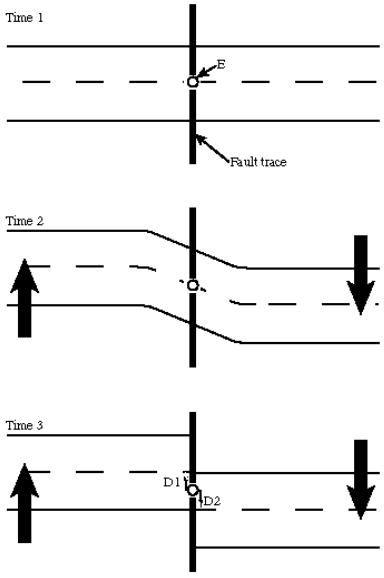
Elastic-rebound theory



Elastic rebound

The **elastic rebound theory** is an explanation for how energy is spread during earthquakes. As rocks on opposite sides of a fault are subjected to force and shift, they accumulate energy and slowly deform until their internal strength is exceeded. At that time, a sudden movement occurs along the fault, releasing the accumulated energy, and the rocks snap back to their original undeformed shape.

In geology, the elastic rebound theory was the first theory to satisfactorily explain earthquakes. Previously it was thought that ruptures of the surface were the result of strong ground shaking rather than the converse suggested by this theory.

Ancient cultural explanations of earthquakes were often along the lines of the mythical Japanese *Namazu:* A giant catfish with the islands of Japan on his back. A demigod, or daimyojin, holds a heavy stone over his head to keep him from moving. Once in a while the daimyojin is distracted so Namazu moves and the Earth trembles.

1 The theory explained

Following the great 1906 San Francisco earthquake, Harry Fielding Reid examined the displacement of the ground surface around the San Andreas Fault.[1] From his observations he concluded that the earthquake must have been the result of the elastic rebound of previously stored elastic strain energy in the rocks on either side of the fault. In an seismic period, the Earth's plates (see plate tectonics) move relative to each other except at most plate boundaries where they are locked. Thus, if a road is built across the fault as in the figure panel Time 1, it is perpendicular to the fault trace at the point E, where the fault is locked. The far field plate motions (large arrows) cause the rocks in the region of the locked fault to accrue elastic deformation, figure panel Time 2. The deformation builds at the rate of a few centimeters per year, over a time period of many years. When the accumulated strain is great enough to overcome the strength of the rocks, an earthquake occurs. During the earthquake, the portions of the rock around the fault that were locked and had not moved 'spring' back, relieving the displacement in a few seconds that the plates moved over the entire interseismic period (D1 and D2 in Time 3). The time period between Time 1 and Time 2 could be months to hundreds of years, while the change from Time 2 to Time 3 is seconds. Like an elastic band, the more the rocks are strained the more elastic energy is stored and the greater potential for an event. The stored energy is released during the rupture partly as heat, partly in damaging the rock, and partly as elastic waves. Modern measurements using GPS largely support Reid's theory as the basis of seismic movement, though actual events are often more complicated.

2 References

[1] Reid, H.F., The Mechanics of the Earthquake, The California Earthquake of April 18, 1906, Report of the State Investigation Commission, Vol.2, Carnegie Institution of Washington, Washington, D.C. 1910

3 External links

- http://earthquake.usgs.gov/regional/nca/1906/18april/reid.php

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4.1 Text

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