

Measuring earthquakes

Earthquakes can be described by either their size or their intensity. This fact sheet explains the difference between the two.

There are two main ways of describing an earthquake: the Magnitude scale and the Modified Mercalli Intensity (MM) scale. The Magnitude is the one most commonly used by the media when reporting an earthquake. However it does not actually describe the damage the earthquake causes. The Magnitude describes the size of the earthquake whereas the MM scale describes how the earthquake was felt.

Magnitude

The Magnitude is a measure of the amount of energy released by the earthquake. Each rise in number on the scale is an increasingly large rise in energy - for example an M6 earthquake has around 30 times more energy than an M5 earthquake, and around 900 times more energy than an M4 earthquake. But an earthquake may happen far away from a community, or right underneath one - this distance makes a huge difference to how that community is affected.

Modified Mercalli Intensity scale

The MM scale gives a description of how the earthquake will or may be felt. Because it depends on local ground conditions the effects on an area can be predicted and planned for. The MM scale uses roman numerals to describe the effects of an earthquake (see table, overpage).

It is important to realise the damage described in the MM scale values is an example only, so not everything mentioned will happen in every earthquake or evenly throughout an area. The words used to describe damage may vary slightly, and describing an earthquake using the MM scale depends on the observer's opinion.

An earthquake has the same energy value or Magnitude wherever you are, but the intensity felt from the earthquake, measured by MM, differs depending on distance from the earthquake and local ground conditions.

What are the likely effects?

How an earthquake affects an area depends on its size and how far it is from people, buildings and services.

However, the damage earthquakes cause also depends on the type of buildings, services and ground conditions in an area. Unreinforced buildings will suffer far more than buildings of modern construction, and those on sand for instance, will suffer more than those on rock or compacted ground.

The Modified Mercalli Intensity Scale

MM value Damage likely to occur
(Effects described in lower values can also be expected in higher values)

| | |
|------|---|
| I | Not felt except in very favourable conditions. |
| II | Felt by a few on upper floors of buildings or at rest. |
| III | Noticeable indoors, may be mistaken for a passing truck. Hanging objects may swing slightly. |
| IV | Felt indoors by many, may wake people at night. Some dishes and windows rattle, walls creak. |
| V | Felt by nearly everyone. Some dishes and windows break, some items move and unstable objects overturn, some plaster cracks, open doors may swing. |
| VI | Felt by all. Some furniture moves, drawers may open, plaster and stucco may crack. |
| VII | Most people alarmed. Difficult to stand up and noticed by drivers. Considerable damage in poorly designed and built houses, but only light to moderate damage in ordinary, well constructed buildings. Unrestrained water tanks may move and leak. Domestic chimneys may crack or fall. |
| VIII | Most people frightened. Driving vehicles becomes difficult. Damage severe in poorly built structures and moderate in well-built buildings. Houses not secured to foundations may move. |
| IX | Considerable damage in specially designed structures, well designed frame structures thrown out of plumb, possible partial collapse and severe damage in ordinary buildings. Some buildings may shift or come off foundations. Brick veneers may fall and expose frames. |
| X | Some well-built wooden buildings destroyed. Most unreinforced masonry buildings severely damaged or destroyed. Specially designed structures (ie bridges) seriously damaged. Train rails may bend. |
| XI | Extensive damage to most buildings. Bridges, railway lines and buried pipes damaged or destroyed. |
| XII | Widespread damage to buildings and infrastructure. Objects may be thrown into the air. Sight lines may be distorted. |

Compiled from several sources

So next time you hear an earthquake reported, you will know from the value given whether it relates to the energy of the earthquake or how it was felt in a particular area.

Further reading Hazardfacts in the Earthquake series:

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| Measuring Earthquakes | Hazardfacts H06 |
| Earthquakes in Auckland | Hazardfacts H07 |
| Earthquake Hazards | Hazardfacts H08 |
| Auckland's Tsunami Hazard | Hazardfacts H09 |

Hull et al, April 1995, Earthquake Hazards in the Auckland Region, Auckland Regional Council Technical Publication No. 57, Auckland Regional Council

Eiby, G A, 1989, Earthquakes, Heinemann Reed, Auckland.

For information on what to do in an earthquake, contact a civil defence emergency management advisor at your local council.



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