

Engineer

Bridges and engineers

Bridges are structures that have been used for centuries to provide a safe route over an obstacle, such as a valley or river. Over time, engineers have improved bridge design and used stronger materials to span greater distances and support more weight. Examples include:

Menai Bridge, Wales

Engineer: Thomas Telford

Date completed: 1826 Span: 176m Material: iron



Clifton Suspension Bridge, England

Engineer: Isambard Kingdom Brunel

Date completed: 1864 Span: 414m Material: steel



Forth Bridge, Scotland

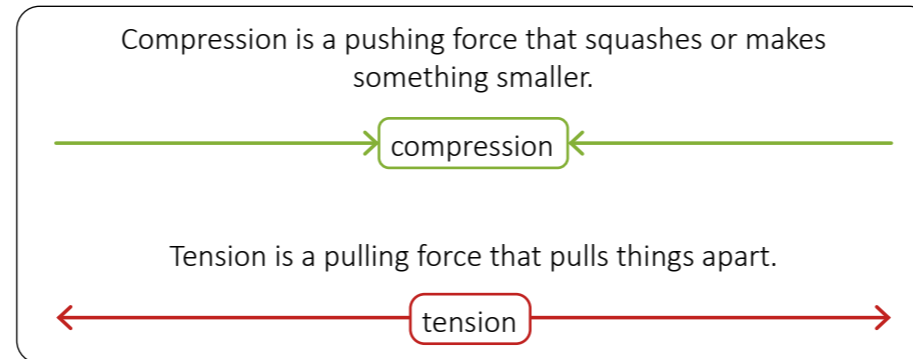
Engineer: Sir John Fowler and Sir Benjamin Baker

Date completed: 1890 Span: 2467m Material: steel



Forces

Two important forces that engineers consider when building a bridge are compression and tension.



When these forces are balanced, a bridge is strong and stable. When they are unbalanced, a bridge will collapse.

Types of bridges

Beam bridge

Beam bridges have a horizontal beam and support piers. The vertical piers absorb forces from the horizontal beam when heavy loads are on the bridge.



Arch bridge

Arch bridges have a curved arch supported by abutments at each end. The arch spreads the forces from heavy loads outwards towards the abutments.



Truss bridge

Truss bridges are similar to beam bridges but use triangular shapes called trusses. The forces from heavy loads are spread across the truss structure.



Suspension bridge

The roadway on a suspension bridge is hung from vertical cables supported by towers. When heavy loads are on the bridge, there are increased tension forces in the vertical cables, which are transferred to the towers.



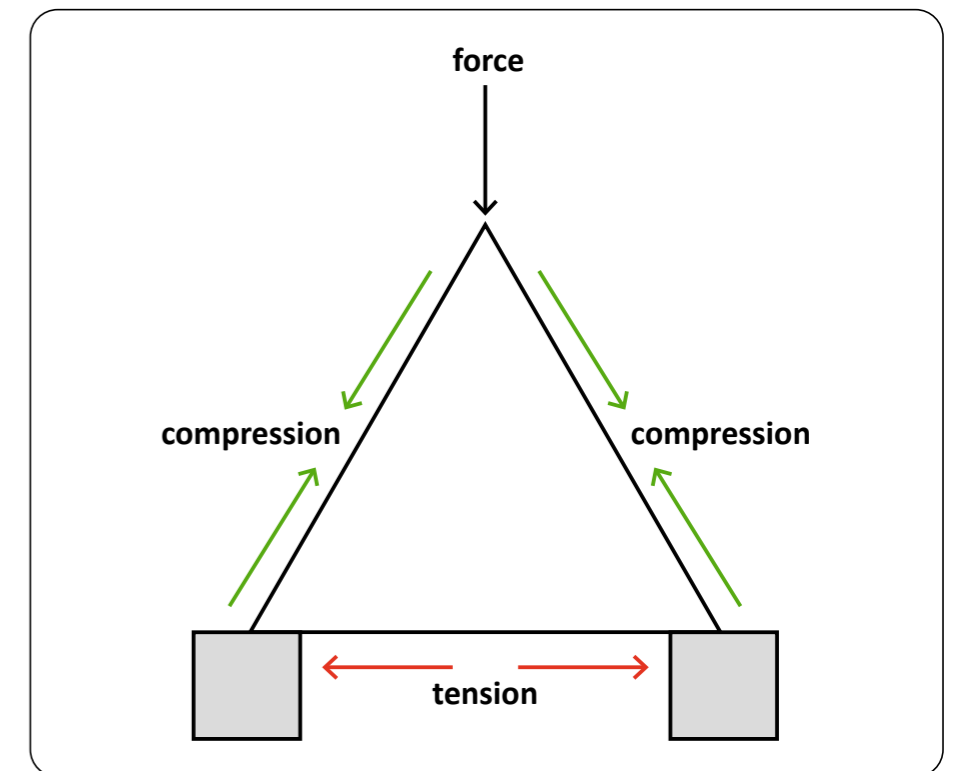
Strengthening paper bridges

Paper bridges can be strengthened by:

- increasing the number of layers of paper used
- changing the shape of the paper
- folding the paper into a concertina

Triangles for strength

Triangles provide structural strength and stability by distributing the force down each side. Triangles do not collapse or distort easily and are commonly used in bridge building to provide support.



Glossary

concertina	Folds made alternately to the front and back of a material.
distort	To change the original shape of something.
engineer	A person who designs or builds machines, electrical equipment or structures such as roads, railways and bridges.
span	The length of something from one end to the other.

Make Do and Mend

Clothes rationing

In 1941, during the Second World War, the British government introduced clothes rationing. This freed up factory space and labour for other essential war purposes. Clothing coupons were given to every family, limiting the amount of new clothes they could buy.



Make Do and Mend campaign

In 1943, the government introduced the 'Make Do and Mend' campaign to encourage people to recycle and repurpose worn-out clothes. Everyone was encouraged to improve their sewing skills. The character 'Mrs Sew and Sew' was introduced as part of the publicity campaign.



Deconstruction

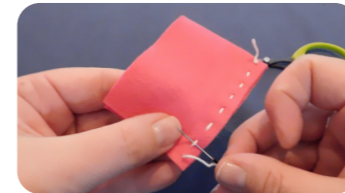
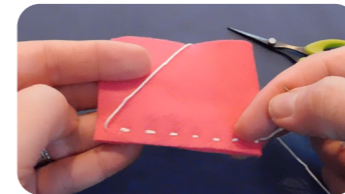
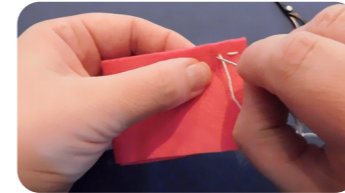
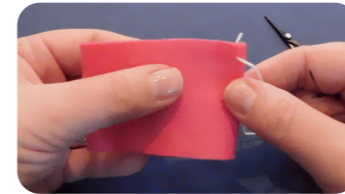
Deconstruction means taking things apart. Deconstruction helps to identify how an article of clothing was made, the material it was made from, and the properties that might make the item suitable for another purpose. During the Make Do and Mend campaign, people were encouraged to deconstruct old clothes and use the material for other garments.

Stitches

Various stitches can be used to join two pieces of fabric together. These include a running stitch, whip stitch and blanket stitch.

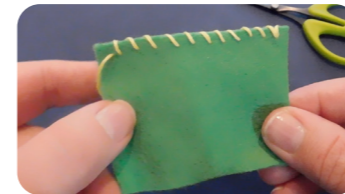
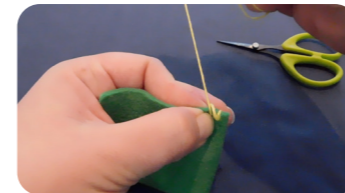
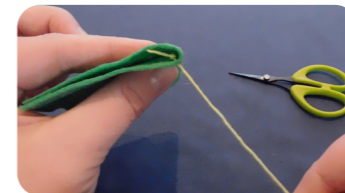
Running stitch

1. Push the needle and knotted thread from the back of the two layers of fabric to the front. Pull the thread to tighten.
2. Push the needle from the front to the back of the pieces of fabric. Pull the thread to make a stitch.
3. Repeat the running stitch along the edge of the fabric.
4. At the end, secure the stitching with a knot to finish.



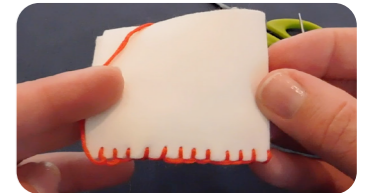
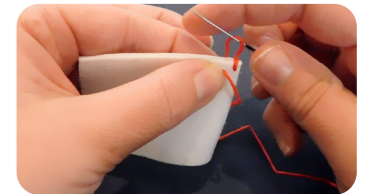
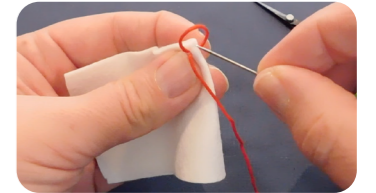
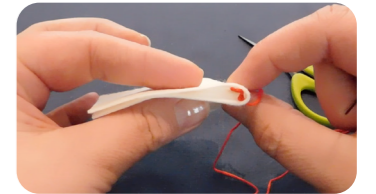
Whip stitch

1. Push the needle from the back to the front of the top layer of fabric. Pull the knotted thread to tighten.
2. Push the needle from the back to the front of both layers of fabric and pull the thread to tighten. The stitch will loop over the edges of the fabric.
3. Move the point of the needle a few millimetres away from the first stitch. Push the needle from the back to the front of the fabric again and pull the thread.
4. Continue the whip stitch along the edge of the fabric and secure the stitching with a knot to finish.



Blanket stitch

1. Push the needle from the back to the front of the top layer of fabric. Pull the knotted thread to tighten.
2. Push the needle from the back to the front of both layers of fabric. Leave a loop of thread at the top of the stitch. Push the needle through the loop and pull to tighten.
3. Move the point of the needle a few millimetres away from the first stitch. Push the needle from the back to the front of the fabric again and pull the thread, leaving a loop at the top of the stitch. Push the needle through the loop and pull the thread to tighten.
4. Repeat the blanket stitch along the edge of the fabric and secure the stitching with a knot to finish.



Repairing clothes

Rips in clothing can be repaired by sewing a piece of the same, or contrasting, fabric on the underside of the material to cover the rip. Holes in knitted fabric can be repaired by darning.



Glossary

coupon	A voucher entitling the holder to buy a certain amount of a rationed item.
darn	A way to mend a hole in knitted fabric by interweaving yarn.
rationing	The system that limits the amount of something that a person is allowed to buy when resources are scarce.
repurpose	To find a new use for a used item.