ShakeMap:

A BROADCASTER'S GUIDE TO REPORTING EARTHQUAKE INTENSITY

What is earthquake intensity? How does ShakeMap display intensity?

ShakeMap is a geographic representation of the ground shaking produced by an earthquake. Intensity is one of the ways that ground shaking is expressed, along with more quantitative measures like velocity and acceleration. The information ShakeMap presents is different from the earthquake magnitude. Magnitude is the number (for example, 7.1) that represents the energy released in an earthquake; a single number representing magnitude is assigned to each earthquake. Intensity, on the other hand, is a measure of how the ground shook at a particular site. So, while an earthquake has one magnitude and one epicenter, it produces a range of ground shaking levels at sites throughout the region. These different intensities depend on distance from the earthquake, the rock and soil conditions at geographical sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the Earth's crust. ShakeMap focuses on the ground shaking produced by the earthquake, rather than the characteristics of the earthquake source.

How are earthquake intensities expressed?

Intensities portray the effects of an earthquake in a particular location. These effects include potential damage, perception of shaking and permanent changes in topography. Whether there was damage, and the severity of observed damage, is one element of intensity. Intensity scales also take into account how the earthquake was perceived by persons in a geographic location ranging from "not felt" to "unable to stand." The impact of the earthquake shaking on the ground, whether, for example, cracks or displacements occurred, or in some cases of severe shaking, landslides, is also a feature of measured intensity.

The most popular intensity scale used in the United States is the Modified Mercalli Scale (MMI) first developed in 1931. This scale uses Roman Numerals to represent progressively greater shaking from MMI I in which "people do not feel any earth movement" to MMI X in which "most buildings and their foundations are destroyed, bridges and dams are severely damaged and large landslides occur." Historically, intensities were derived in the months following an earthquake through questionnaires sent to Post Offices in the impacted area. Postal officials were asked to report the effects of shaking in their district and their observations were combined with those of scientists and engineers. When all the questionnaires and observations were combined, they were used to construct an intensity map of the earthquake.

With the development of the new California Integrated Seismic Network, intensity (ShakeMaps) maps can be generated automatically from measured ground acceleration

and velocity. These “instrumental intensities” are calculated and mapped within 5 minutes of the earthquake and are thus termed “real-time” maps. To the extent possible, shaking expressed as intensity in ShakeMap correspond to the observed intensity of the older Modified Mercalli scale. To provide news broadcasters guidance in the interpretation of intensities reported in ShakeMap, we have provided below the ten intensity levels and the human perception, damage and topographic change associated with each level.

It is important to note in reporting intensity information contained in ShakeMap that shaking and damage vary considerably from location to location, and only some structures may exhibit the effects noted below in an area assigned a particular intensity.

MODIFIED MERCALLI INTENSITY SCALE

MMI Value	**Full Description**
I	People do not feel any earth movement.
II	Felt by persons at rest, on upper floors of tall buildings
III.	Felt by people indoors. Hanging objects swing back and forth. Vibration from the earthquake may seem like the passing of light trucks. May not be recognized as an earthquake.
IV	Hanging objects swing. Vibration may seem like the passing of heavy trucks or a jolt, like a heavy ball striking the walls. Parked vehicles may rock noticeably Windows, dishes, doors may rattle and glasses clink. In the upper range of IV, walls of wood frame buildings may creak.
V	Almost everyone feels movement whether inside or outdoors. Sleeping people are awakened. Liquids in containers are disturbed; some are spilled. Small unstable objects are displaced or overturned. Doors swing, close, or open. Shutters, pictures on the wall move.
VI	Felt by all; some are frightened and take cover. People have difficulty walking due to motion. Objects fall from shelves and dishes, glassware and ceramics may be broken. Pictures fall off walls. Furniture moves or is overturned. Weak plaster and masonry cracked. Damage slight in poorly constructed buildings. Trees, bushes shaken visibly, or are heard rustling.

VII People have difficulty standing. Drivers on the road feel their cars shaking. Furniture may be overturned and broken. Loose bricks fall from buildings and masonry walls and cracks in plaster and masonry may appear. Weak chimneys may break at the roofline. Damage is slight to moderate in well-built structures; considerable in poorly constructed buildings and facilities.

VIII Drivers have trouble steering. Tall structures such as towers, monuments and chimneys may twist and fall. Wood frame houses that are not bolted to their foundations may shift and sustain serious damage. Damage is slight to moderate in well-constructed buildings, considerable in poorly constructed buildings. Branches are broken and fall from trees. Changes occur in flow or temperature of springs and wells. Cracks appear in wet ground and on steep slopes.

IX. Masonry structures and poorly constructed buildings suffer serious damage or collapse. Frame structures, if not bolted, shift off foundations. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in the ground. In alluvial areas, sand and mud ejected and sand craters are formed.

X Most masonry and frame structures destroyed along with their foundations. Some well-built wooden structures and bridges are destroyed. Serious damage to dams, dikes, and embankments. Large landslides occur. Water thrown on the banks of canals, rivers, and lakes. Sand and mud shift horizontally on beaches and flat land. Rails bent.