

Division Of Geological Survey

HANDS ON

EARTH SCIENCE

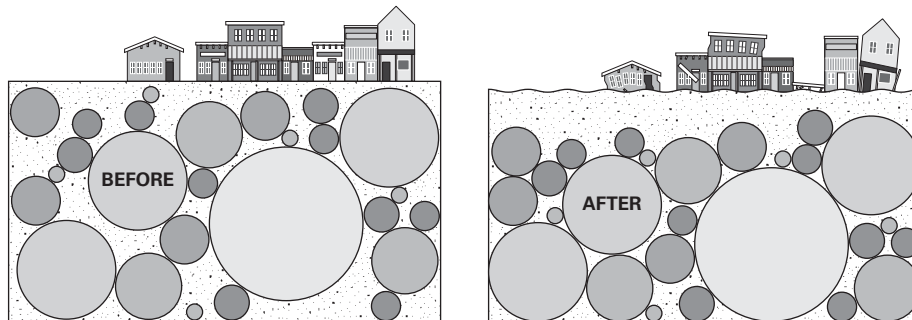
No. 17

SHAKE, RATTLE, AND LIQUEFY

Modified from a classroom lesson prepared by Wendy Gerstel,
Washington Division of Geology and Earth Resources

Background:

In Ohio, the effects of an earthquake commonly are amplified in areas underlain by sandy unconsolidated sediments in modern river valleys, such as along the Ohio River, or in buried glacial valleys, such as those in many parts of Ohio. When such sediments liquefy, they lose their structure and strength. During earthquake shaking, the individual grains of sand within a deposit collapse on each other. Any structure built on sandy sediments can sink or collapse. Picture a container of balls of different sizes—baseballs, golf balls, marbles. If they were transported by water into the container and then deposited, they would settle with spaces between them. Some of the spaces would be filled with water, some with air. When you shake the container, the balls settle against each other, and the water and air are forced to the surface. That is exactly what happens in a sediment-filled valley. The valley is a large “container” holding gazillions of “balls” or grains of sand. Shaking the container simulates an earthquake.



Purpose:

We know that flat river-valley bottoms are prone to flooding, but we think of them as being geologically stable. This experiment demonstrates what happens to sandy soils when they liquefy. You will create a model river valley, then watch how and why houses get damaged or collapse during an earthquake in a seemingly stable geologic environment.

Equipment needed:

- glass baking pan (must use glass so contents of pan can be observed)
- enough dry sand to fill pan 1-2 inches deep
- a few toy houses or wooden blocks
- water

Procedure:

1. Evenly pour the dry sand into the pan.
2. Mark the level of the sand on the side of the pan (use a washable marker).
3. Place houses or blocks gently on the surface.
4. Slowly add water until about two-thirds of the thickness of the sand is saturated.
5. Gently shake the table on which you have placed your pan (or gently shake the pan itself).

Observations:

You should see the following:

- The water will work its way to the surface, flooding the area around the houses.
- The houses will start leaning over and sinking into the sand.
- The volume of the sand should decrease by a small amount. Note where the surface is after shaking in relation to the mark denoting the surface before shaking.

Variation:

Try the experiment using clay or gravel to separate sand layers and represent different types of sedimentary layers. Watch what happens to the water and the surface of your model of a river valley. Compare what happens to the water when using different materials.

Source: Earth Connections No. 2, published in *Washington Geology*, v. 27, no. 2/3/4, December 1999, Washington Division of Geology and Earth Resources.