculators. Store copies of your inventory in a safe location or online.
- Regularly take photographs that demonstrate your property's condition and level of maintenance.
- Take plenty of photos or videos of objects and structures affected once it is safe to return home.
- Using the photos, make an inventory of damaged or destroyed items. Include notes from the household inventory, such as brands, models and serial numbers of white goods and electrical items.

# During an earthquake

**Earthquakes are unpredictable, so ground shaking will often be your first warning that one has begun. Learning how to respond during an earthquake will reduce the risk of injury.**

## Drop, Cover, and Hold On

The Drop, Cover and Hold On move is the safest option when there is an earthquake. Follow the three-step sequence to help avoid injuries and potentially save lives.

### If you feel shaking:

**1** 

DROP to the ground

**2** 

COVER your head and neck with your arms and shelter under a sturdy desk or table. If there isn't safe shelter nearby, crouch alongside a bench or an inside wall.

**3** 

HOLD ON to your shelter and be prepared to move with it until the shaking stops

Using a cane


Using a walker


Using a wheelchair


*Source: Earthquake Country Alliance*

### Important

Avoid the following areas before Drop, Cover, Hold On.

- When indoors: tall furniture, televisions, hanging objects, mirrors, windows, and exterior-facing walls may fall or break unless secured.
- When outside: windows, overhead structures, concrete fencing, power lines, trees, signs, vehicles, and other hazards may fall on you.





## If indoors

Staying indoors is the safest option when an earthquake occurs. Follow the Drop, Cover, Hold On sequence, and remain indoors until the earthquake has stopped. The best course of action for those with limited mobility may be to stay in place and call 000 in a life threatening emergency.

### Important

Do not use elevators.

Earthquakes will likely generate power outages, and people can get trapped in an elevator. To evacuate, use the emergency stairs when the shaking has stopped.

## If outside

Do the Drop, Cover, Hold On sequence, but check the surroundings and avoid windows, overhead structures, awnings, concrete fencing, bridges, power lines, trees, etc.

## If driving

Park in a safe place and stay inside the car until the shaking stops. Avoid stopping close to or on overpasses, bridges, power lines, signs, and other hazards. When safe, continue your route, and avoid fallen debris, cracked or shifted pavement. Give way to emergency vehicles. If a power line falls on the car, stay inside until a trained person removes the wire.

### Important

During an earthquake, dangerous actions include running or leaving a building or car:

- Running is dangerous as people can stumble.
- Leaving a building is dangerous as heavy or sharp objects can fall and injure you.
- Leaving a car is dangerous as other cars can still be moving, or power lines can fall.

## If you are in a coastal area

Earthquakes can trigger violent and destructive tsunamis that can impact near-shore areas of Western Australia. If you are near the coast during an earthquake, follow the tips below to evacuate safely:

### If you are near the coast and feel shaking:

**1**


DROP, COVER AND HOLD ON!
To protect yourself during earthquakes.

**2**


GO TO HIGH GROUND OR INLAND
Do not wait for an official warning to evacuate the coastal area.
Tsunami waves may arrive in minutes, or be delayed up to hours.

**3**


STAY ON HIGH GROUND
Tsunami waves may stay for hours.
Return home when emergency services advise it is safe to do it.

*Source: Earthquake Country Alliance*

### Important

**You should not wait to receive a warning message before you act.**

You may receive a tsunami telephone warning alert indicating the best course of action for the emergency. It is one of many ways emergency services can warn a community of a likely or actual emergency.

Telephone warnings are not used in all circumstances. Emergency services will determine if a telephone message is the most effective way to warn communities about an emergency. It is important that you stay up to date on the developing situation from official sources.

Jump to Official Sources – Page 32





## When the shaking is over

- Stay calm. Wait and look around to recognise threats such as debris or hanging objects.
- Stay at home if there is no indication of damage in the building.
- Use official sources to get emergency information and earthquake related news.

- Evacuate the building only if walls, ceilings, or roofs have visible damage, such as tilting, significant cracks, doors jammed, or fallen parts. Refer to the next section on how to evacuate.
- Open the door to secure an exit.
- Find and keep the emergency kit with you.

- If you are trapped inside a room or unable to move, avoid shouting; this could exhaust you and endanger your life. Instead, make loud noises by, for instance, using something solid to hit the door or walls to let others know that you are in the room.

### Important

Be prepared for **aftershocks**. Repeat the Drop, Cover, and Hold On sequence if another earthquake occurs. Aftershocks can occur minutes to hours after the initial earthquake and may last for weeks, months or even years after the main event. In the case of earthquake swarms, aftershocks happen for weeks or months afterwards, but obviously, you must get out from under the table sooner than that!

## Once you are safe

- Put out small fires with a fire extinguisher. Evacuate if a large fire is present. Call 000 and alert neighbours as the fire could spread to adjacent properties.
- Immediately shut off the gas supply at home if there is evidence of damage to the gas system, such as a gas smell or you can hear a gas leak.
- Immediately shut off the power supply if potential damage to wiring or sparking is visible.
- Unplug appliances and electronics. When power is restored, damaged appliances and electronics could start a fire.

- Stay informed through official information sources on the radio, TV, or other methods available at the time. Use a portable battery radio that should be in your emergency kit.
- Contact family or friends using text messages (SMS). Avoid using telephone calls for non-essential and non-emergency calls, which could overload telephone lines.

- Check for injuries, or help others injured. Provide assistance if you have first aid training.
- Call 000 for life threatening injuries.

## Further safety actions include:

- Use a torch instead of lighting candles or any open flame as there may be a gas leak.
- Protect yourself before you start moving. Wear thick-soled shoes as shattered glass, broken pieces of ceramic or other materials will likely be on the floor. If necessary, wear gloves.
- To reduce the risk of injury, work with several people when attempting to rescue others.
- Stay away from areas where the ground is broken or trenches. These may be unstable and are very dangerous.





## Evacuate

**1** **In general, staying where you are is the safest course of action. Only evacuate:**

- If the building was damaged during the earthquake, look for a safe way to evacuate.
- Wear sturdy shoes to prevent injury and secure the emergency kit.
- Once outdoors, go to an open space and follow updates through official information sources.
- Do not re-enter the building until it has been evaluated and determined safe for re-entry.

- If in a coastal area, do not wait for an official warning to evacuate the coastal zone.
- Take only essential items that you can carry, including important papers and medical needs.
- Go to a safe high-ground area inland. Be aware that a tsunami may arrive within minutes to hours.
- Stay on the high ground until emergency services advise it is safe to return home.

### Important

**Walk during the evacuation.**
Do not drive unless a family member has any disability or limited mobility.
Driving during an earthquake can cause traffic jams and can put you in danger from falling power lines and other hazards on the road.

## 2 If safe, before evacuating, do the following check while visually inspecting the situation around you:

- Confirm that all possible sources of fire have been turned off.
- Switch off electrical appliances as power restoration can damage them or cause a fire.
- Shut off gas, water, and electric supplies.

- If you're not with your family or members of your household, leave a note and send text messages (SMS) telling them where you have evacuated to.

## 3 Only trust official information sources:

- **Emergency WA**
  emergency.wa.gov.au

- **Earthquakes@GA**
  earthquakes.ga.gov.au

- **13 DFES (13 3337)**

- **Local ABC radio channel**

- **Facebook**
  @dfeswa





## 4 During the evacuation, be careful of the following unsafe actions:

- In built-up areas, you could be hurt by falling objects such as roof tiles, masonry, brick walls, chimneys, outdoor units of air conditioners, and planter boxes. Concrete fences and verandahs are also prone to collapse.
- In commercial, industrial, and office districts, you could be hurt by falling objects such as signboards, neon signs, shards of glass, brick parapets, and building non-structural facades.

- In crowded areas, be aware that mass panic is frequent during a natural disaster. Maintain calm and evacuate, considering those around you.
- When evacuating at night, take care due to low visibility. Use a torch and move carefully while visually confirming the situation.
- Be particularly careful near roads.

- Be aware of broken or sagging power lines posing the danger of electrocution. Be cautious if trees or signs are touching the power line.

### Important

After the evacuation, only return home when local authorities have lifted the evacuation order. Never enter a damaged building, if you return and your home is damaged seek assistance.

There are multiple types of hazardous situations during and after an earthquake, and there may be some that you cannot see that could pose a threat to your health. When the hazard has been addressed, local authorities will notify residents to re-enter the area.

# After an earthquake

**Experiencing an earthquake can be frightening. You and others around you may be injured or in a state of shock, your home or workplace may be damaged, your pets may have run away, and you may not be able to contact your family.**

Recovering from the impacts of an earthquake will take time.

To assist with your recovery, we've put together some helpful advice on what to do in the following days and months after an earthquake.

## What to expect after an earthquake

- There could be damage to buildings, including your home.
- Telecommunications, electricity, water, gas and sewerage may not be working.
- There could be road and airport closures.
- Expect aftershocks – depending on the size of the earthquake, aftershocks may last for weeks, months or even years after the main event.

## When your home is damaged

### Seeking emergency accommodation

- If your home was damaged, you may not be able to return straight away – this is for your own safety.
- Call the Department of Communities Disaster Response Hotline on 1800 032 965 for emergency accommodation and assistance.
- If insured, contact your insurance company to see if you are covered for emergency accommodation.
- Let people know your temporary address.

### Returning home

- Do not return home until your local authorities say it is safe to do so.
- Do not enter if there are cracks or damage in the roof, walls or chimney.
- Do not turn on electricity, gas, and water if there are signs of damage or if unsure. Seek a professional contractors advice.
- Use a torch when entering a building, never use matches, candles or naked flames as there may be gas leaks.
- If you need help with temporary emergency repairs, call the State Emergency Service on 132 500.





### Insurance, repairs and rebuilding

- Speak to your insurer as soon as possible and report damage or loss to your property or contents. Depending on their advice, you may be able to begin repairs or rebuilding.
- If your property is heritage-protected, check with your local government to determine if any heritage approvals are needed before repair work can be undertaken.
- If you are a tenant and have contents insurance, contact your insurer and tell your real estate agent, owner, landlord or Department of Communities.
- Take photos and/or videos as you go through the house for insurance purposes (before moving anything).

## Your wellbeing

Your wellbeing is vital, and feeling psychological and emotional distress after an emergency is completely normal. Most people will recover over time with the support of family and friends. However, it is often easier to talk to someone uninvolved in the situation and trained to listen after a crisis.

Follow these simple steps to help you and your family get back to normal:

- Use official sources to get emergency information and earthquake related news.
- Talk to your family, friends, and neighbours about their experience.
- Try to get your children back into their regular routine as quickly as possible.
- Get involved in community activities when you feel comfortable.
- Seek support from welfare organisations:
  - Crisis Care: Call 08 9223 1111 or free call 1800 199 008 (day or night)
  - Lifeline: Visit the lifeline.org.au or call 13 11 14

## State Recovery

Planning for recovery occurs long before disaster events occur and there is a suite of arrangements, policies and governance bodies in place ready to be activated if needed.

In Western Australia, the framework for managing recovery from disaster events is set out in the Emergency Management Act 2005 (WA), the State Emergency Management Policy and the State Emergency Management Plan.

In most cases, local governments are responsible for leading recovery in their communities. However, following a severe disaster where the scale of recovery exceeds the capacity of local government, the State government may activate State Recovery arrangements. In these situations, DFES provides staff and resources to coordinate State Recovery activities to support long term recovery efforts.

# Further information

**For more information on earthquakes, earthquake preparedness and ways to protect your family and property, please visit the following websites:**

- Department of Fire and Emergency Services: dfes.wa.gov.au/hazard-information/earthquake/
- Geoscience Australia: ga.gov.au/scientific-topics/community-safety/earthquake
- Joint Australian Tsunami Warning Centre: bom.gov.au/tsunami/
- Earthquake Felt Report: earthquakes.ga.gov.au/

## Further reading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## Glossary

**Aftershock** is a smaller earthquake that occurs after a larger earthquake. Aftershocks can continue for days, weeks, or even months after the initial earthquake.

**Alluvial soil/land** is composed of loose material (generally sand, clay, or gravel) deposited by geologic processes that involve water, such as rivers, floods, or debris flows.

These deposits may be located near a river, floodplain or dunes but can also be the product of ancient geological processes.

**Craton** is a portion of the continental crust that is considered tectonically inactive. Cratons are composed of ancient rocks that have survived billions of years of erosion and geologic processes. Rocks on the Yilgarn, Pilbara and Kimberley cratons of Western Australia contain rocks over 2.5 billion years old.

**Earth's crust** is the Earth's solid outermost layer. It is less than 1% of the Earth's volume.

**Earth's mantle** is the layer underneath the crust, composed of rocks hot enough to behave like fluids at geologic timeframes. The fluid-like nature of mantle rocks allows the overlying tectonic plates to move.

**Earthquakes** are the shaking of the ground caused by the sudden release of energy which happens when rocks deep underground move along fault planes.

**Earthquake swarms** are a sequence of low-to-moderate magnitude events, in a localised area. Each event has its own aftershock sequence, but there is no clear main shock event.

**Epicentre** is the point on the Earth's surface directly above an earthquake's hypocentre. It is the point where the earthquake's intensity is strongest and where the most damage is likely to occur.

**Geological fault** is a fracture in the Earth's crust where rocks on either side of the fracture have moved relative to each other. Faults can vary from small cracks to massive features spanning hundreds of kilometres. They are caused by tectonic forces that build up and cause the rock to deform and eventually break.

**Hypocentre (or focus)** is the point underground where an earthquake begins. It is where the fault rupture starts, and energy is released, causing seismic waves to radiate in all directions.

**Intensity scales** describe the level of damage produced by an earthquake and how the population perceived it. The Modified Mercalli Intensity scale (MMI) and the Peak Ground Acceleration (PGA) are used to describe earthquakes in Australia.

**Intraplate setting** refers to zones located far from tectonic plate boundaries. Large earthquakes are relatively rare in this tectonic setting, but stresses may build up from distant active margins. Australia lies in the middle of the Indo-Australian Plate, recording an average of 100 earthquakes of magnitude 3.0 and above each year. Damaging magnitude 5.0 earthquakes occur once per year, and a magnitude 6.0 or above is expected every ten years.

**Liquefaction** is a process in which water saturated soil or sediment loses its strength and stiffness, becoming more like a liquid than a solid, losing its ability to support buildings and other structures during an earthquake.

**Magnitude** is the measure of the energy released at the source of an earthquake, and it is determined from measurements recorded on seismic instruments. The most widely used magnitude scales include the Local magnitude (ML) and Moment Magnitude (Mw).

**Scarp** is a steep slope or cliff created by rock displacement along a geological fault during an earthquake, visible as a long, steep slope on the Earth's surface, and is the most significant type of scar caused by fault displacement.

**Seismic waves** are energy shockwaves released during earthquakes, classified into Body and Surface waves. P-waves and S-waves are Body waves, with P-waves being faster and compressing the ground back and forth in the same direction, while S-waves have a larger amplitude, move in a perpendicular direction, and are more destructive. Surface waves move along the Earth's surface like ripples, travel slower than Body waves, have larger amplitudes, and are often the most destructive seismic wave.

**Seismogenic** means capable of generating earthquakes.

**Soft storey** is a building configuration where an upper level is stiffer than a lower level and it is a significant source of serious earthquake damage.

**Tectonic plates** are the large, fractured pieces of the Earth's crust that have relative moments. These plates can move apart, generating new crust (divergent boundaries), slide against each other (transform boundaries), or collide with other plates (convergent boundaries or subduction zones).

**Tsunamis** are destructive series of waves that originate on short notice that can move onshore rapidly and flood coastal areas.

## Acronyms List

**DFES:** Department of Fire and Emergency Services

**FRSZ:** Flinders Ranges Seismic Zone

**GA:** Geoscience Australia

**GSWA:** Geological Survey Western Australia

**M:** generic magnitude

**ML:** Local Magnitude

**MMI:** Modified Mercalli Intensity scale

**Mw:** Moment Magnitude

**NEAC:** National Earthquake Alert Centre

**NSHA18:** Australian National Seismic Hazard Assessment 2018

**NWSSZ:** Northwest Shelf Seismic Zone

**PGA:** Peak Ground Acceleration

**SESZ:** Southeast Seismic Zone

**SWSZ:** Southwest Seismic Zone





## Prevention Checklist – Inspection and Maintenance

**As the property owner, you're responsible for minimising damage to your property and injury to your family during an earthquake by inspecting your property annually.**

If you have any doubts about the condition of your property, contact a qualified building practitioner to have your property professionally inspected. The following is a list of items on your property that should be checked regularly and repaired or replaced as necessary.

| Item | Completed |
|---|---|
| **Insurance** | |
| Your home insurance includes earthquake protection. | ☐ |
| Contents are included in your insurance policy. | ☐ |
| Household inventory and building condition records are up to date. | ☐ |
| **Household inspection** | |
| Roof tiles are in good condition, i.e., not broken, dislodged, or missing. | ☐ |
| Mortar between tiles is in good condition i.e., not missing or broken, especially at ridges and hips or along the edges of the roof. | ☐ |
| Tile tie down clips are not missing. | ☐ |
| There are no signs of corrosion in any metal components including nails and screws. | ☐ |
| There are no signs of rot or termite activity in any timber components. | ☐ |
| Freestanding carports, pergolas and patios are in good condition and well secured to the ground. | ☐ |
| Carports, verandahs, chimneys, or patios attached to buildings are in good condition and are well secured to the building and to the ground. | ☐ |
| Pool fences and exterior concrete walls are in good condition and are well secured. | ☐ |
| Smoke alarms are working properly. | ☐ |
| **If a building professional has not recently checked your house, engage one to check:** | |
| If retrofitting is necessary. | ☐ |
| If asbestos-containing materials are present. | ☐ |
| Extensions are seismic resistant. | ☐ |
| Foundation is reinforced. | ☐ |
| Sections built over pillars, posts or piers are in good condition. | ☐ |

## Prevention Checklist – Inspection and Maintenance (continued)

| Item | Completed |
|---|---|
| **Inside home** | |
| Secure heavy or tall furniture to the wall or ceiling. | ☐ |
| Secure or relocate heavy or fragile items placed in high positions (over 1.5 m). | ☐ |
| Keep the emergency exits and paths clear. | ☐ |
| The fire extinguisher is accessible and within the date printed in the tag. | ☐ |
| **Make a plan** | |
| Practice Drop, Cover, and Hold On. | ☐ |
| If in the coastal area, learn about evacuation protocols. | ☐ |
| Identify safe areas at home, school, and office. | ☐ |
| Define a meeting point in case your house is damaged (e.g. Letterbox). | ☐ |
| Your emergency kit is complete, with food and water in date. | ☐ |
| Your pets registration, microchip and tag details have your up to date contact information. | ☐ |
| Find out where and how to shut off your home's power, gas, and water supplies. | ☐ |



Cut here and stick it to your fridge

## WHO TO CALL?

**000** *(Fire or life threatening emergencies)*
**132-500** *(SES Emergency assistance in a flood, storm, tsunami and earthquake)*

## Family emergency information

| | | |
|---|---|---|
| **Emergency contact** | **Name:** | **Phone:** |
| **School contact** | **Name:** | **Phone:** |
| **Workplace 1** | **Name:** | **Address:** |
| **Workplace 2** | **Name:** | **Address:** |
| **Notes** | | |

| Family Emergency Plan |
|---|
| Where to reunite (other than home) |
| Where is the emergency kit |
| Where to shut off gas supply |
| Where to shut off power supply |
| Where to shut off water supply |

| Health Details | | | | |
|---|---|---|---|---|
| **Family member** | **1** | **2** | **3** | **4** |
| Name | | | | |
| DOB | | | | |
| Medication | | | | |
| Doctor name | | | | |
| Blood type | | | | |
| Notes | | | | |

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E: dfes@dfes.wa.gov.au
ABN: 39 563 851 304
dfes.wa.gov.au/hazard-information/earthquake