How Suspension Bridges Work

from the award-winning team at HowStuffWorks

There's no doubt you've seen a bridge, and it's almost as likely that you've traveled over one. Bridges are truly ubiquitous -- a natural part of everyday life. A bridge provides passage over some sort of obstacle – and the type of bridge used usually depends on the size of that obstacle. A suspension bridge, the pinnacle of bridge technology, is capable of spanning up to 7,000 feet. It manages this feat by successfully dealing with two important forces called compression and tension.

Compression is a force that acts to compress or **shorten** the thing it is acting on. **Tension** is a force that acts to expand or **lengthen** the thing it is acting on. A simple, everyday example of compression and tension is a spring. When we press down, or push the two ends of the spring together, we compress it. The force of compression shortens the spring. When we pull up, or pull apart the two ends, we create tension in the spring. The force of tension lengthens the spring.

Compression and tension are present in all bridges, and it's the job of the bridge design to handle these forces without buckling or snapping. **Buckling** is what happens when the force of compression overcomes an object's ability to handle compression, and **snapping** is what happens when the force of tension overcomes an object's ability to handle tension. The best way to deal with these forces is to either **dissipate** them or **transfer** them. To dissipate force is to spread it out over a greater area, so that no one spot has to bear the brunt of the concentrated force. To transfer force is to move it from an area of weakness to an area of strength, an area designed to handle the force.

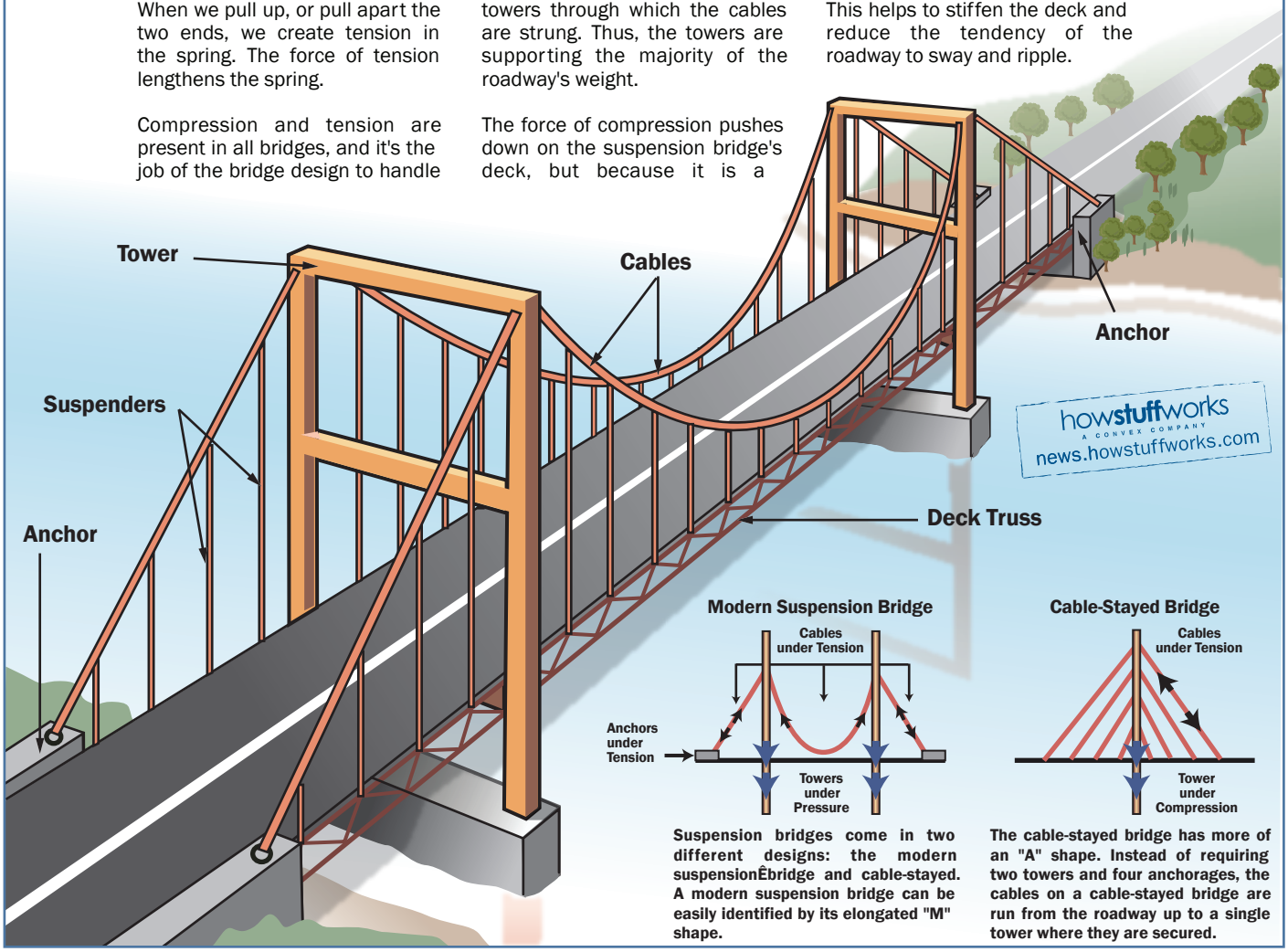
A suspension bridge is one where **cables** (or ropes or chains) are strung across the river (or whatever the obstacle happens to be) and the deck is suspended from these cables. Modern suspension bridges have two tall towers through which the cables are strung. Thus, the towers are supporting the majority of the roadway's weight.

The force of compression pushes down on the suspension bridge's deck, but because it is a suspended roadway, the cables transfer the compression to the towers, which dissipate the compression directly into the earth where they are firmly entrenched.

While a modern arch bridge can safely span up to 800 or 1,000 feet, a suspension bridge can span as much as seven times more – up to 7,000 feet.

The supporting cables, running between the two anchorages, are the lucky recipients of the tension forces. The cables are literally stretched from the weight of the bridge and its traffic as they run from anchorage to anchorage. The anchorages are also under tension, but since they, like the towers, are held firmly to the earth, the tension they experience is dissipated.

Almost all suspension bridges have, in addition to the cables, a supporting **truss** system beneath the bridge deck (a **deck truss**). This helps to stiffen the deck and reduce the tendency of the roadway to sway and ripple.



Suspension bridges come in two different designs: the modern suspensionÊbridge and cable-stayed. A modern suspension bridge can be easily identified by its elongated "M" shape.

The cable-stayed bridge has more of an "A" shape. Instead of requiring two towers and four anchorages, the cables on a cable-stayed bridge are run from the roadway up to a single tower where they are secured.