

EduTrend Contents

W4C · SCIENCE & ENGINEERING · PRIMARY

Bridge Builders

How can one sheet of paper hold a load?

Ages 7–10	Level: Foundation	60 minutes	Pairs · up to 30	Activity 01

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 pupil worksheets · assessment checklist

ACTIVITY 01 · AT A GLANCE

Bridge Builders

Pupils discover that the shape of a material matters as much as the material itself. They test flat, folded and rolled paper, then design and improve a paper bridge that carries a cup of coins across a 20 cm gap. The activity introduces forces, fair testing and the engineering design cycle using only paper, tape and coins.

Learning outcomes

By the end of the session pupils can:

- describe a force as a push or a pull, and a load as a force pushing down on a structure;
- show that folding or rolling paper makes it much stronger;
- carry out a fair test and record results in a table;
- use test results to explain one change they made to a design.

KEY WORDS

force · load · span · support · beam · fold · fair test · prediction · improve

CURRICULUM LINKS

Science: forces and materials. Design & technology: design, make, evaluate. Maths: counting, measuring, comparing data. Engineering design for grades 3–5 (NGSS 3-5-ETS1).

1	2	3	4	5	6
ASK	**IMAGINE**	**PLAN**	**BUILD**	**TEST**	**IMPROVE**
What is the problem?	Share ideas	Sketch it	Make it	Count the coins	Change one thing

Materials (per pair)

- 6 sheets of A4 paper (80 gsm printer paper)
- 30 cm of masking tape
- 1 small paper cup
- 50 coins or metal washers of the same size
- Ruler and pencil
- Worksheets 1, 2 and 3
- For the class: books or blocks for two equal supports per pair, a timer and a board for results

Before the session

- Set up two supports 20 cm apart for each pair.
- Count coins into bags of 50.
- Cut tape into 30 cm strips and stick them to the table edge.
- Print one set of worksheets per pupil.
- Try the flat-sheet test yourself so you can show it confidently.

SAFETY

Test at table height. Count coins out and back in at the end: small items are a choking risk for young children.

ACTIVITY 01 · SESSION PLAN

Step by step

Timings are for a 60-minute session. For two 45-minute sessions, stop after the Talk step and start the second session with a two-minute recap of the class results.

Time	What happens	Say or ask
0–5 min **Hook**	Lay one flat sheet across the gap between two supports. Put the empty cup in the middle and add coins one at a time. The paper sags and the cup touches the table after one or two coins.	*"What happened to the paper when we added a coin?"* *"How could the same sheet hold more?"*
5–20 min **Explore**	Pairs test three shapes, one sheet each: flat, zigzag (fold backwards and forwards in 2 cm strips) and tube (roll and tape). They predict first, then add coins one at a time and record the result on Worksheet 1. A test ends when the cup touches the table or the paper falls.	*"What will you keep the same so the test is fair?"* *(same paper, same gap, one coin at a time)*
20–25 min **Talk**	Collect each pair's results on the board. Agree which shape was strongest. Introduce the key words load, span and beam, pointing to the pupils' own models.	*"Why do you think the zigzag held more?"*
25–45 min **Design & build**	Read the challenge card. Pairs sketch their idea on Worksheet 2 before touching the materials, then build.	*"Which result from Worksheet 1 will you use in your design?"*
45–55 min **Test & improve**	Pairs test and record. Each pair may change one thing only, then test again and record the second result.	*"Where did your bridge bend first? What will you change there?"*
55–60 min **Share**	Each pair names the change that helped most. Pupils complete Worksheet 3. Count all coins back into the bags.	*"What would a real engineer do next?"*

CHALLENGE CARD (print or copy onto the board)

Build a bridge that crosses a 20 cm gap and carries as many coins as possible in a cup placed in the middle. You may use up to 4 sheets of paper and 30 cm of tape. Nothing may touch the table between the supports.

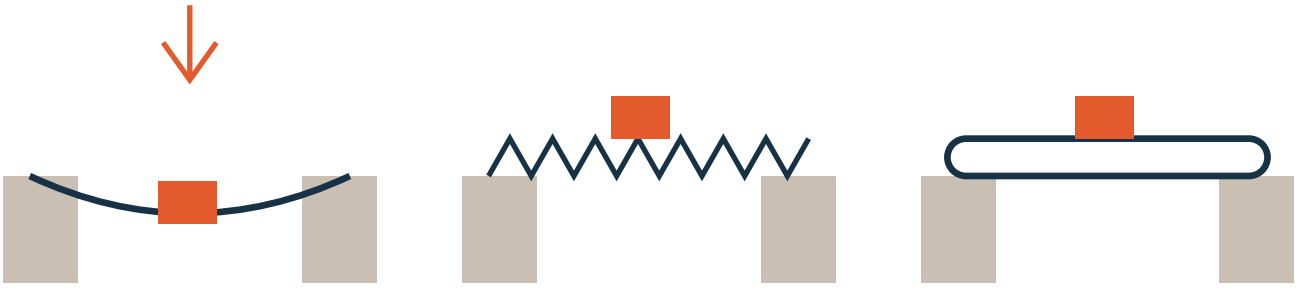
ACTIVITY 01 · FACILITATOR NOTES

The science in brief



Photo: Vitaly Gariev / Unsplash

A flat sheet of paper is very thin, so a small load in the middle bends it easily. When the sheet is folded into a zigzag, the folds stand up like a row of small walls and the paper becomes much deeper from top to bottom. Depth is what resists bending: for a simple beam, doubling the depth makes it roughly eight times stiffer. Rolling the paper into a tube works in a similar way.



Flat: bends at once

Zigzag: deep folds resist bending

Tube: strong along its length

Engineers use the same idea in real structures. Steel I-beams, box girders and the triangles of a truss bridge all put material far from the middle of the beam, where it does the most work. Corrugated cardboard and egg boxes are everyday examples pupils can look for at home.

Common ideas to listen for

- "More tape makes it stronger." Tape adds little strength; shape matters more.
- "A thicker pile of flat sheets is best." Stacked flat sheets still bend; folding them is far stronger.
- "It broke, so we failed." A collapse is useful information about where to improve.

Adapting the activity

Support

Give one pre-folded zigzag as a model, reduce the gap to 15 cm and let pupils count coins in fives.

Stretch

Widen the gap to 30 cm, work out a "strength score" (coins held divided by sheets used) and draw where the bridge bent first.

WORKSHEET 1

Test the shapes

Name: _____ Class: _____ Date: _____

Predict how many coins each shape will hold. Then test it: add one coin at a time until the cup touches the table or the paper falls.

My results

Shape	My prediction (coins)	Result (coins)	Strongest?
Flat			
Zigzag			
Tube			

Was it a fair test?

Tick the things you kept the same:

- ☐ the same kind of paper
- ☐ the same gap
- ☐ one coin at a time

What did you find out?

The strongest shape was the _____ because

WORKSHEET 2

Design my bridge

Challenge: cross a 20 cm gap with up to 4 sheets of paper and 30 cm of tape. The cup must sit on top.

1 Sketch your bridge

Draw the two supports, your folds and where the cup will go.

2 Build and test

Test	Coins held
Test 1	
One thing we changed:	
Test 2	

3 Did the change help? How do you know?

WORKSHEET 3

Engineer's log

Colour in the box that is true for you.

What I can do

I can...	Not yet	Nearly	Yes!
explain what a load is			
say which paper shape was strongest and why			
keep a test fair			
use a test result to improve my design			
work well with my partner			

The best idea in our bridge was...

Home challenge

Find something at home that uses folds or tubes to be strong, such as a cardboard box, an egg box or a drink carton. Draw it here and label the part that makes it strong.

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight pupils; copy as needed.

Pupil	Explains shape and strength	Keeps the test fair	Uses results to improve

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Bridge Builders is a sample activity from the EduTrend Contents W4C Science & Engineering programme (primary, level: foundation). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

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