



Bridge Building Challenge

Learn engineering principles and construction basics in the Illinois 4-H Bridge Building Challenge!

In this challenge, youth will:

1. Get familiar with the parts of a bridge and types of bridge
2. Perform tests to compare different bridge designs and determine which ones can support more weight
3. Design and construct their own paper bridges and bridges with other materials

Challenge resources:

[All About Bridges Overview video](#) on YouTube

[Paper Bridge Challenge video](#) on YouTube

[Building Brick Bridge Challenge video](#) on YouTube

[Popsicle Stick Bridge Challenge video](#) on YouTube

Challenge details:

Visit <https://4h.extension.illinois.edu/programs/home-activities> to get access to the challenge materials. Watch the videos to learn about the challenge and the basic concepts you can use to succeed. Follow the links in the video descriptions to get additional information and inspiration! We encourage you to start with the "All About Bridges" video for an overview of useful concepts: <https://youtu.be/0cdeXfXOAFQ>.

After watching the video, complete one or more of the following bridge building challenges (paper, building brick or popsicle stick). For all the challenges consider documenting your bridge, including how much weight it held, photos or video. With parent/guardian permission, share your photos with your 4-H club, family and friends, and/or on social media. If you also choose to share your work on social media, consider using our hashtag #that4H and/or tagging "Illinois 4-H."

Paper Bridge Challenge

Watch the Paper Bridge Challenge Video for guidance and inspiration:

<https://youtu.be/OOpnDBnOWTw>.

Build a bridge out of paper that can hold at least 100 pennies (or approximately 260 grams or 9.25 ounces). The bridge may use the following supplies:

- One piece of 8 ½ x 11-inch paper
- Invisible tape (only for holding bridge shape, not for reinforcement of whole structure)

The bridge must meet the following specifications:

- Bridge should span a space 8-inches wide between two elevated surfaces (boxes or books work well).
- Bridge cannot be taped or attached to the elevated surfaces (i.e. boxes or books). The ends of the bridge should be sitting on top of the edge of each surface.
- The bridge should be engineered to hold as many pennies (the "load") over the gap between the surfaces as possible, without buckling. That means when you place whatever your load is, it should not be on the portion of the bridge that is on top of the box surface.

Illinois 4-H At-Home STEM Challenge

Once your bridge is complete, test it and record how many pennies or weights it can hold. If you have a scale, record the total weight it was able to hold. Try to get at least 100 pennies or approximately 9.25 ounces. That might mean you need to try various designs out and then work to improve them (this is called testing and troubleshooting).

Once you've tackled the paper challenge, consider moving on to complete another bridge challenge below based on what supplies you might have around your house.

Building Brick Bridge Challenge

Watch the Building Brick Challenge Video for guidance and inspiration:

<https://youtu.be/Os4IsWS7i0Q>. Choose one of the bridge designs from the [Bridge Overview video](#) as inspiration, then build a bridge using plastic building bricks or building systems (i.e. LEGO, Megablocks,, K'nex, Duplo etc). Use whatever system you have available to you.

The bridge must meet the following specifications:

- Bridge should span a space at least 10-inches wide on the ground. We recommend placing 2 parallel lines of painter's or masking tape on the floor, spaced 10 inches apart to help you plan and test.
- Bridge cannot have any piers or pillars between the 10-inch space. The piers or abutments can only be at the ends of the bridge, outside of the 10-inch space.
- The bridge should be engineered to hold the load over the gap between the lines of tape, without buckling. That means when you place whatever your load is, it should be on the portion of the bridge that is between the 10-inch floor markings (not on the portion that is outside the tape).
- You may construct your bridge to have pieces that sit below the level of the "road surface" that you will test on, but none of those pieces should touch the ground.
- Make sure you include a bridge deck surface that you can load with weight safely. Work with your parents to figure out what objects you may be able to use as weights so that you can design accordingly to accommodate those objects resting on your bridge deck.

Once your bridge is built, test your bridge **with parental supervision** using heavy objects in your home (like books). We recommend keeping your bridge within 5 inches of the ground when testing to help minimize risk when the bridge eventually breaks. Test your bridge over a durable surface that you are unlikely to damage (like a garage floor). Be sure to stay as far back as possible when placing loads and ensure no body parts (especially hands, faces and feet) or pets are under the bridge deck or close to the bridge. You may want to consider wearing safety goggles. Load the bridge with weight slowly so that you can easily identify the objects it was able to hold before it busted. Record the load the bridge held by placing the objects it held on your home scale. If you had fun, challenge yourself to use your observations from your first bridge to make improvements and build a second bridge. Or move on to the Popsicle Stick Bridge Challenge.

Popsicle Stick Bridge Challenge

Watch the Popsicle Stick Bridge Challenge Video for guidance and inspiration:

<https://youtu.be/bbbgVXKwBB4>. Choose one of the bridge designs from the [Bridge Overview video](#) as inspiration, then build a bridge using popsicle sticks and glue.

The bridge may use the following supplies:

- Popsicle/craft sticks (wide or skinny)
- Glue (craft or wood)
- String or fishing line (if opting for a suspension bridge)
- Binder clips or clamps (optional for building, not part of the finished product)

The bridge must meet the following specifications:

Illinois 4-H At-Home STEM Challenge

- Bridge should span a space at least 10-inches wide between two elevated surfaces (boxes or books work well).
- Bridge cannot have any piers or pillars between your two boxes or stacks of books. It should use your boxes or books as the piers or abutments. Bridge should be able to overlap on each support surface by 2 inches.
- The bridge should be engineered to hold the load over the gap between the surfaces without buckling. That means when you place whatever your load is, it should not be on the portion of the bridge that is on top of the elevated surface.
- You may construct your bridge to have pieces that sit below the level of the books/boxes and may allow these pieces to touch the sides of the books/boxes (the abutments). If you choose to do this, you may need to increase the height of your elevated surfaces so that your bridge is not close to touching the floor.
- Make sure you include a bridge deck surface that you can load with weight safely. Work with your parents to figure out what objects you may be able to use as weights so that you can design accordingly to accommodate those objects resting on your bridge deck.

Once your bridge is built, allow the glue to dry for the time specified on the glue bottle. Once glue is dry, test your bridge **with parental supervision** using heavy objects in your home (cans, books, etc.). We recommend keeping your bridge within 5 inches of the ground when testing to help minimize risk when the bridge eventually breaks. Test your bridge over a durable surface that you are unlikely to damage (like a garage floor). Be sure to stay as far back as possible when placing loads and ensure no body parts (especially hands, faces and feet) or pets are close to the bridge or under the bridge deck. Load the bridge with weight slowly so that you can easily identify the objects it was able to hold before it busted. Record the load the bridge held by placing the objects it held on your home scale. If you had fun, challenge yourself to use your observations from your first bridge to make improvements and build a second bridge.

Questions?

Email amyh@illinois.edu or visit <https://4h.extension.illinois.edu/programs/home-activities>

Want to learn more about 4-H near you?

Find your local 4-H office at go.illinois.edu/FindYour4HOffice or learn more about Illinois 4-H at 4h.extension.illinois.edu

Did you have fun with this challenge?

Consider entering the DKK 4-H Bridge Bust challenge, held each winter! In this challenge, youth or family teams build bridges using a supplied kit that includes balsa wood and wood glue. They then test the bridges by adding weight until they bust! It's a really fun event, and we've had bridges hold more than 70 pounds! Learn more about this event (hosted by DuPage, Kane and Kendall County 4-H) at go.illinois.edu/stem4Hdck.



Resource originally produced by Amy Henschen for DuPage, Kane & Kendall County 4-H.

If you need a reasonable accommodation to participate in this program, please contact your local University of Illinois Extension office.

Early requests are strongly encouraged to allow sufficient time for meeting your access needs.

University of Illinois Extension provides equal opportunities in programs and employment.

University of Illinois College of ACES • United States Department of Agriculture • Local Extension Councils Cooperating