

BUILD A BRIDGE

Volunteer Instructions • Girl Scout STEM Workshop • K–12

Workshop goal: Participants design and build a bridge from simple materials that can span a gap and support as much weight as possible. The emphasis is on **structure, problem-solving, testing, and improving a design.**

MATERIALS & SUPPLIES — KEEP IT SIMPLE

For each small team	Suggested amount
Craft sticks / popsicle sticks	20–30
Paper or index cards	8–12 sheets/cards
Masking tape or painter's tape	2–4 ft
String or yarn	2–3 ft
Straws	6–10
Small cups	2 for supports / testing
Pennies, washers, or other small weights	10–30 for testing
Two sturdy tables, desks, books, or boxes	To create the bridge gap
Pencils + worksheets	1 per participant

Minimum-material version: You can run the challenge with only craft sticks, masking tape, two supports, and pennies/other weights. The extra materials simply give teams more design choices.

BEFORE THE TROOP ARRIVES

- **Set up the gap.** Place two tables, desks, stacks of books, or boxes a fixed distance apart. A 12-inch gap works well for most groups.
- **Mark the starting line** on both supports so every team knows how far the bridge must span.
- **Prepare the testing weights.** Pennies are inexpensive and easy to count. Washers or reusable plastic counters also work.
- **Decide the challenge level.** Younger groups can focus on building a bridge that stays up. Older groups can compete on load capacity, material efficiency, or strength-to-material ratio.
- **Print one worksheet per participant** (or one per team for very young participants).

THE CHALLENGE

Mission: Build a bridge that spans the entire gap between two supports and holds as much weight as possible. You have limited materials, so you must decide how to use them efficiently.

SUGGESTED 45–60 MINUTE FLOW

Time	Activity	Volunteer focus
5 min	Introduce the challenge	Ask what makes a bridge strong and what might make it bend or collapse.
5–10 min	Plan	Have teams sketch their bridge and identify where they expect the most stress.
15–20 min	Build	Encourage experimentation. Let teams solve structural problems themselves.
10 min	Test	Add weights gradually and count the load supported.
5–10 min	Improve + retest	Have teams change one feature and compare results.
5 min	Share	Discuss different structures and what testing revealed.

HOW TO RUN THE BUILD

1. Introduce the problem

Explain that bridges must carry loads while spanning an open space. Engineers have to balance strength, weight, cost, materials, and other constraints.

2. Set the constraints

Tell teams exactly how wide the gap is, what materials they may use, and how much building time they have. The bridge must rest on the supports without being taped or attached to the supports.

3. Plan first

Have participants sketch their idea. Ask where the bridge will be strongest and where it might bend.

4. Build

Give teams their materials and let them construct. Encourage them to test small pieces or sections before committing to the entire structure.

5. Test carefully

Place the bridge across the gap. Add weights gradually near the center of the span, using the same procedure for every team.

6. Record the result

Count the number of weights supported before the bridge bends, slips, or collapses.

7. Improve

Have teams change one feature—such as adding supports, changing the shape, reinforcing a joint, or rearranging materials—and test again.

8. Compare

Discuss what changed and whether the result improved. Emphasize that an unsuccessful design still provides useful engineering information.

VOLUNTEER GUIDE: FACILITATING THE ENGINEERING

GOOD QUESTIONS TO ASK

- Where do you think your bridge will bend first?
- What part of the bridge needs to be strongest?
- How could you make the bridge stronger without simply adding more material?
- What happens when you change the shape of a beam or support?
- Where could a triangle help your design?
- What happened during your test that you did not expect?
- What is one change you could make and test next?

KEY IDEAS TO EXPLAIN — ADJUST FOR AGE

Age range	Keep the explanation focused on...
K–2	Strong shapes and support: Bridges need to hold themselves up and carry weight. Some shapes bend more easily than others.
3–5	Forces and structure: A bridge experiences forces when weight is placed on it. Triangles, beams, and supports can help distribute those forces.
6–8	Compression and tension: Different parts of a bridge can be pushed together or pulled apart. Structure and geometry affect how those forces are handled.
9–12	Structural engineering: Discuss load paths, tension, compression, bending, trusses, constraints, tradeoffs, and optimization. Compare strength with material use.

TESTING RULES

- Use the same gap width for every team if results will be compared.
- Use the same type of weight and add it in the same location and order for each team.
- Add weight gradually rather than dropping it onto the bridge.
- For younger participants, an adult should handle the final load-testing step if a structure is unstable.
- If a bridge collapses, ask what failed and why. Treat the failure as data, not simply as a mistake.
- For a fair competition, give every team the same material limits and building time.

OPTIONAL EXTENSIONS

- **Longest-span challenge:** Keep the materials the same and increase the gap.
- **Strength challenge:** Which bridge holds the most weight?
- **Efficiency challenge:** Which bridge carries the most weight using the least material?
- **Truss challenge:** Require teams to include at least one triangle in the design.
- **Fair-test challenge:** Change only one feature between tests and explain why this makes the comparison useful.
- **Real-world connection:** Compare the activity to beam bridges, truss bridges, suspension bridges, and arch bridges.

SAFETY & CLEANUP

- Keep hands and faces away from the center of a bridge during load testing.

- Do not stand or lean over a bridge while weights are being added.
- Use lightweight test loads for younger groups and stop testing if a structure becomes unstable.
- Keep small weights such as pennies supervised around young children because they are choking hazards.
- Collect broken craft sticks and tape scraps after the activity.
- Return reusable materials to labeled containers.

Volunteer reminder: The goal is not simply to build the strongest bridge. Participants should practice predicting, designing, testing, observing failure, changing a variable, and using evidence to improve their next design.