

engineering

Build a stronger structure

Lesson at a glance

Open with the challenge choice: a free-standing bridge that holds a toy car across a 20–30 cm gap, or a tower that holds a small weight. Demo a flat newspaper strip versus a rolled tube, plus a weak join versus an overlapped tape join. Groups build with newspaper, card, straws, lolly sticks and masking tape, then predict, load-test, make one strengthen change and retest. They draw strong shapes and firm joins on the Investigation Journal page before a short share and tidy.

Learning objectives

- Build a free-standing bridge or tower that does a simple job
- Test and strengthen the build using good shapes and joins

Before the bell – prep

Before the bell: mark every bridge gap at the same 20–30 cm with book stacks; set one materials tray per group (newspaper, card, straws, lolly sticks, masking tape) kept out of sight until the build; ready a front-table demo kit; print one Investigation Journal page each; have one toy car and one small weight (bag of coins or wooden block) per testing group.

**Materials**

Item	Qty	Per	Source	Low-cost substitute
newspaper sheets	6	group	classroom	used plain paper or old worksheets
card offcuts (from cereal boxes or scrap card)	4	group	classroom	folded thick paper or magazine covers
drinking straws	10	group	supermarket	rolled paper tubes taped along the seam
lolly sticks	10	group	school kit	short strips of stiff card
masking tape roll	1	group	classroom	sticky tape or washi tape
toy car for bridge load test	1	bridge group	school kit	a small wooden block or eraser of similar size
small weight for tower load test (bag of coins or wooden block)	1	tower group	classroom	a board rubber or a small bag of marbles
books or desk gap supports to make a 20–30 cm bridge span	2	bridge group	classroom	two identical lunch boxes or pencil cases as supports
Investigation Journal page	1	pupil	classroom	plain A4 paper for a labelled drawing
front-table demo kit (newspaper sheet, tape, two supports with the same marked 20–30 cm class gap)	1	class	classroom	same items taken briefly from one group tray for the demo only

Safety watch-point

Only the placer loads; others stand back. Mind fingers when taping and folding; no running with sticks or straws; never stand on chairs to load a tall tower; keep bridge-gap lanes clear and catch falling pieces.

Teaching moves

- **Getting Started:** Hold up the toy car and small weight with group trays still hidden. Ask what job the bridge or tower must do and how we will know it worked. Capture two or three pupil ideas on the board (fold, roll, triangle, tape well) and name real-world strong shapes — boxes, roof frames, Irish bridges.
- **Strong shapes and firm joins:** Keep the board to the flat-vs-tube question plus the two focus words. Live-demo: flat strip sags across the class gap; rolled taped tube holds better; tiny dab of tape peels, overlapped both-sides tape holds; optional one-minute tripod tower. Head off 'more tape alone = stronger' before trays go out.
- **Build our structure:** State the shared success picture once: free-standing, at least one strong shape, joins firm enough for a gentle load. Groups of 3–4 choose bridge or tower. Pause halfway — stop new features, firm joins, check it stands alone. Circulate with: Where is your strongest shape? Is it free-standing yet?
- **Test and strengthen:** Run predict → first load → one change → retest at each desk in parallel, not a race. One placer only; others stand back. Bridge: car mid-span. Tower: weight on top. Keep the same load and gap. If it fails completely, ask where it gave way first and simplify one shape or join — no brand-new design.
- **Draw what made it strong:** Investigation Journal is a blank drawing space: structure, strong shapes marked, joins that held, plus one spoken stem to a partner — This made it stronger because... If time is tight, labelled drawing plus one sentence to you is enough.
- **Share and pack away:** One or two groups only finish Our bridge/tower held because... then prioritise tidy: peel tape, recycle scrap, return book stacks, clear gaps and floor. Revoice that good shapes, firm joins and one-change testing make a structure steady.

What it should show

Many first builds sag, lean or peel at a join — useful data, not failure. After one strengthen change, expect rolled tubes, triangle braces and overlapped both-sides tape to hold the gentle load better. A bridge that still sags often has a flat deck or weak mid-span join; a tower that leans usually needs a wider tripod base or firmer foot joins.

Misconceptions & interventions

- **More tape alone makes it stronger.** — Point back to the demo: the tiny dab peeled while the overlapped both-sides join held. Ask which join is firmer and whether a floppy flat strip would hold even under lots of tape.
- **If it falls we failed and should start a whole new design.** — Treat the collapse as evidence: Where did it give way first — the shape or the join? In the two-minute window, simplify one join or roll one floppy leg into a tube, then retest the same build.
- **A free-standing structure needs hands or books propping it during the test.** — Restate the success picture before the load: no hands holding it. Help strip back to two side-by-side tubes (bridge) or a three-tube tripod (tower) that can stand alone for one gentle test.

**Differentiation**

Emerging	Developing	Proficient
• Offer a starter build: two rolled tubes side by side for a bridge deck, or three tubes taped as a tripod for a tower, then firm the joins for one gentle test.	• After the retest, ask why the one change helped and point to the shape or join on their Investigation Journal drawing.	• Stretch within the same kit: a slightly wider gap, a second storey on the tower, or a fair critique of which join still looks weakest after the retest.

Cross-curricular hook

Link to Maths 2-D shapes — triangles and cylinders as strong forms — and spot them on Irish bridges, climbing frames and cardboard boxes.