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**Science in Your Inbox**

**Da Vinci Bridge**

**Purpose:**

In this experiment, you will explore the mechanical engineering required to build a bridge with no mechanical fasteners or adhesives based on one of Leonardo da Vinci's designs. You will be weaving the sticks together so that the tension between the sticks keeps the bridge together and lifts it off the ground.

**Background Information:**

We like highways and railroads to be straight and level, but Earth's bumps and wiggles make that kind of construction a challenge. How do you take a highway through a valley or make a railroad cross a creek? To make a bridge strong enough to hold people or even cars, bridge designers (engineers) use forces. **Forces** make things move but they can also hold them still.

The biggest and most pervasive force in the universe is gravity. Gravity is constantly tugging things down, which makes designing a bridge a challenge because we don’t want to fall into the water we are trying to get across. Furthermore, the longer the bridge is, the more it weighs and the more it carries and the bigger the risk it'll collapse. Bridges certainly do fall down from time to time, and quite spectacularly, but most stand happily still for years, decades, or even centuries. They do it by carefully balancing two main kinds of forces called **compression** (a pushing or squeezing force, acting inward) and **tension** (a pulling or stretching force, acting outward), channeling the **load** (the total weight of the bridge and the things it carries) onto **abutments** (the supports at either side) and **piers** (one or more supports in the middle). Although there are many kinds of bridges, virtually all of them work by balancing compressive forces in some places with tensile forces elsewhere.

**Materials (What You Need):**

* 12 pencils (If you don’t have pencils, that’s okay. There are lots of other materials that will work, like popsicle sticks or even toothpicks.)
* 32 small rubber bands

**Procedure:**

Check out this video on how to build the bridge:

<https://www.youtube.com/watch?v=QKdQV2q5PRk&feature=youtu.be>

Since the pencils are very slick there may not be enough friction to hold them together. If you are having trouble, wrap a rubber band around the pencil in the locations where the pencils touch each other to increase the friction.

The bridge is strong when it comes to downward force, but lateral force (from the sides) may cause it to topple. Moving the bridge while it stands (even slightly) could cause it to fall apart, so be careful.

**Focus Questions:**

1. What do you think makes this bridge so strong?
2. Is there anything you could change about the design of your bridge to make it stronger?

**If you want to keep experimenting, try these ideas!**

1. Try building the bridge with a different material. What difference does the material you select make?
2. Can you make your bridge longer?
3. Can you make your bridge hold even more weight?
4. Can you figure out a process to build the bridge faster?