engineering

Why beams are deep, not wide

Lesson at a glance

Open by bending one plastic ruler flat, then on its edge, so the class feels the same stick change strength. Name depth, width, beam and orientation on that ruler, then groups predict and bend a ruler, card strip and lolly stick both ways, recording which orientation was harder on the Investigation Journal page. Groups measure depth and width of two reachable classroom beams, pool up to six readings in the data-recorder interactive, and close with a display-only talk linking the bend pattern to why builders fit beams deep.

Learning objectives

- Compare how easily a beam bends flat versus on its edge
- Measure depth and width of real beams and record which way round they are fitted
- Explain why beams used in structures are deeper than they are wide

Before the bell — prep

Day before: scout the room and corridor for two reachable rectangular beams (shelf batten, door lintel/head, bench rail). Pre-mark safe zones; bring a timber offcut if fittings are hidden. Count one plastic ruler, card strip and lolly stick per pupil or pair, plus measuring tapes and Investigation Journal pages.

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Materials

Item	Qty	Per	Source	Low-cost substitute
30 cm plastic ruler	1	pupil	classroom	a sturdy strip of thick card of similar length
card strip (roughly 30 cm by 2 to 3 cm)	1	pupil	classroom	a strip cut from a cereal box
wooden lolly stick	1	pupil	supermarket	a clean ice-lolly stick brought from home, or a thin craft stick
measuring tape (mm/cm)	1	group	school kit	a second 30 cm ruler used carefully end to end
timber offcut or spare shelf batten (fallback demo beam)	1	class	hardware shop	a spare wooden shelf support already in the room, or a thick craft stick used only for measuring demo
Investigation Journal page	1	pupil	classroom	plain paper ruled into a simple results table by the pupil

Safety watch-point

Gentle two-finger bends only — stop before card creases or sticks snap. Measure in agreed indoor zones; no climbing, moving furniture or removing fittings.

Teaching moves

- **Getting Started:** Hold one 30 cm plastic ruler only — kit stays away. Bend it gently flat between two fingers, then stand it on edge and try the same light push. Ask what changed and whether it was the same ruler.
- **Depth, width and beams:** Still using that ruler, point up-down on edge as depth and side-to-side as width, then introduce beam and orientation. Head off "thicker is always stronger" — direction will matter as much as material.
- **What do you predict?:** Think-pair-share: which way will be harder to bend — flat or on edge — and why. Capture two or three spoken predictions on the board without judging them.
- **Bend it flat, bend it on edge:** Model the full cycle aloud with the ruler only, then hand out ruler, card and lolly stick. Groups use a gentle two-finger push both ways and stick to one judgement method. Circulate; stop hard presses. Record harder orientation per material on the Journal and agree a short board table before moving on.
- **Beams around our school:** Before anyone leaves seats, label depth (up-down as fitted) and width (side-to-side) on a shelf support or demo offcut. Groups measure at least two safe beams in mm, naming orientation first. Call them back with two minutes in hand — two solid readings beat a rushed third.
- **Chart what we found:** Open the data-recorder interactive. Type one varied beam per group (six rows max): name, width mm, depth mm, and Yes/No for depth greater than width. Pause after each row, then show the depth bar chart.
- **What does the evidence show?:** Keep the bend-test board table beside the chart. Separate observation (all three materials bent more easily flat; structural beams were deeper than wide) from inference (deep orientation resists sag). Ask what would happen if a floor beam were fitted flat and wide.

What it should show

Almost every pupil feels ruler, card and lolly stick bend far more easily flat than on edge. Measured structural members (joists, lintels, shelf supports) should show depth greater than width. A flat, wide shelf board may reverse that — treat it as honest contrast, not a joist. Odd "edge feels weak" results usually mean too hard a push or a twisted grip; re-run with a gentle two-finger press.

Misconceptions & interventions

- **"Thicker material is always stronger — so the edge must be thicker."** — Have them read both faces on the ruler markings: the material has not changed, only which face meets the push. Orientation, not extra thickness, is doing the work.
- **Pupils swap depth and width, calling the side-to-side size "depth."** — Agree as a class: once the beam is fitted the builder's way, depth is the up-down measurement and width is side-to-side. Point again on the demo beam before they measure.
- **Any flat board in the room is treated as a structural beam like a floor joist.** — Record flat shelf boards honestly, then ask whether they sag under books compared with a deeper support. Only members that span or carry a load count as the structural pattern.

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Differentiation

- {'emerging': ['Offer a binary choice for predictions (flat easier / edge easier) and a sticky note labelled depth / width on the demo beam while measuring.', 'Pair at the teacher table for the first bend so the gentle push and Journal row are modelled hand-over-hand.'], 'developing': ['Ask whether card and wood show the same pattern as the plastic ruler, and press for two clear mm readings with orientation named first.'], 'proficient': ['Stretch pairs to find a true joist or lintel and explain its job, or to contrast a flat shelf board with a deep support using the class chart evidence.']}

Cross-curricular hook

Tie to Maths Measures and Data — millimetre readings pooled into the class bar chart comparing depth across beams.