

From Paper to Bridge

Anyone could make a bridge (that spans an 8" gap) out of steel: it's one of the strongest and most durable materials we have commonly available. What happens when we try to make a bridge out of a material that's not so strong, and even flimsy? We're here to find out!

In this project, we challenge you to build the strongest bridge you possibly can using only paper. Let's do this!

Materials:

- An 8" gap (for example, between two stacks of books on a table. It only needs to be ~4" high)
- Paper
- Pennies or paper clips

Learning objectives:

- Understanding the strength that comes from form & materiality
- Sketch prototyping
- Testing and iteration

Time required: 20-45 minutes

Context:

There are many strategies that can be used to create a strong structure. Sometimes we rely on strong materials, and other times we rely on a strong shape. Usually, the material and the shape need to work together to create the strongest solution. For example, have you ever seen a bridge that is a flat surface of steel? Probably not - it would sag in the middle, especially with the weight of cars and trucks on it. Bridges generally rely on things like cables and trusses to and certain shapes to make them strong enough to span a large distance safely.

Since engineers can't build a whole bridge and then test it to make sure it works, they sometimes use prototypes, or small physical models, to test out their ideas. They might use different materials and the models may be more precise than what we're going to use, but there is a lot that you can learn from small models like this that applies to a large (Golden Gate Bridge-sized!) scale. The goal here is to play with different forms to see which one can hold the most weight.

Context:

This activity is also about practicing coming up with ideas when you have a lot of constraints. Constraints are limitations or guidelines. But when we're designing, they can actually be a big help for coming up with creative and unexpected solutions. In this activity, you'll be given tight constraints on what materials to use, and how much you can use. Play with it, and see what you can come up with within those guidelines.

Activity:

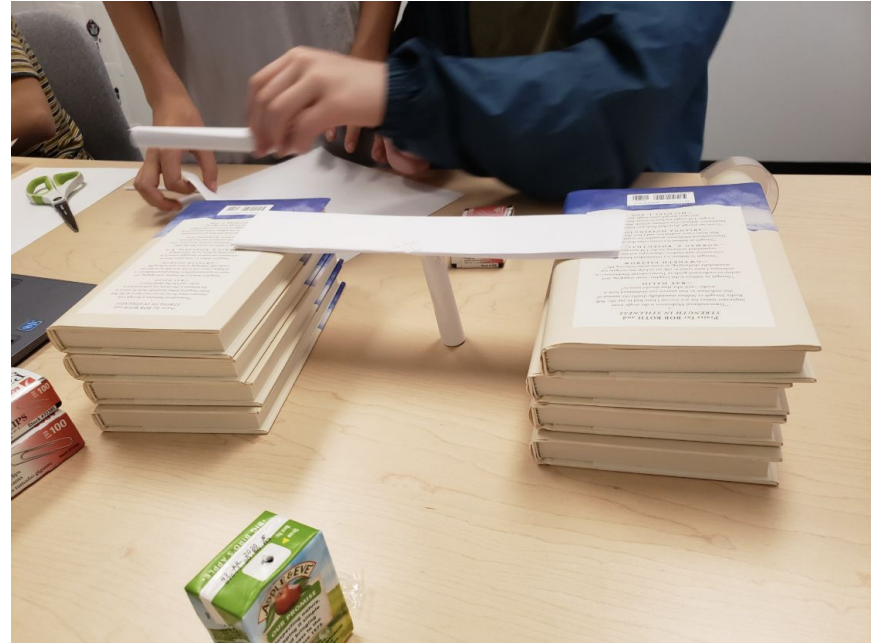
1. Set up two stacks of books so there is an 8" gap in between them. You're going to build the bridge over this gap.
2. Using only paper (max 5 sheets of standard printer paper per bridge), prototype 3 different bridge ideas. Make sure they are long enough to span the 8" gap.



Activity:

3. Test out your bridges, one at a time, by placing them across the span and placing pennies or paper clips on top of the bridge. Start with just one or two, then keep adding weight until it falls. Keep track of how much each bridge can hold. Do not use tape or any other material to attach the bridges to the books.

4. Now that you have a better idea of what works and what doesn't, try 3 more ideas. You can either modify one of your existing bridges or start with a new idea.



Activity:

5. Test your 3 new ideas in the same way. Which bridge is the winner?
6. Share your favorite(s) and how many ideas you came up with at #MadeToHack.

Reflection:

What did you do to make the flimsy paper into a bridge that could hold weight?

How much weight did you expect your bridges to hold? How much weight did they actually hold?

Did you notice any difference if you stacked your weight all in the center of your bridge, verses spreading the weight out across the bridge? Why do you think that might make a difference?

Happy Building!

-Team Hack