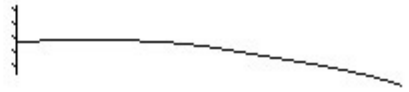
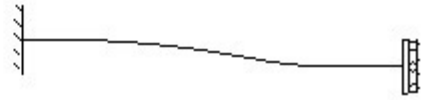
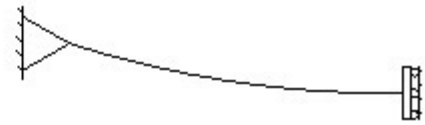
Buckling

In theory an object that has a compressive force directly in the axial direction, and is a homogeneous material **should not buckle unless a small lateral force is place on it**. However, in real life columns still buckle even if we believe the above are implemented. The reason for this is because materials are not perfectly homogeneous, and it is highly unlikely a perfect axial force is place on the part.

Basically, buckling occurs in a column due to an instability. This means that a column does not always buckle at the force that will correspond to the yield stress. Instead it will buckle at what is called the buckling force. To view this in real life, take a credit card or something similar and slowly apply a compressive force to it. You will notice at a certain force it will start to buckle.

Buckling is more pronounced in long narrow columns then in short thick columns. Also, depending on the materials used and how brittle they are, yielding or rupture may occur when buckling occurs. While in other cases, particularly long narrow column the structure will return to its original condition once the load is released.

The following table provides the equation to calculate buckling force for certain conditions.

Boundary Condition	Critical Load	Deflected Shape
Simple Support/ Simple Support	$\frac{\pi^2 EI}{L^2}$	
Clamped / Clamped	$\frac{4\pi^2 EI}{L^2}$	
Clamped /Simple Support	$\frac{2.04\pi^2 EI}{L^2}$	
Clamped / Free	$\frac{\pi^2 EI}{4L^2}$	
Clamped / Guided	$\frac{\pi^2 EI}{L^2}$	
Simple Support / Guided	$\frac{\pi^2 EI}{4L^2}$	

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