

PAPER BRIDGE BUILDING CHALLENGE

TEST THE STRENGTH OF PAPER WITH THIS FUN ENGINEERING CHALLENGE.



WHAT MAKES A BRIDGE WORK?

Ever wonder what makes a bridge so strong? It comes from the materials used, the way it's constructed, and most importantly the design. Bridge designs use various geometry to add strength to the bridges. You've probably seen bridges shaped like an arch or with triangles or with cables that support the surface.

Bridge designs help to overcome many different forces on the structure, including two called compression and tension. When cars drive across a bridge, the load causes the bridge to compress (imagine a spring pushing together). It also causes the underside to stretch (imagine a tug of war pulling on a rope). Bridges are designed to reduce these forces or to transfer them to other areas such as the supports.

In this challenge, you're building what's called a beam bridge. It's a simple bridge that places a length of paper across a span between two stacks of books. The strength of the bridges you build in this challenge come from the paper beam laying across the books, but not all shapes are considered equal. You'll discover that making cylinders and folds help reduce and transfer the forces on the bridge.

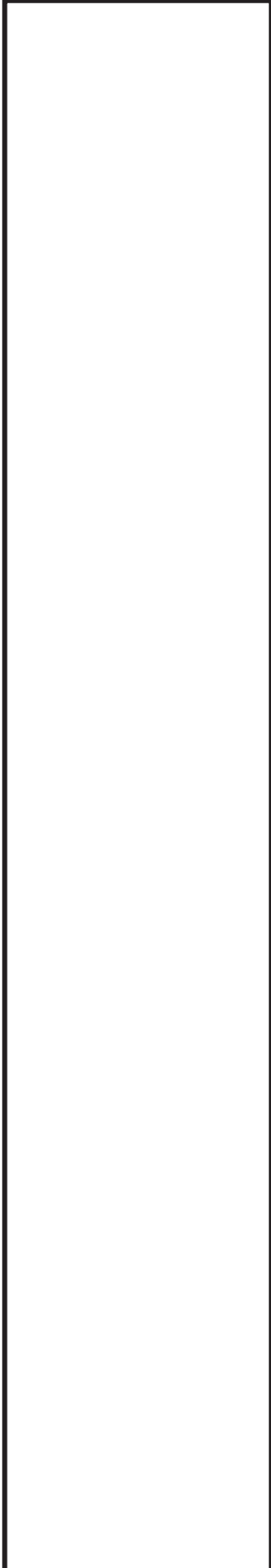
SUPPLIES:

- Paper
- Scissors
- Tape
- Books or other stackable items
- Pennies
- Pencil to record results

PAPER BRIDGE BUILDING CHALLENGE TEMPLATE

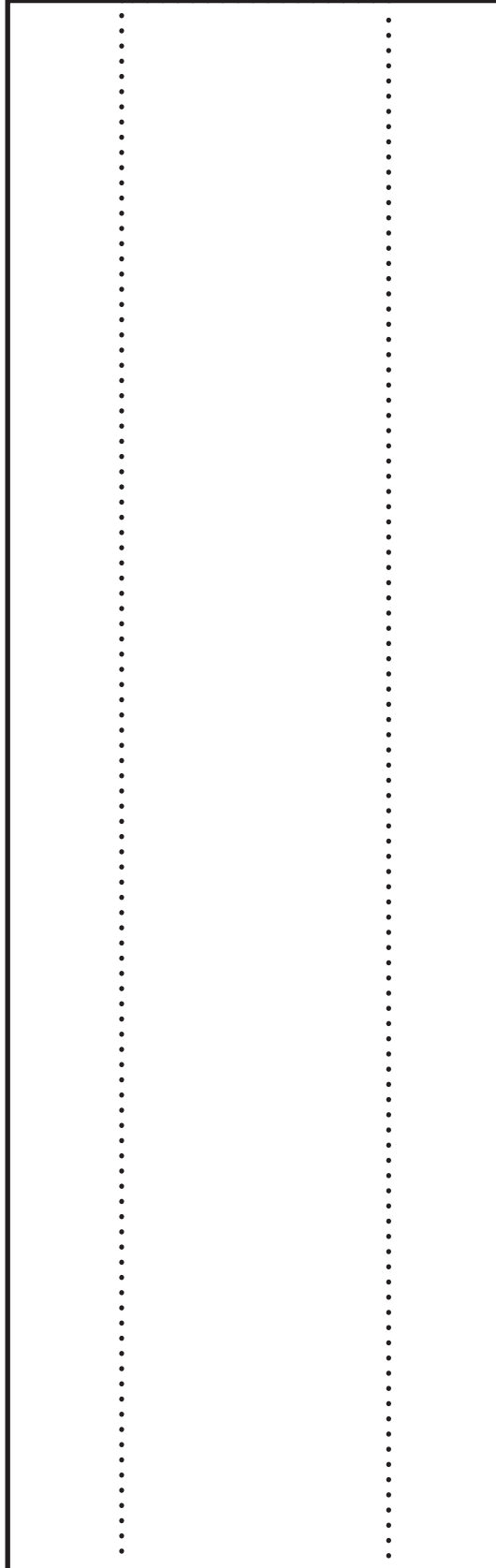
BRIDGE #1

1. Cut around the solid black lines.



BRIDGE #2

1. Cut around the solid black lines.
2. Fold along the dotted lines so that bridge has a U shape.



BRIDGE #3

1. Place a sheet of paper on a flat surface and roll into a tight cylinder, about 1" in diameter. Tape to secure closed with no more than 2" of tape.

BRIDGE #4

1. Come up with your own bridge design to test using no more than two sheets of paper and 2" of tape. Can you make it stronger than the other bridges?
2. Some ideas to try:
 - Combine the designs of bridges #1, 2, or 3.
 - Make accordion folds.
 - Make a rectangle and tape.

CHALLENGE INSTRUCTIONS

1. Stack two piles of books or boxes on a flat surface, approximately 6" apart.
2. Cut out and fold the bridges according to the directions above.
3. Lay Bridge #1 across the two stacks of books.
4. Stack pennies on top of the center of the bridge one at a time until it collapses. Count the number of pennies it can hold (the number of pennies on the bridge when it collapses minus 1). Record this number.
5. Repeat Step 3 and Step 4 for all of the bridges you have made.
6. Compare your results. Which bridge is the strongest? Why do you think it is the strongest?
7. For an added challenge, test your bridges with different placements of pennies. Does spreading them out across the span make the bridge work better or worse?