

# 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

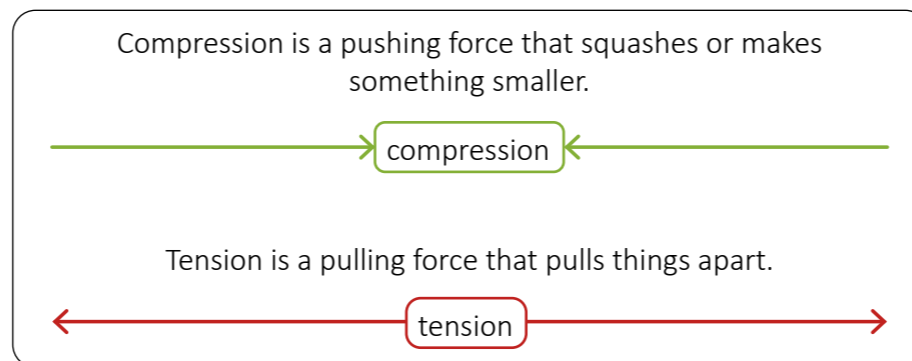
Engineer: Sir John Fowler and Sir Benjamin Baker

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.



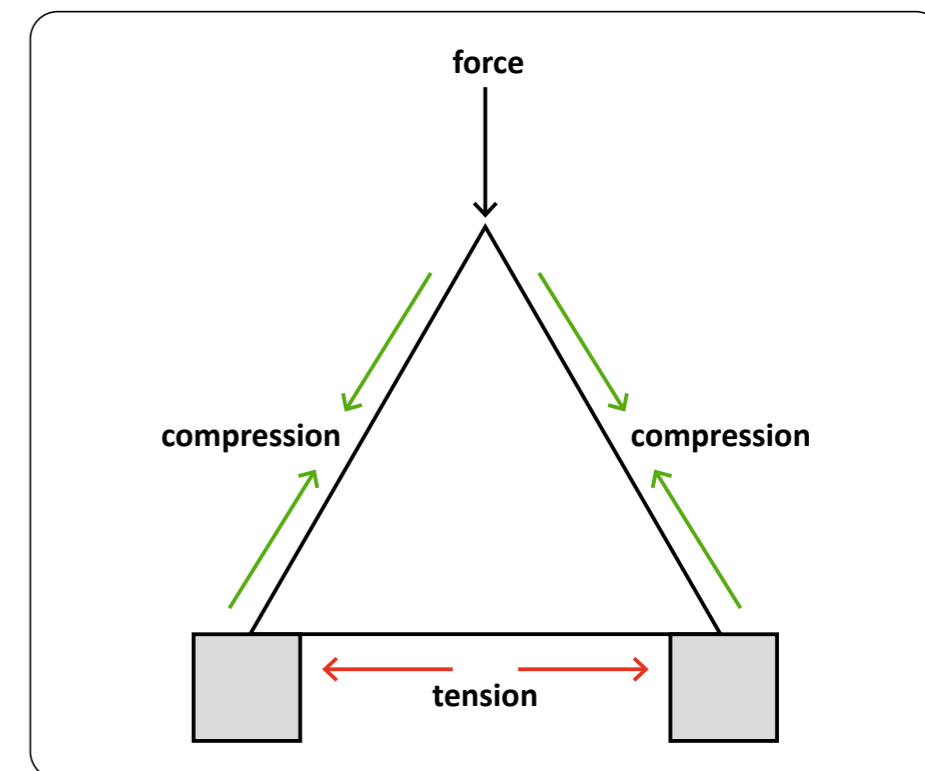
## Strengthening paper bridges

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

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