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 resists more. They measure depth and width of real classroom beams in millimetres, pool one beam each into the data-recorder interactive, and close by linking the bend pattern to why floor beams and lintels stand 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 classroom and corridor for two reachable rectangular members (shelf batten, door lintel, bench rail); bring a spare timber offcut if the building hides beams; pre-mark zones. Gather one plastic ruler, card strip and lolly stick per pupil (or pair), plus measuring tapes. Open the data-recorder interactive on the IWB.

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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	provided printable	plain paper ruled into a simple results table by the pupil

Safety watch-point

Gentle two-finger bends only — stop before creasing or snapping. Stay in classroom and agreed indoor zones; no climbing, moving furniture or removing fittings.

Teaching moves

- **Getting Started:** Hold one 30 cm plastic ruler only — kit stays put. Bend it gently flat between two fingers, then stand it on edge and push the same way without forcing. Ask what changed and whether it was still the same ruler. Do not name depth or width yet.
- **Depth, width and beams:** Reveal the words one at a time on the same ruler: up-down when on edge is depth; side-to-side is width; then beam and orientation. Stress that direction matters as much as material, and agree as a class that depth is the up-down size once the builder has fitted it.
- **What do you predict?:** Think-pair-share on ruler, card and lolly stick: which way will be harder to bend? Capture two or three spoken predictions on the board without judging. Note anyone already linking strength to orientation rather than material alone.
- **Bend it flat, bend it on edge:** Model the full cycle aloud with the ruler only, then hand out ruler, card strip, lolly stick and Investigation Journal pages. Groups use a gentle two-finger push both ways and stick to one judgement method. Circulate; stop anyone pressing hard on edge. Build a short whole-class board table (Material | Harder orientation) before leaving the step.
- **Beams around our school:** Before anyone leaves seats, label depth and width on a shelf support or the demo offcut and remind them to measure load-carrying members only. Groups stay in marked classroom/corridor zones, write object, orientation, depth (mm) and width (mm) in the journal while measuring. Call back with two minutes spare; two solid beams beat a rushed third.
- **Chart what we found:** Pool six varied beams only into the data-recorder interactive: name, width (mm), depth (mm), and Yes/No for depth greater than width. After each row pause for class confirmation, then show the bar chart and ask whether depth bars dominate on structural members.
- **What does the evidence show?:** Keep the bend-test board table beside the depth/width chart. Separate observation (all three materials bent more easily flat; structural beams deeper than wide) from inference (standing a beam on its deeper face resists sag). Ask what would happen if a floor beam were fitted flat and wide.

What it should show

Almost every group feels ruler, card and lolly stick all resist bending far more on edge than flat. Structural members (joist-style supports, lintels, battens) should read deeper than wide in mm. A flat shelf board may show the opposite — record it honestly as contrast, not a joist. Odd bend results usually mean an unfair hard push on edge; re-run with a gentle two-finger start.

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Misconceptions & interventions

- **Thicker material is always stronger — so orientation should not matter.** — Point back at the bend board table: same plastic, card and wood, three materials, same pattern. Ask what stayed the same and what only changed.
- **Pupils swap depth and width, or say the edge is thicker so the material grew.** — Have them measure both faces with the ruler markings on the same stick — material unchanged, only which face meets the push. Re-agree: depth is up-down as fitted.
- **Any wide board in the room counts as a structural beam.** — Ask whether it spans a load or just holds books flat. Flat wide shelf boards are useful No rows on the chart; contrast them with lintels and deep supports.

Differentiation

Emerging	Developing	Proficient
• Offer a binary choice (flat easier / edge easier) and a sticky note labelled depth / width beside the member being measured. • Pair at the teacher table for the first modelled ruler bend before independent materials.	• Ask whether card and wood match the plastic ruler pattern, and require both orientations recorded for every material. • Aim for three labelled classroom beams if the two-beam minimum is secure.	• Find one clear joist or lintel and explain its job in a sentence using the chart evidence. • Critique a flat-fitted shelf board: would a deeper support sag less under books, and why?

Cross-curricular hook

Tie to Maths Measures and Data — millimetre readings compared, then bar-charted on the class data-recorder.