Earthquake intensity scale pdf

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The size of an earthquake is often described using magnitude, which is the amount of energy released during an earthquake. However, not all of the energy released in an earthquake will necessarily be felt at the surface, depending on the earthquake's depth. In New Zealand, where earthquakes occur from near the surface right down to a depth of over 600 km, the Modified Mercalli intensity scale is a better indicator of an earthquake's effects on people and their environment. Simplified New Zealand MMI Scale The original Mercalli scale graded the effects of earthquakes into ten steps. The scale used in New Zealand is a twelve step ranking, hence Modified Mercalli (MM), with 1 representing the weakest of shaking, through to 12 representing almost complete destruction. The descriptions below are a simplified version of the New Zealand Modified Mercalli Intensity scale. The table shows a simplified version of the New Zealand Modified Mercalli Intensity scale. We have added a generalised Intensity term. MMIIntensityDescription 1 unnoticeableBarely sensed only by a very few people. 2 unnoticeableFelt only by a few people at rest in houses or on upper floors. 3 weakFelt indoors as a light vibration. Hanging objects may swing slightly. 4 lightGenerally noticed indoors, but not outside, as a moderate vibration or jolt. Light sleepers may be awakened. Walls may creak, and glassware, crockery, doors or windows rattle. 5 moderateGenerally felt outside and by almost everyone indoors. Most sleepers are awakened and a few people alarmed. Small objects are shifted or overturned, and pictures knock against the wall. Some glassware and crockery may break, and loosely secured doors may swing open and shut. 6 strongFelt by all. People and animals are alarmed, and many run outside. Walking steadily is difficult. Furniture and appliances may move on smooth surfaces, and objects fall from walls and shelves. Glassware and crockery break. Slight non-structural damage to buildings may occur. 7 severeGeneral alarm. People experience difficulty standing. Furniture and appliances are shifted. Substantial damage to fragile or unsecured objects. A few weak buildings are damaged. 8 extremeAlarm may approach panic. A few buildings are damaged and some weak buildings are destroyed. 9 extremeSome buildings are damaged and many weak buildings are destroyed. 10 extremeMany buildings are damaged and most weak buildings are destroyed. 11 extremeMost buildings are damaged and many buildings are destroyed. 12 extremeAll buildings are damaged and most buildings are destroyed. Common Alerting Protocol Common Alerting Protocol (CAP) is a format for exchanging all-hazard emergency alerts and public warnings. CAP describes the severity of impact of a hazard as one of four terms: minor, moderate, severe or extreme. The table shows how GeoNet classes these CAP Severity terms against the Modified Mercalli intensity descriptions. MMIIntensityCAP Severity 1unnoticeableMinor 2unnoticeableMinor 3weakMinor 4lightMinor 5moderateMinor 6strongModerate 7severeSevere 8extremeExtreme 9extremeExtreme 10extremeExtreme 11extremeExtreme 12extremeExtreme The violence of seismic shaking varies considerably over a single affected area. Because the entire range of observed effects is not capable of simple quantitative definition, the strength of the shaking is commonly estimated by reference to intensity scales that describe the effects in qualitative terms. Intensity scales date from the late 19th and early 20th centuries, before seismographs capable of accurate measurement of ground motion were developed. Since that time, the divisions in these scales have been associated with measurable accelerations of the local ground shaking. Intensity depends, however, in a complicated way not only on ground accelerations but also on the periods and other features of seismic waves, the distance of the measuring point from the source, and the local geologic structure. Furthermore, earthquake intensity, or strength, is distinct from earthquake magnitude, which is a measure of the amplitude, or size, of seismic waves as specified by a seismograph reading. See below Earthquake magnitude. A number of different intensity scales have been set up during the past century and applied to both current and ancient destructive earthquakes. For many years the most widely used was a 10-point scale devised in 1878 by Michele Stefano de Rossi and Franc̦ois-Alphonse Forel. The scale now generally employed in North America is the Mercalli scale, as modified by Harry O. Wood and Frank Neumann in 1931, in which intensity is considered to be more suitably graded. A 12-point abridged form of the modified Mercalli scale is provided below. Modified Mercalli intensity VIII is roughly correlated with peak accelerations of about one-quarter that of gravity (g = 9.8 metres, or 32.2 feet, per second squared) and ground velocities of 20 cm (8 inches) per second. Alternative scales have been developed in both Japan and Europe for local conditions. The European (MSK) scale of 12 grades is similar to the abridged version of the Mercalli. Modified Mercalli scale of earthquake intensityI. Not felt. Marginal and long-period effects of large earthquakes.II. Felt by persons at rest, on upper floors, or otherwise favourably placed to sense tremors.III. Felt indoors. Hanging objects swing. Vibrations are similar to those caused by the passing of light trucks. Duration can be estimated.IV. Vibrations are similar to those caused by the passing of heavy trucks (or a jolt similar to that caused by a heavy ball striking the walls). Standing automobiles rock. Windows, dishes, doors rattle. Glasses clink, crockery clashes. In the upper range of grade IV, wooden walls and frames creak.V. Felt outdoors; direction may be estimated. Sleepers awaken. Liquids are disturbed, some spilled. Small objects are displaced or upset. Doors swing, open, close. Pendulum clocks stop, start, change rate.VI. Felt by all; many are frightened and run outdoors. Persons walk unsteadily. Pictures fall off walls. Furniture moves or overturns. Weak plaster and masonry cracks. Small bells ring (church, school). Trees, bushes shake.VII. Difficult to stand. Noticed by drivers of automobiles. Hanging objects quivering. Furniture broken. Damage to weak masonry. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices. Waves on ponds; water turbid with mud. Small slides and caving along sand or gravel banks. Large bells ringing. Concrete irrigation ditches damaged.VIII. Steering of automobiles affected. Damage to masonry; partial collapse. Some damage to reinforced masonry; none to reinforced masonry designed to resist lateral forces. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed pilings broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.IX. General panic. Weak masonry destroyed; ordinary masonry heavily damaged, sometimes with complete collapse; reinforced masonry seriously damaged. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas, sand and mud ejected; earthquake fountains, sand craters.X. Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, and so on. Sand and mud shifted horizontally on beaches and flat land. Railway rails bent slightly.XI. Rails bent greatly. Underground pipelines completely out of service.XII. Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air. With the use of an intensity scale, it is possible to summarize such data for an earthquake by constructing isoseismal curves, which are lines that connect points of equal intensity. If there were complete symmetry about the vertical through the earthquake’s focus, isoseismals would be circles with the epicentre (the point at the surface of the Earth immediately above where the earthquake originated) as the centre. However, because of the many unsymmetrical geologic factors influencing intensity, the curves are often far from circular. The most probable position of the epicentre is often assumed to be at a point inside the area of highest intensity. In some cases, instrumental data verify this calculation, but not infrequently the true epicentre lies outside the area of greatest intensity. Magnitude scales can be used to describe earthquakes so small that they are expressed in negative numbers. The scale also has no upper limit. Learn more about how we measure earthquake magnitude. Earthquake Magnitude Scale Magnitude Earthquake Effects Estimated Number Each Year 2.5 or less Usually not felt, but can be recorded by seismograph. Millions 2.5 to 5.4 Often felt, but only causes minor damage. 500,000 5.5 to 6.0 Slight damage to buildings and other structures. 350 6.1 to 6.9 May cause a lot of damage in very populated areas. 100 7.0 to 7.9 Major earthquake. Serious damage. 10-15 8.0 or greater Great earthquake. Can totally destroy communities near the epicenter. One every year or two Modified Mercalli Intensity Scale

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