

Working from the same page consistent messages for CDEM

PART B: Hazard-specific information



Damage from the Christchurch earthquake, February 2011

Earthquakes

- ▶ Everyone, everywhere should know the right actions to take before, during and after an earthquake
- ▶ Information about earthquake risk is also available on the GNS Science website at www.gns.cri.nz.

In this chapter

Awareness messages

Why talk about earthquakes?	3
What are earthquakes and what causes them?.....	3
What damage can earthquakes do?	4
How can I protect myself in an earthquake?.....	5

Action messages

Be prepared for an earthquake: protect yourself	6
Protect your property	7
What to do during an earthquake.....	8
What to do after an earthquake.....	10

Earthquakes general information

Media and community education ideas	13
Fiction and facts.....	13
Useful links	14
Useful numbers.....	15

CORE ACTION MESSAGES IN THIS CHAPTER (pp6–15)

- ▶ **Identify safe places in each room.**
- ▶ **Practise drop, cover and hold.**
- ▶ **At work, preplan a safe, clear area outside as an assembly point.**

For general preparedness, every household should create and practise a Household Emergency Plan and assemble and maintain Emergency Survival Items and a Getaway Kit. In addition, every household should take earthquake-specific precautions and plan and practise what to do in the event of an earthquake.

- ▶ **Make sure your home is securely anchored to its foundations.**
- ▶ **Secure heavy objects both inside and outside the home.**
- ▶ **If you are outside, find a clear spot and drop to the ground.**
- ▶ **If you are inside when the shaking starts, move no more than a few steps to a safe place and drop, cover and hold.**
- ▶ **Check on those around you (including neighbours) for injuries and identify any immediate hazards caused by the earthquake.**
- ▶ **Expect aftershocks.**
- ▶ **Listen to the radio for updated emergency information.**
- ▶ **Before leaving a building, identify a safe assembly point away from the building - a clear area away from potential dangers such as tall buildings, power lines etc.**
- ▶ **In the workplace, work as a team to establish a safe route to an assembly area before leaving the building.**

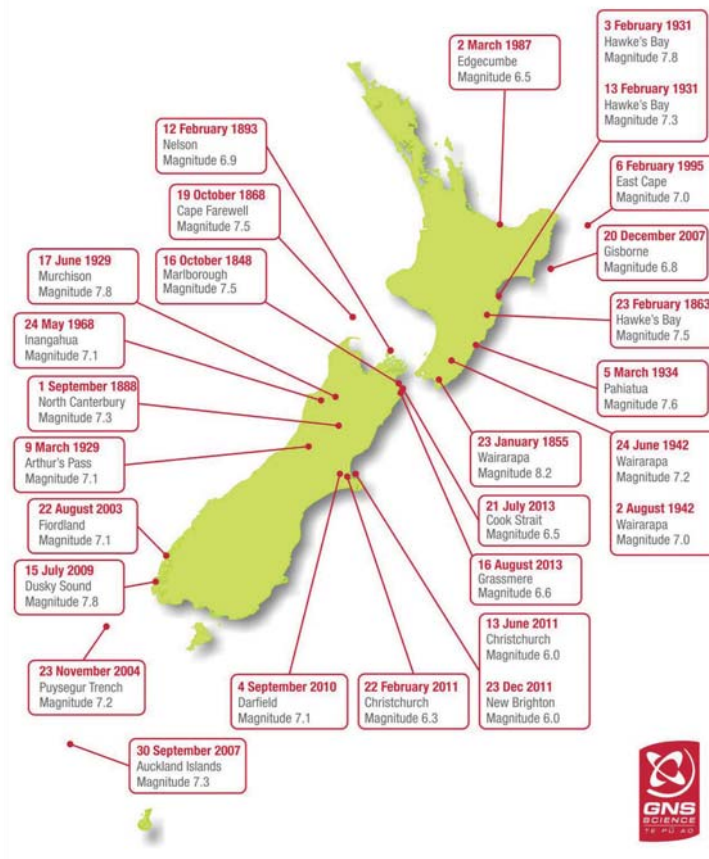
Please note: Core Action Messages should be read in conjunction with the rest of the text in this chapter.

Awareness messages

Why talk about earthquakes?

Earthquakes happen every day in New Zealand. Instruments record the ground shaking from over 20,000 earthquakes in and around the country each year. Most are too small to be noticed, but between 200 and 300 are big enough to be felt. On a world scale, seismicity (earthquake activity) in New Zealand varies from moderate to very high. In the past couple of decades, we have seen that damaging quakes can occur almost anywhere in New Zealand.

Figure 1 Large shallow earthquakes in New Zealand 1840–2013 (GNS Science)



The locations of large shallow earthquakes ($M > 6.0$) that have occurred in New Zealand since 1840 are shown in Figure 1. The last decade has been punctuated by several large ($M > 6.0$) earthquakes, some of which were close to populated areas of the country. The Canterbury earthquake sequence, starting in 2010, was by far the most devastating of these, with 185 casualties and causing \$40 billion dollars in damage.

What are earthquakes and what causes them?

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the earth as the huge plates that make up the surface move slowly over, under, past, and away from each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the forces grow strong enough, the plates suddenly break free causing the ground to shake. While we know the locations of many large fault lines in New Zealand, there are many other faults buried underground that we don't know about.

Aftershocks are earthquakes that follow the main shock as the rocks readjust and the ground settles into position. They can cause damage to buildings. Aftershocks occur days, weeks, months, and even years after the main shock. While the number of aftershocks decreases over time following a large earthquake, the magnitude of those aftershocks can be almost as high as the main shock. Even aftershocks that are smaller in magnitude than the main shock can cause stronger ground shaking, depending on the depth and location at which those aftershocks are centred. Additionally, some earthquakes are actually foreshocks that precede a larger earthquake.

What damage can earthquakes do?

Ground shaking from earthquakes (including aftershocks) can cause buildings and bridges to collapse; items to fall (e.g. chimneys, parapets, items inside a building), disrupt gas, electricity, telephone/internet services; transport networks; and can sometimes trigger landslides, liquefaction, flash floods, fires, and tsunami. Buildings with foundations resting on unconsolidated (loose) landfill or other unstable soils are at increased risk of damage, as are homes not properly attached to their foundations.

Collapse of buildings is the main cause of casualties, either through crushing or entrapment. Injuries can be caused by building and infrastructure collapse, falling objects, and people moving around during and after shaking. Loss of services is the main cause of people becoming displaced. In general, damage to buildings is the main cause of financial loss from earthquakes.

Earthquakes can cause damage in the following ways:

Strong ground-shaking will cause buildings close to the epicentre to sustain at least minor damage.

Fault rupture is a relatively rare cause of damage. However, if a fault ruptures up to the earth's surface, anything extending across it, such as buildings, roads or pipelines, can be severely damaged. This is because the land on either side of the fault moves in different directions horizontally and vertically by up to a few metres.

Landslides. Strong ground shaking is a major cause of landslides in New Zealand. Factors affecting slope stability include the slope angle and height, slope modification, underlying geology, the history of landslides in the area and groundwater content. Properties above and below unstable slopes are also at risk from undermining and burial respectively. In the 1929 magnitude 7.8 Murchison earthquake, 16 of the 17 fatalities were as a result of landslides. Flash floods can result from landslides that dam waterways, which then give way, releasing the water. Sediment from landslides in hilly areas (as well as liquefaction silt) can also flow downstream and build up the level of river beds. This reduces the capacity of rivers, causing on-going flooding issues.

Liquefaction occurs when saturated, unconsolidated (loose) soil is subjected to strong shaking. Effects range from 'sand boils' that cause silt and water to accumulate on the ground surface, to serious ground damage, such as subsidence.

Subsidence can lead to increased flooding caused by changes to natural drainage patterns. Liquefaction can cause substantial damage to buildings and underground services such as tanks and pipelines, as was seen following the Canterbury earthquakes in 2010-11. Liquefaction can also cause cracks in the ground that may be a few metres deep, but are usually only tens of centimetres wide.

Tsunami. Large earthquakes can generate tsunami if they cause significant uplift or down thrust of the sea floor, or trigger coastal or submarine landslides. Tsunami generated by local earthquakes are very dangerous as they can arrive at the nearest shore within minutes. Natural warnings (e.g., if you feel shaking for longer than one minute, or if it is too strong to stand up in) may be your only cue to head to higher ground or inland immediately.

Fire. Post-earthquake fire is a highly variable phenomenon. Most earthquakes are not accompanied by fire, but devastating fires have occurred after earthquakes. In Napier, following the 1931 earthquake, much of the central business district burned and the loss due to the fire was about equal to the loss from the ground shaking. The 1906 San Francisco and 1923 Tokyo earthquakes caused fire losses that greatly exceeded the losses from ground shaking. The fires are often caused by the ignition of leaking gas from pipes that were ruptured by the ground shaking, and from fallen power lines.

The critical factors in creating a fire risk are weather (particularly wind), water, and building stock. If the shaking is strong enough to disrupt the water supply, winds are strong enough to spread the fire across city streets lined with wooden buildings, and vegetation is flammable following hot, dry weather, then the scene is set for a high level of fire risk.

Water quality. The environment can also be damaged by an earthquake, particularly due to decreased water quality in streams, rivers and estuaries. This is often caused by ruptured wastewater and stormwater lines, and from an increase in sediment in the streams. Groundwater levels can also change due to an earthquake.

How can I protect myself in an earthquake?

Ground shaking during an earthquake is seldom the direct cause of death or injury. Most earthquake-related injuries and deaths result from collapsing walls and roofs, and falling glass and objects. It is important for a person to move as little as possible to reach the place of safety he or she has identified in order to drop, cover and hold, because most injuries occur when people try to move more than a short distance during the shaking.

Much of the damage caused by earthquakes is predictable and preventable. We must all work together in our communities to apply our knowledge to enact and enforce up-to-date building codes, retrofit older unsafe buildings, and avoid building in hazardous areas, such as those prone to landslides and liquefaction. We must also look for and eliminate hazards at home, at our children's preschools and schools, in our workplace and public areas, and prepare necessary items for an emergency. And we must learn and practise what to do if an earthquake occurs ("Drop, cover, hold").

Action messages

Be prepared for an earthquake: protect yourself

If you are at home, you should:

1. Discuss with members of your household the possibility of earthquakes and what to do to stay safe if one occurs. Knowing how to respond will help reduce fear.
2. Develop an emergency communication plan in your family (for all hazards) in case family members are separated from one another during an earthquake, such as during the day when adults are at work and children at school. Have a plan for getting back together.
3. Pick safe places in each room of your home and your office or school. A safe place could be under a piece of furniture, such as a sturdy table or desk, or against an interior wall away from windows, bookcases, or tall furniture that could fall on you. The shorter the distance to your safe place, the less likely it is that you will be injured by furniture or fixtures that can become flying debris during the shaking. Injury statistics show that persons moving as little as three metres during an earthquake's shaking are more likely to experience injury than those who don't move that far.
4. Practise **drop, cover, and hold** in each safe place. Drop to the floor, take cover under a sturdy piece of furniture, and hold on to a leg of the furniture. If suitable furniture is not nearby, sit on the floor next to an interior wall and cover your head and neck with your arms. Responding quickly in an earthquake may help protect you from injury.
5. Practise drop, cover, and hold at least twice a year.
6. Keep a torch and sturdy shoes by each person's bed.
7. Inform guests, babysitters, and caregivers of earthquake plans. Everyone in your home should know what to do if an earthquake occurs, even if you are not there at the time.

If you are at work, you should:

8. Identify a safe clear area outside as an assembly point. This should be pre-planned by your workplace, noting that your normal fire evacuation assembly point may not be appropriate after an earthquake.

CORE ACTION MESSAGES

- ▶ Identify safe places in each room.
- ▶ Practise drop, cover and hold.
- ▶ At work, preplan a safe, clear area outside as an assembly point.

For general preparedness, every household should create and practice a Household Emergency Plan and assemble and maintain Emergency Survival Items and a Getaway Kit. In addition, every household should take earthquake-specific precautions and plan and practise what to do in the event of an earthquake.

Protect your property

How to protect your property:

9. Make sure your home is securely anchored to its foundation. Depending on the type of construction and the materials used in building your home, you may need to have it bolted or secured in another way to its foundation. If you are not sure that your home is securely anchored, contact a professional engineer or professional building contractor. Buildings securely attached to their foundations are less likely to be severely damaged during earthquakes and become uninhabitable.
10. Brace hot water cylinders and gas appliances to wall framing. If the water heater tips over, the gas line could break, causing a fire hazard, and the water line could rupture. The water cylinder may be your best source of drinkable water following an earthquake. Consider having a certifying plumber and gasfitter install flexible fittings for gas and water pipes.
11. Securely fix bookcases, china cabinets, and other tall furniture to wall framing. Brace or anchor high or top-heavy objects. During an earthquake, these items can fall over, causing damage or injury.
12. Hang heavy items, such as pictures and mirrors, away from beds, couches, and anywhere people sleep or sit. Earthquakes can knock things off walls, causing damage or injury. Close picture hooks to prevent the string or wire disengaging as the item swings.
13. Brace heavy overhead light fixtures. During earthquakes, overhead light fixtures may fall, causing damage or injury.
14. Install strong latches on cabinet doors. The contents of cabinets can shift during the shaking of an earthquake. Latches will prevent cabinets from opening and spilling their contents. Place heavy objects on shelves near the floor.
15. Secure large ornamental items that might fall and break.
16. Store weed killers, pesticides, and flammable products securely in closed, latched metal cabinets.
17. Evaluate places your pets are kept and like to hide in. Ensure they are as safe as possible. Consider what might fall in or on that place and if there are hazardous substances there.
18. Consider having your home evaluated by a Chartered Professional Engineer or other Licensed Building Practitioner. This is particularly important if there are signs of structural defects, such as foundation cracks. Earthquakes can turn cracks into ruptures and make smaller problems bigger. Heavy, unreinforced chimneys can also collapse, causing damage to the structure and threatening lives.

CORE ACTION MESSAGES

- ▶ **Make sure your home is securely anchored to its foundations.**
- ▶ **Secure heavy objects both inside and outside the home.**

What to do during an earthquake

If you are inside when the shaking starts, you should:

19. Drop, cover, and hold.
20. Move only a few steps to the safest nearby place, away from windows that may shatter and large furniture that could fall.
21. If you are elderly or have limited mobility, remain where you are, bracing yourself in place against the shaking.
22. If you are in bed, stay there, hold on, and protect your head with a pillow. You are less likely to be injured if you stay in bed.
23. Stay indoors until the shaking stops and you are sure it is safe to exit. Most buildings in New Zealand provide greater safety inside.

If you are outdoors when the shaking starts, you should:

24. Outside: if possible find a clear area away from buildings, trees, streetlights and power lines, as these may fall causing injuries during an earthquake. Drop to the ground and stay there until the shaking stops.
25. Coastal area: drop, cover and hold during an earthquake. If the shaking is so strong that you cannot stand up then move immediately to higher ground when the shaking stops or, if the area is flat, move as far inland as possible. Earthquakes off the coast can generate a tsunami and there may be little time for anything other than to run uphill or inland.
26. Mountainous areas or near unstable slopes or cliffs: be alert for falling rocks and other debris that could be loosened by the earthquake. Earthquakes can trigger landslides.
27. Vehicle: if possible, pull over to a clear location, stop and stay there with your seatbelt fastened until the shaking stops. Trees, power lines, poles, street signs, overpasses and other overhead items may fall during earthquakes. Once the shaking has stopped, proceed with caution. Avoid bridges, tunnels, cliff roads or ramps that might have been damaged by the quake. Listen to your car radio for advice from Civil Defence Emergency Management.

CORE ACTION MESSAGES

- ▶ **If you are outside, find a clear spot and drop to the ground.**
- ▶ **If you are inside when the shaking starts, move no more than a few steps to a safe place and drop, cover and hold.**

What to do after an earthquake

When the shaking stops, you should:

28. Look quickly for damage around you, particularly in buildings where furniture and fittings may have become hazardous. Look for small fires and if practicably possible, extinguish them.
29. Check yourself for injuries and receive or apply first aid if necessary, before helping other injured or trapped persons. Check your neighbours.
30. Expect aftershocks. Each time you feel one, drop, cover, and hold. Aftershocks can occur minutes, days, weeks and even months following an earthquake.
31. Listen to a portable, battery-operated radio for updated emergency information and instructions. Civil Defence Emergency Management will provide the most appropriate advice for your particular situation. Remember this will not be immediately available. If the electricity is out, this may be your main source of information.
32. If you are away from home during the earthquake, listen to the radio and take advice from authorities on conditions, safe routes, public transport arrangements etc.
33. Telephone and mobile phones are frequently overloaded in disaster situations and need to be clear for emergency calls to get through. Use your phone only to make a brief call to your Household Emergency Plan contact and to report life-threatening emergencies. Mobile texting can be more effective than attempting phone calls.
34. If available, put on long trousers, a long-sleeved top, sturdy shoes and heavy duty gloves to protect yourself from injury by broken objects.
35. Help people who require special assistance; infants, elderly people, those without transportation, families who may need additional help in an emergency situation, people with disabilities and the people who care for them.
36. Be alert for and observe official warnings.

If you are at work

37. Care for the injured and select a leader.
38. Look outside if possible, to see what has happened in the surrounding area. This will help prepare your exit from the building.
39. Work as a team to establish a safe route to an assembly area before leaving the building.
40. First check for damage to stairways and for fallen/falling debris at your exit point(s) to determine a safe exit route.
41. Identify a safe clear area outside as an assembly point. This should be pre-planned by your workplace, noting that your normal fire evacuation assembly point may not be appropriate after an earthquake.
42. Ensure all persons inside are aware of the exit route and assembly point.

43. Take bag, phone, wallet, coat, phone charger and any emergency supplies you have ('getaway' or 'go' bag)
44. Once outside move quickly away from buildings to the assembly point, being conscious of the risk of injury from falling debris. Do a roll call to ensure everyone is accounted for.
45. Keep a register of people present, log when they leave and their intentions (e.g. walk home). Arrange to travel in groups where possible.
46. If your fire alarm activates, carry out the steps from number 37 above, taking extra care to:
 - Check for and extinguish small fires if safe and able to be done quickly
 - Check exit paths for safety before using them - never use lifts, and seek alternatives if stairs are missing or detached from walls etc.
 - Assist injured people to evacuate or note their locations to pass on to rescuers

If you are in a building away from home

47. If in a store, unfamiliar commercial building or on public transport, follow the instructions of those in charge.

If you have pets or livestock

48. Try to keep pets calm and under control so that they don't try to run away. Keep leashes and pet-carrier boxes handy. Make sure they have plenty of water. Pets may become disoriented, particularly if the disaster has affected scent markers that normally allow them to find their way home.
49. If farming, check livestock access to fresh water as well as their general welfare. Check fences to ensure livestock are secure.
50. Be aware also that the behaviour of pets and livestock may change dramatically after an earthquake and they may become more aggressive or defensive.

CORE ACTION MESSAGES

- ▶ **Check on those around you (including neighbours) for injuries, and identify any immediate hazards caused by the earthquake.**
- ▶ **Expect aftershocks.**
- ▶ **Listen to the radio for updated emergency information.**
- ▶ **Before leaving a building, identify a safe assembly point away from the building - a clear area away from potential dangers such as tall buildings, power lines etc.**
- ▶ **In the workplace, work as a team to establish a safe route to an assembly area before leaving the building.**

Building damage assessment

51. Check for damage outside your home or building. Watch out for fallen power lines, as they may still be live. Be aware that parts of the building may have come loose above, and could fall in an aftershock.
52. Then, if the structures appear safe to enter, check for damage inside. Building damage may have occurred where you least expect it. Carefully watch every step you take, looking up and down. Get out of the building if you think it is unsafe.
53. Open doors cautiously, including closet and cabinet doors, as contents may have shifted during shaking and could fall, creating a risk of further damage or injury.
54. Examine walls, floors, doors, staircases and windows. Watch for loose plaster, wall cladding and ceilings that could fall.
55. Hazardous materials: Check for and clean up any spilled medications, bleach, chemicals or flammable liquids immediately, if safe to do so. Ensure extreme care and safety precautions are taken while handling any dangerous liquids.

Utility services

56. Electrical system: If you see sparks, smell burning insulation or broken/frayed wires are visible, turn off the electricity at the main fuse box or circuit breaker. Do not step in water to get to the fuse box or circuit breaker.
57. Gas leaks: If you smell gas or hear a blowing or hissing noise, open a window and get everyone out quickly. Turn off the gas, using the outside main valve if you can. If you turn off the gas for any reason, it must ONLY be turned back on by a registered plumber or gas fitter. Do not smoke or use a naked flame.
58. Water lines: If street water pipes are damaged, avoid using water from the tap. You can obtain safe water from undamaged hot water cylinders or from your emergency stored water.
59. Sewage lines: If you suspect sewage lines are damaged, avoid using the toilets - check with your local council and follow their advice.

Insurance

Property and contents insurance actions:

60. Residential property and contents damage caused by earthquakes is covered by Earthquake Commission (EQC) insurance, providing you already have house and/or contents insurance. If your property has been damaged, lodge a claim by calling 0800 326 243 or visit www.eqc.govt.nz.
61. If there is significant damage to your property, ring your insurance company as soon as possible. In almost all cases the insurance company will send an insurance assessor to look at your property. They will confirm what repairs and replacements are needed and what is covered by your policy.
62. Photograph or video record your damaged property and list the damage to your property and belongings.
63. If your insurance policy covers you for loss of perishable goods, make a list of all the foods you throw away. Include anything in your fridge or freezer ruined by loss of power.

Ask your insurer:

64. How long it will be before the assessor visits.
65. If they will cover the cost of temporary accommodation. This could be a nearby motel, bed and breakfast, a caravan or a rented house.

Things to help with your insurance claim:

66. Confirm the insurance company will pay for any service or equipment you need.
67. Make a note of all telephone calls. Record the date, name of liaison and what was agreed.
68. Keep copies of all letters and emails you send and receive.
69. Keep receipts.
70. Don't throw anything away until told (except ruined food).
71. If you rent your property, contact your landlord and your contents insurance company as soon as possible.

Earthquakes general information

Media and community education ideas

Ask your community to adopt and enforce up-to-date building codes. Modern building codes are an important risk reduction measure. These codes identify construction techniques for buildings that help them withstand earthquakes without collapsing and killing people. Codes are updated regularly to make use of information learned from recent damaging earthquakes, so adopting and enforcing up-to-date codes is essential.

Ask your local newspaper or radio or television station to:

72. Present information about how to respond if an earthquake occurs.
73. Do a series on locating hazards in homes, workplaces, day care centres, schools, etc.
74. Provide tips on how to conduct earthquake drills.
75. Organise interviews with representatives of the gas, electricity, and water companies about how individuals should prepare for an earthquake.

Fiction and facts

Fiction: During an earthquake, you should get into a doorway for protection.

Fact: In modern homes, doorways are no stronger than any other part of the structure and usually have doors that will swing and can injure you. During an earthquake, you should get under a sturdy piece of furniture and hold on.

Fiction: During an earthquake, the earth cracks open and people, cars, and animals can fall into the cracks.

Fact: The earth does not crack open like the Grand Canyon. The earth moves and rumbles and, during that movement, small cracks can form. The usual displacements of the earth during an earthquake are caused by up-and-down movements, so shifts in the height of the ground are more likely than chasm-like cracks.

Fiction: Animals can sense earthquakes and give advanced warning.

Fact: Animals may be able to sense the first low-frequency waves of an earthquake that occurs deep within the earth, but the damage-causing primary and secondary waves follow just seconds behind. Animals do not make good earthquake warning devices.

Fiction: Big earthquakes always happen in the early morning.

Fact: Several recent damaging earthquakes have occurred in the early morning, so many people believe that all big earthquakes happen then. In fact, earthquakes occur at all times of day.

Fiction: It's hot and dry – earthquake weather!

Fact: 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 kilometres below the region affected by surface weather. People tend to notice earthquakes that fit the pattern and forget the ones that do not. In all regions of the world, “earthquake weather” tends to be whatever type of weather prevailed at the time of the region's most memorable earthquake.

Fiction: We have good building codes so we must have good buildings.

Fact: New Zealand's building codes are among the world's best, and as a result modern (post-1980) buildings are most unlikely to collapse in even the strongest earthquake shaking. However, there are no grounds for complacency. The majority of our buildings were constructed before 1980, and even though these are unlikely to collapse, many of them, along with essential services, will be so badly damaged in a large earthquake as to be unusable. For this reason New Zealand's cities could be rendered non-functional by earthquake damage to buildings, their contents and to infrastructure.

Fiction: Scientists can now predict earthquakes.

Fact: Scientists do not know how to predict earthquakes, and they do not expect to know how to any time in the foreseeable future. However, based on scientific data, probabilities can be calculated for potential future earthquakes.

Fiction: "Triangle of life" advice has replaced "Drop, cover and hold".

Fact: Drop, cover and hold is the best advice for New Zealand conditions where falling objects present a real threat.

Useful links

- www.getthru.govt.nz
- www.gns.cri.nz
- www.geonet.org.nz
- www.eqc.govt.nz
- www.teara.govt.nz (search for 'earthquakes')
- www.rural-support.org.nz/
- www.maf.govt.nz/mafnet/rural-nz/adverse-events/
- www.mpi.govt.nz/protection-and-response/response-and-management/adverse-events/

Useful numbers

A wide range of local services might be useful to people following an earthquake. People should be encouraged to have the contacts of the services they might need, depending on their household. These include:

- Local authority emergency helpline
- Insurance company 24-hour
- Insurance number and policy number
- Local radio station (frequencies)
- School
- Family, neighbours and baby sitters
- Bank phone number and details
- Work phone numbers
- Medical Centre/GP
- Local police station
- Vet/kennel/cattery
- Gas supplier and meter number
- Electricity supplier and meter number
- Water supplier and meter number
- Electrician
- Plumber
- Builder