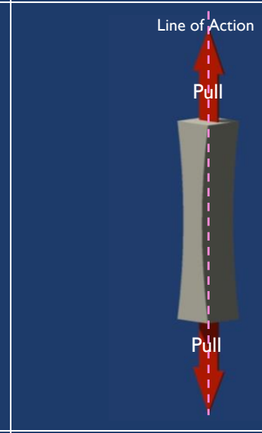
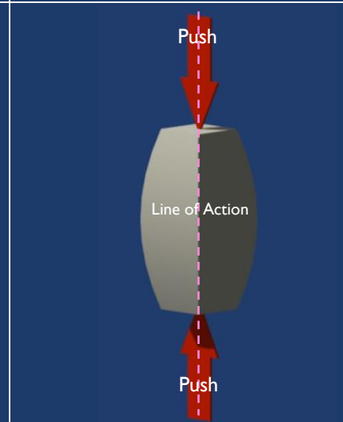
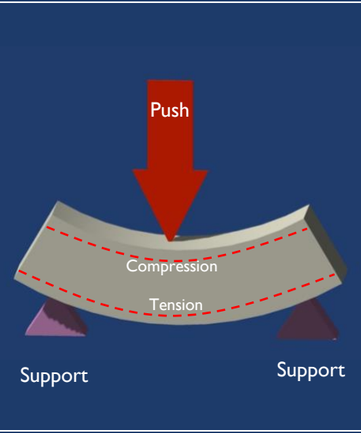
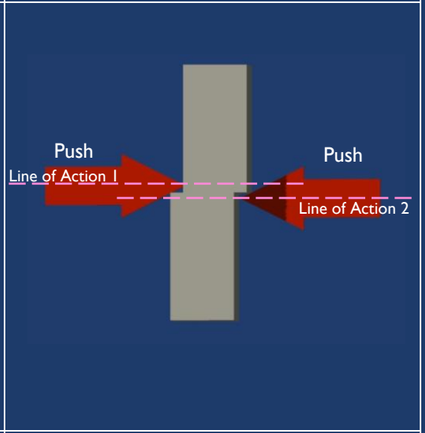
RAIC Centre for Architecture at Athabasca University

Basic Structural Forces

	Tension	Compression	Bending	Torsion	Shear
 Unloaded Structural Component					
What is it?	Tension is a force that tries to stretch a structural component by pulling on both ends of the component with equal magnitude but in opposite directions. Both forces occur along the same line of action.	Compression is a force that tries to crush a structural component by pushing on both ends of the component with equal magnitude but in opposite directions. Both forces occur along the same line of action.	Bending occurs when a force is applied perpendicular to the longitudinal (the long) dimension of a slender component. It causes compression on the surface to which it is applied and tension on the opposite surface.	Torsion is a force that tries to twist the component. Again the two forces are equal but acting in opposite directions	A shear force tries to split or divide the component. The forces are equal and work in opposite directions but they do not have the same line of action – although they can be close.
Examples	A cable in a suspension bridge is acting in tension. So is a string when you pull on it.	A column in a building is usually acting in compression. So is bread dough when you push on it.	A beam resting on two supports will bend when a load is applied to it.	An entire building when subjected to a strong wind can experience torsion.	Lateral forces such as wind can cause a shear force between the top and bottom of a building. Scissors use shear force to cut.
How to Resist it?	Materials such as steel are strong in tension	Materials such as concrete, stone and masonry are strong in compression.	Reinforced concrete is a good material to resist bending. The reinforcing resists the tension and the concrete resists the compression.	A closed hollow section like a box or a circle is good at resisting torsion.	A shear wall is designed to resist the lateral forces acting upon it. Various kinds of bracing can be used to resist shear.