

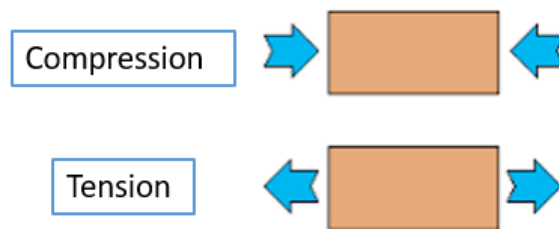


## Awesome Arches

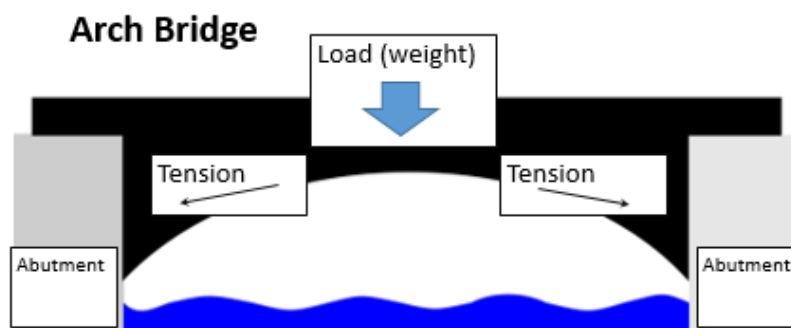


Arches are amazing structures. As curved symmetrical structures that span various openings, they are designed to support the weight the bridge, wall, or roof that are above it. They are used in construction throughout the world. Stone arch support structures were first used widely by the Romans who built some of the most durable edifices ever made. Many of them are still functioning today.

For an arch to be effective in supporting large weights, it must withstand the forces acting on them without buckling or snapping. The two main forces that act on an arch are compression and tension. Compression is a force that acts to compress, or shorten, the object that it is acting on. Tension is a force that acts to expand, or lengthen, the object it is acting on.



If the compressive forces become too great an arch will have a tendency to collapse and if the forces of tension become too great an arch will often snap. To counter these forces, arches are designed to spread out the forces acting on them. By spreading out, or dispersing, these forces, no one area of the arch has to bear the brunt of a concentrated force. In the arch bridge pictured below, the force of tension is transferred from an area of weakness near the top of the arch to an area of strength (abutment) that is designed to handle this force.



In this STEM Challenge, your initial task is to build an arch using ice cubes made of Plaster of Paris. Your second task is to measure and compare the strength of two simple bridges- each made out of 2 pieces of cardstock paper. For the first, you will build a simple beam bridge and for the second you will use an arch in the construction. In each case, you will actively investigate how the design acts to disperse forces and, in doing so, adds (or fails to add) to the strength of the structure.