

### WHAT IS AN EARTHQUAKE?



An earthquake is caused by the release of energy built up in the earth where rocks are sliding past one another. As the rocks slide past each other some pieces get stuck and instead of quickly snapping off they bend a bit, yes rocks bend. When they finally are released they snap back into position, this snapping releases the energy that was stored in them into the ground in the form of waves. (This is similar to pulling on a rubber band until it breaks; when it finally breaks, it snaps back to its original shape releasing all the energy it had in it, usually in the form of a welt on your hand).

When this energy is released it travels out in all directions (including up and down) like waves around a rock thrown in a pond. These earthquake waves are what cause the ground to shake. Earthquake waves have 4 main different forms; each of these forms travels at a different rate and has a different movement.

P-waves are compressional waves and travel the fastest. They move the ground back and forth in the direction the wave travels. These waves travel through the body of the earth, so when they hit the surface they are coming from an angle or underneath. P-waves can travel through fluids.

S-waves are shear waves and travel the next fastest. They move the ground side to side opposite the direction of travel. Like P-waves they travel through the body of the earth and bounce off the different density layers to reach the surface. S-waves cannot travel through fluids.

There are also two kinds of surface earthquake waves, Rayleigh and Love waves. These earthquake waves travel along the surface of the earth; Rayleigh waves move the surface of the earth in an ellipse parallel to the direction of wave propagation, and Love waves move side to side parallel to the surface of the earth and perpendicular to the direction of wave propagation.

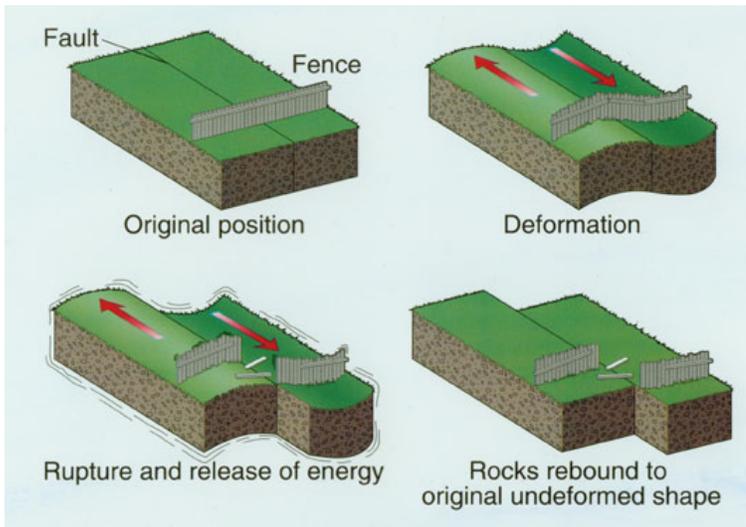
#### How far do earthquake waves travel?

Waves generated by earthquakes are like waves generated by rocks thrown in water, close to the point at which they originate they are large and over time they attenuate (get smaller). For extremely large earthquakes some of the surface waves go around the Earth multiple times, and for even small to moderate earthquakes they travel through the Earth (which is how we know what the interior of the Earth looks like).



# SCEEP

South Carolina Earthquake Education & Preparedness Program



One of the interesting things about earthquake waves is that they do travel at different speeds (P waves are faster than S-waves). Because we know how fast each wave travels through the Earth we can then use how far ahead of the S-wave the P-wave is to determine how far away the earthquake was. A good example might be if you drive at an average speed of 50 mph and your friend drives at an average speed of 40 mph you will arrive before your friend—and the farther you go the farther ahead you will be. The same is true of earthquake waves.

## Activities

### Elastic Rebound

A simple way to get a similar effect is to put your hands together so that just the tips of the fingers are holding onto each other, then pull your hands apart and grip onto the opposite hand with your finger tips. Pull hard! Then have your finger tips let go—your arms will snap away from each other. (This can also be done with two people.)

### Breaking Loose

[http://scifiles.larc.nasa.gov/docs/guides/guide2b\\_02.pdf](http://scifiles.larc.nasa.gov/docs/guides/guide2b_02.pdf)

National Science Education Standards Addressed (5-8 and 9-12):

- Science as Inquiry
- Physical Science
  - Properties of objects and changes in matter
  - Transfer of Energy and Interactions in Energy and Matter
- Earth and Space Science
  - Energy in the Earth System
- Science in Personal and Social Perspectives
  - Natural and Human-induced Hazards