

Civil Structures-Bridges

Instructions: Upon completion of each design challenge, students will select at random one of the following content questions to answer.

1. What is the difference between Mass and a Force?

Mass is characteristic of matter.

Force=Mass *acceleration

Thus the more massive something is the more force it will exert when acceleration is constant.

2. What is acceleration due to gravity on Earth in m/s/s?

9.8 m/s/s

3. What is the definition of Shear stress?

A stress which is applied parallel or tangential to a face of a material, as opposed to a normal stress which is applied perpendicularly. In other words, considering that weight is a force, hanging something from a wall creates a shear stress on the wall, since the weight of the object is acting parallel to the wall, as opposed to hanging something from the ceiling which creates a normal stress on the ceiling, since the weight is acting perpendicular to the ceiling.

4. What is formula for shear stress?

The formula to calculate a shear stress is:

$$\text{Shear stress} = F/A$$

where

F = the force applied

A = the cross sectional area

5. What is the definition of Shear strength?

A term used to describe the strength of a material or component against the type of yield or structural failure where the material or component fails in shear.

6. What kinds of things do Engineers consider when designing a bridge?

Open Ended Question

7. What is the definition of compression? Give an example of compression in action.

Compression is a force that acts to compress or shorten 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.

8. What is the definition of tension? Give an example of tension in action.

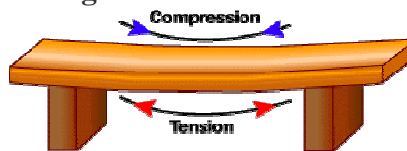
Tension is a force that acts to expand or lengthen the thing it is acting on. A simple, everyday example of compression and tension is a spring. When we press down, or push the two ends of the spring together, we compress it. The force of compression shortens the spring. When we pull up, or pull apart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

9. What are the three major types of bridges?

Beam bridge, arch bridge, suspension bridge

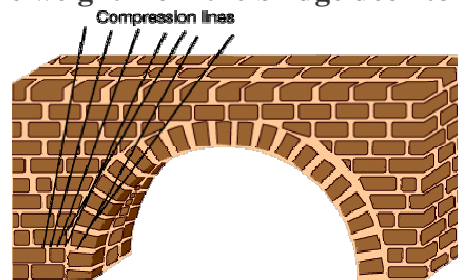
10. What is a beam bridge?

A beam bridge is basically a rigid horizontal structure that is resting on two piers, one at each end. The weight of the bridge and any traffic on it is directly supported by the piers. The weight is traveling directly downward. Take a two-by-four and place it on top of two empty milk crates -- you've just created a crude beam bridge.



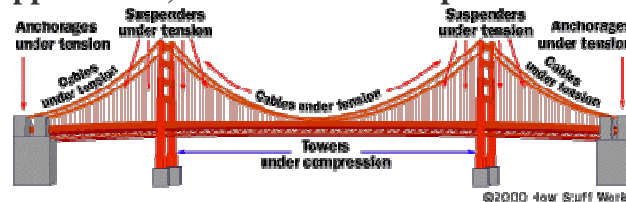
11. What is an arch bridge?

An arch bridge is a semicircular structure with abutments on each end. The design of the arch, the semicircle, naturally diverts the weight from the bridge deck to the abutments.



12. What is a suspension bridge?

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.



13. What is the definition of dissipation?

Tension and compression add stress to the bridge that will eventually cause it to break. Dissipation is causing the forces exerted on the bridge to spread out so that all the tension or compression is not in one place.

14. What is truss?

A truss is supporting lattice work on the beam of a bridge. This support truss adds rigidity to the existing beam, greatly increasing its ability to dissipate the compression and tension.