

Build a stronger structure

Lesson at a glance

Open by holding up a toy car and a small weight and posing the free-standing bridge-or-tower challenge. Live-demo a flat paper strip sagging across a 20–30 cm book-stack gap versus a rolled newspaper tube that holds, plus a weak join peeling open against an overlapped both-sides tape join. Groups build with newspaper, card, straws, lolly sticks and masking tape, then run predict → gentle load → one strengthen change → retest. Close by drawing strong shapes and firm joins on the Investigation Journal page and a short share.

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

Night before: mark one shared 20–30 cm gap on two book stacks per bridge group and match the front-table demo gap. Tray per group: newspaper, card offcuts, straws, lolly sticks, masking tape. Print Investigation Journal pages. Keep group trays hidden until the build step; only the demo kit (one sheet, tape, stacks, car, weight) sits out early.

**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

One placer only during load tests; others stand back. Mind fingers when pressing tape and folding card; no running with sticks or straws; never stand on chairs to load a tall tower; keep bridge-gap lanes clear.

Teaching moves

- **Getting Started:** Hold up the toy car and small weight only — trays stay out of sight. Ask what job the bridge or tower must do and how we will know it worked. Capture two or three quick board ideas (fold, roll, triangle, tape well) and invite real-world strong shapes children have noticed (boxes, roof frames, Irish bridges).
- **Strong shapes and firm joins:** Keep the live demo short: flat strip sags across the class gap; rolled taped tube holds better — name the strong shape. Show a tiny-dab join peel, then overlap and tape both sides. Under one minute, stand one tube (leans) versus three tubes in a tripod holding the weight. Head off ‘more tape alone equals stronger’ before trays go out.
- **Build our structure:** Say the shared success picture first: free-standing, at least one strong shape, joins firm enough for a gentle load. Groups of three or four choose bridge or tower. Call a halfway pause — stop new features, firm joins, check it stands alone. If a build still needs hands, strip back to two side-by-side tubes (bridge) or a three-tube tripod (tower), not a brand-new design.
- **Test and strengthen:** Run predict → first load → one change → retest at each desk in parallel. One placer only; everyone else stands back. Bridge: car at mid-span. Tower: weight on top. After the first watch, allow one strengthen only (brace, retape, roll a leg) with the same car/weight and same gap. If it fails completely, ask where it gave way first — shape or join — and simplify that one thing for the retest.
- **Draw what made it strong:** Pupils draw the real build on the Investigation Journal page, mark strong shapes and joins that held, and say one sentence to a partner: ‘This made it stronger because...’. If time is tight, labelled drawing plus one spoken sentence to you is enough.

What it should show

A successful build stands free, shows at least one strong shape (roll, fold, triangle, tube) and holds the gentle load after one strengthen pass — or clearly improves (less sag/lean). First builds often sag or lean; that is useful data. Odd total collapse is usually a weak join peeling or a flat unrolled span; simplify that one join or shape and retest rather than starting over.

Misconceptions & interventions

- **More tape always makes it stronger.** — Point back to the demo join that peeled despite tape, then the overlapped both-sides join that held. Ask: ‘Is the problem how much tape, or how the pieces meet?’
- **If it falls we failed, so we should scrap it and start a whole new design.** — Treat the collapse as evidence: ‘Where did it give way first — the shape or the join?’ Keep them in the two-minute window fixing only that one thing for the retest.
- **A flat sheet of newspaper is as strong as a rolled tube of the same paper.** — Re-show the flat-vs-tube gap demo if needed. Have them gently press both and feel the stiffness difference before they rebuild the span or leg as a tube.

**Differentiation**

Emerging	Developing	Proficient
• Offer the starter build: two rolled tubes side by side for a bridge deck, or three tubes taped as a tripod tower, then focus talk on firming one join. • Pair at the teacher table for the halfway free-standing check before the first load.	• After the retest, prompt: ‘Why did that one change help — was it the shape or the join?’ • Ask them to point to the join most likely to peel next and say how they would firm it.	• Stretch within the same kit: wider gap for a bridge, or a second storey on the tower, still free-standing under the same load. • Ask a fair-test critique: ‘What did we keep the same between the two loads so we know the change made the difference?’

Cross-curricular hook

Link to Maths 2-D/3-D shape — name triangles, tubes and folds in the build and in Irish bridges, climbing frames and cardboard boxes.

