

# Does Seismometer Depth and Surrounding Materials Affect the Arrival Times of Seismic Waves at two locations in New Harmony, IN.?

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## INDIANA STANDARDS:

Although many standards are addressed by using the scientific method, these are the main ones targeted in this experiment:

---8.5.10 Explain how the comparison of data from two groups involves comparing both their middles and spreads.

---8.2.4 Use technological devices, such as calculators and computers, to perform calculations.

---8.2.5 Use computers to store and retrieve information in topical, alphabetical, numerical, and keyword files and create simple files.

---8.3.4 Explain that earthquakes often occur along the boundaries between colliding plates, and molten rock from below creates pressure that is released by volcanic eruptions, helping to build up mountains.

## BACKGROUND INFORMATION:

The town of New Harmony, Indiana is located on the Lower Wabash River in the Wabash Valley Seismic Zone. Although small in area and population, the town has a rich history of geologic inquiry and exploration. The David Dale Owen laboratory, site of the first U.S. Geological Survey, has been restored to its original grandeur in the Granary building. A working seismic station was installed in April, 2002 in the Granary. One vertical component seismometer is buried in a shaft seventy feet into the limestone bedrock. Another vertical seismometer and two horizontal seismometers are also installed in a cellar about nine feet under the Granary floor. Less than a mile away, a PEPP station was set up at New Harmony School in 2002 with a Guralp broadband three component seismometer. It is buried in a shaft in loose unconsolidated soil about seven feet deep near the science lab window.

## QUESTION:

How do the vertical component P and S wave seismograms compare and contrast between the unconsolidated shallow soil of the New Harmony School location and the solid deep bedrock of the Granary location?

## HYPOTHESIS:

Since many scientists work from a null hypothesis, we will too for this experiment. "If we compare vertical component seismograms from both locations, then we think there will be no difference in arrival times and wave shapes even though the burial depths and surrounding materials differ."

## PROCEDURE:

- 1). Go to the USGS most recent earthquake site listing and record the dates and times of 5-7 major recent earthquakes of interest to you.
- 2). Retrieve and review the stored files from the Z component of the School's data for the earthquake events you chose.
- 3). Move all the raw data into WinQuake files and look at P and S wave settings and arrival times. Use filters to see different frequencies and to invalidate the differences between the 1 hertz filters the Granary uses.
- 4). Store all of these selected seismograms into a special folder and name it.
- 5). Get the Granary data for the same events from the deep vertical component and compare and contrast them looking at P and S wave arrival times, amplitudes, and filtered frequencies.
- 6). Look for patterns. Store them all in the special folder you created.

## CONCLUSION:

If our null hypothesis is supported, there will be no differences as our seismic stations are so close together in geographic location. If the null is refuted and there are recognizable and calculated differences, you will need to look up topics such as soil liquefaction and resonance/amplification as possible sources of discussion.

