

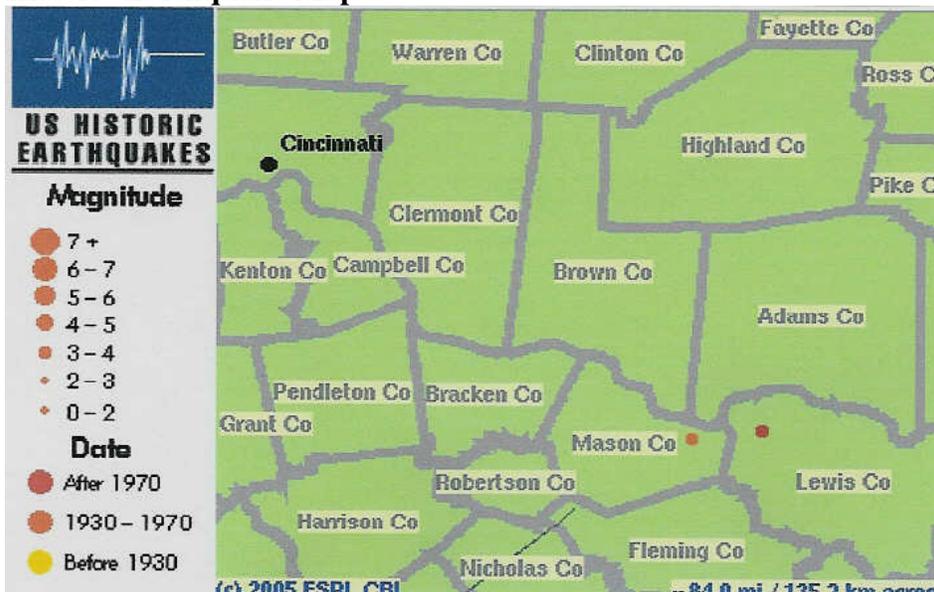
## Composite of Brown County

Earthquakes, and the potential damage from earthquakes, are one of nature's most violent acts. Earthquakes are caused by the release of strain between or within the Earth's tectonic plates. The severity of an earthquake depends on the amount of strain that is released along a fault or at the epicenter of an earthquake.

## History

About 200 earthquakes occur each year in the New Madrid seismic zone, but most are too small to be felt by people. As such, there is very little recent history regarding earthquakes and Brown County. The chart below reflects some of the most recent data related to earthquakes in the southwestern Ohio region.

### Historic Earthquake Map



source: [www.esri.com/hazards](http://www.esri.com/hazards)

The historic earthquake event data displayed on this site is drawn from ESRI's ArcAtlas: Our Earth data set. The data has been overlaid on topographic maps, fault lines, and earthquake risk zones compiled from several sources, including the USGS.

## Measuring Earthquakes

### The Richter Scale

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The Richter Scale is a measurement of the magnitude, or the amount of energy released by an earthquake. Magnitude is a measure of the strength of an earthquake or strain energy released by it, as determined by seismographic observations.

An increase of one unit of magnitude (for example, from 4.6 to 5.6) represents a 10-fold increase in wave amplitude on a seismogram or approximately a 30-fold increase in the energy released. There is no beginning nor end to this scale. However, rock mechanics seems to preclude earthquakes smaller than about -1 or larger than about 9.5. A magnitude -1.0 event release about 900 times less energy than a magnitude 1.0 quake. Except in special circumstances, earthquakes below magnitude 2.5 are not generally felt by humans.

Intensity is a measure of the effects of an earthquake at a particular place on humans, structures and (or) the land itself. The intensity at a point depends not only upon the strength of the earthquake (magnitude) but also upon the distance from the earthquake to the point and the local geology at that point.

## The Modified Mercalli Intensity (MMI) scale

The Modified Mercalli Intensity scale was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place. After the occurrence of widely-felt earthquakes, the Geological Survey mails questionnaires to postmasters in the disturbed area requesting the information so that intensity values can be assigned. The results of this postal canvass and information furnished by other sources are used to assign an intensity within the felt area. The maximum observed intensity generally occurs near the epicenter.

The **lower** numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The **higher** numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.

The following is an abbreviated description of the 12 levels of Modified Mercalli intensity.

- I.** Not felt except by a very few under especially favorable conditions.
- II.** Felt only by a few persons at rest, especially on upper floors of buildings.
- III.** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

**IV.** Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

**V.** Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

**VI.** Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

**VII.** Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

**VIII.** Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

**IX.** Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

**X.** Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

**XI.** Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

**XII.** Damage total. Lines of sight and level are distorted. Objects thrown into the air.

## Vulnerability and Risk

An earthquake of high intensity could cause damage to older, unreinforced structures within Brown County. The major impact of an earthquake on Brown County is damage to businesses and infrastructure. Most structures are not insured for earthquakes, so economic costs could be substantial. The taxable value of residential real estate in Brown County totals \$309,104,380. All other parcels including farms, commercial and industrial land uses is \$131,058,220, for a total assessed value of \$440,162,600. There are more than 17,193 housing units in Brown County, with more than 71% of them owner occupied. Of the owner occupied homes 62.8% are valued between \$60,000 and \$125,000, for a median value of \$89,900.