Erosion and Engineering

Writers: Justin Vawter
Time: 30-90 minutes

Content Connections:

- Science
- Geology
- Erosion
- Applied Technologies
- Urban Development

Topic: Depending on the depth necessary to engage the class, you have construction, sinkholes and erosion, Ground-Penetrating Radar (GPR), topography, GIS, and even drones.

Materials:

- Pictures to show (or display) of the Fort Worth sinkhole (picture below)
- Pictures to show (or display) of Ground-Penetrating Radar (picture below)
- Bucket-and-dirt analog to explain erosion (picture below)
- Easy
    - Paper strips to extend across gaps (acting as roads)
    - Weight, such as a glue bottle, to simulate the car
- Medium
    - Paper strips to extend across the gap
    - Small tubs that allow students to reinforce all the way to solid “bedrock” (picture below)
    - Random assortment of materials for the solution: playdoh, popsicle sticks, Legos, etc.
- Hard
    - *Same materials as medium*
- Expert
    - Paper stripes to extend across the gap
    - Small tubs (same as medium and hard)
    - Random assortment of materials for the solution: playdoh, popsicle sticks, Legos, etc.
    - (optional) Access to a web-enabled computer with Google Maps.
- Extension (options)
    - Web-enabled computer(s)
    - Drones

Directions

Part One

- Begin by showing a picture of the Fort Worth sinkhole (link or see below) and asking the students what they believed cause this.
- Depending on their predictions, ask them *how* would someone be able to see into the ground to *see* the problem [discuss or share the pictures on Ground-Penetrating Radar (GPR)--link or see below].

Part Two

- Use the bucket-and-dirt analog to explain the erosion; use the glue bottle to demonstrate how the weight of the road and cars causes the road (paper strip) to collapse.

Part Three

- Introduce the challenge:
    - *You* are a geospatial engineer called in to assess the cause and consequence of the Fort Worth sinkhole. You decide to utilize ground-penetrating radar.
    - There it is, a busted pipe.
    - You access the city's GIS system to identify the storm drain--apparently it separated and caused erosion. You utilize topographical maps to spot other, downstream potential hazards, and you send an aerial drone to assess. 900 yards of the busiest, populated part of downtown Fort Worth is in danger!
    - There are shop owners that won't allow for prolonged construction, plus there's the upcoming parade and marathon...but worst of all, the city would be responsible if repairs aren't made.
    - You have a team of civil engineers and construction workers awaiting your decision. What are you going to do? Go!
        - **FIX THE HOLE AND SUPPORT THE ROAD, BUT KEEP IT OPEN FOR SHOP OWNERS, THE PARADE, AND MARATHON**

EASY ***Support just the road temporarily with a bridge***	**MEDIUM** ***Support the road completely***	**HARD** ***Reinforce the entire area***	**EXTREME** ***Unforeseen engineering solution***
For this challenge, students simply build a bridge. This can be done between two desks pulled slightly	For this, the students must support the road (paper strip) AND completely reinforce	The entire gap (not just the road) must be fixed.	An entirely unforeseen engineering solution. Perhaps the area is rezoned as a

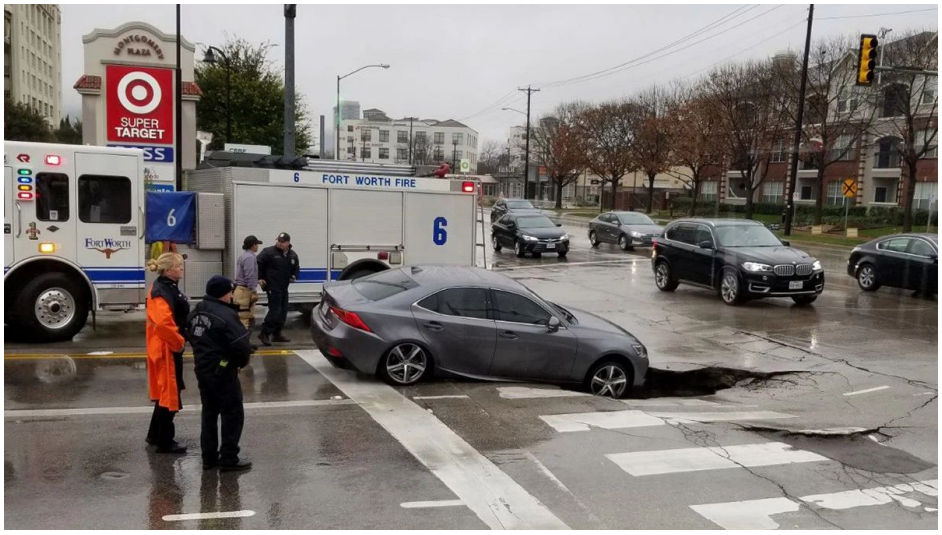
apart. They must be able to span the gap and support the weight (e.g.--glue bottle)	the area all the way to bedrock (table).		community park while all roads go underground. You may want students to check the area using Google Maps before making executive decisions.

EXTENSION

- Students can move up the range of difficulty, Easy to Extreme
- Have students find the area on the Fort Worth Online Zoning Tool (Geographic Information Systems - GIS). Here is the link to Google Maps

Bucket and dirt analog (with street and car).

Using tubs as gap (with bedrock) for medium, hard, and expert challenge



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