MODELING AN EARTHQUAKE IN YOUR CLASSROOM

Brian Grublesky
Curriculum and PD Specialist
Problem

With the increase in seismic activity, we would like suggestions on how to construct new buildings to better survive a seismic event. We know that Illinois is not as active as other parts of the country, but we know there have been seismic events in the past and recently. Please help us take the proper amount of precaution based on the severity of the threat for our area.
What do we know about this problem?

What do we need to know?
Where do earthquakes take place and what are their strengths?

http://earthquake.usgs.gov/earthquakes/map/
Recent Illinois Earthquakes

- June 28, 2004: 4.2, 10 miles from Ottawa
- January 2, 2006: 3.6, 2 miles from Equality
- April 18, 2008: 5.2, 6 miles from Mt. Carmel
- February 10, 2010: 3.8, centered in Sycamore
- November 4, 2013: 3.2, 1 mile from Summit
Suburban tremor not earthquake, officials say

BY ANNEMARIE MANNION
Tribune reporter

People in the western suburbs who felt the earth move Monday weren't imagining it. But the cause remains a mystery.

The U.S. Geological Survey assigned the tremor that occurred about 12:35 p.m. near Countryside a preliminary magnitude of 3.7. Soon after, they downgraded the tremor to 3.2 and said it wasn't an earthquake, but likely was caused by work at a nearby quarry.

"Based on what they've looked at, we're pretty sure it's from a blast," said Paul Caruso, a geophysicist with the Survey.

The website Did You Feel It?, which is operated by the agency, reported by mid-afternoon that more than 700 people had contacted the site to say they had, indeed, felt it. Police departments in Hinsdale, Elk Grove Village, Oak Brook and elsewhere where residents called to report the tremor.

Harley Benz, a scientist with the Survey, said his agency looks at the seismic waves that travel through the earth and other factors to determine whether an incident is an earthquake or a human-made event.

An earthquake occurs much deeper beneath the earth's surface than Monday's event, he said.

Benz said the Survey always assumes that an event is an earthquake until its analysis shows them otherwise.

Survey officials also look at how close the event is to an area that has mining, quarrying or other industrial operations. It cannot pinpoint the source of Monday's tremor but said it occurred within 2 miles of McCook.

Joshua Robbins of Vulcan Materials said his company, at 5500 Joliet Road in McCook, was not responsible.

"Vulcan Materials did not blast today," Robbins said Monday. A spokesman for nearby Hanson Material Service, 901 W. 47th Street in McCook, declined to say if her company did any blasting Monday.

"I actually can't comment on that at this point," said the woman, who would identify herself only as Jennifer.

McCoy police did not immediately return a call for comment.

Tribune reporters Dan Haar, Carlos Osorio and Rosemary Rojas Sobol contributed.

The earth definitely shook. But how? Why?

Monday's west suburban tremor remains a mystery

BY MATTHEW WALBERG

When nature called just before 1 p.m. Monday, security guard John Herbeck heard a chirping and headed outside.

What he saw was an upscale community of houses, apartments and a shopping center. He was a little surprised.

The source of the chirping was a measurement called Peak Particle Velocity (PPV) to record the velocity of the ground vibration. According to Leilah Hanson officials and the state Department of Natural Resources, the blast caused a PPV of 0.35 inches per second, well below the state's mandated limit of 1 inch per second.

The blast was felt by residents who live near the entrance to the quarry. The vibration was felt by residents of the property, which is a part of a larger development.

Leilah Hanson and the village

La Grange resident Karen McDowell said the blast was unusual, but the shock that followed shook chairs and knocked a piece of china from a cabinet to the floor.

"We got a lot of tremors from the blasts here, but it was obviously much more significant than that," she said. "Maybe the people at the quarry are able to learn from it so it doesn't happen again."

Herbeck believes the blast was the source of the tremor.

But at least the property didn't tip over.

"Then I would have really been in trouble," he said.

Freelance reporter Joseph Bouchard contributed.

More on that mystery tremor: It was real quake, experts say

BY MATTHEW WALBERG

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Blasting at a quarry in McCook was followed seconds later by a real tremor, the USGS now says.
Different cause of an Earthquake
How are earthquakes studied and how do they cause damage?

http://www.sciencecourseware.org/VirtualEarthquake/
What are the waves caused by an earthquake?

- P-waves
- S-waves
- Surface waves
Final Challenge

- Construct a building using only toothpicks and marshmallows
- Building must be at least 12” tall
- Building will be shaken for 1 minute
- Can construct own shake table to test using materials in aluminum tray
Science Curriculum:

- **MS-ESS2-2.** Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.
- **MS-ESS3-2.** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

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Science and Engineering Practices:

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations and Designing Solutions
- Engaging in an Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

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Other Disciplines Covered:

• 6.EE 9: Represent and analyze quantitative relationships between dependent and independent variables
• 6.SP 2, 4,5: Develop understanding of statistical variability and summarize and describe distributions
• Mathematical Practices: Make sense of problems and persevere in solving them, construct arguments and critique the reasoning of others, use appropriate tools strategically, and attend to precision.
• 17.A.3b: Explain how to make and use geographic representations to provide and enhance spatial information including maps, graphs, charts, models, aerial photographs, satellite images.
• 17.C.3a: Explain how human activity is affected by geographic factors.

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