A concept that is misunderstood in engineering pertains to the concept of buckling. It sometimes isn't apparent that the limiting compressive load carrying capacity of a column isn't always the same as the compressive strength when the column material will break but rather it is sometimes limited by an elastic phenomenon called buckling which is based on the column's geometry. Does that definition sound confusing? It is!

The easiest way I've found to illustrate this phenomenon is to ask a student to take an ordinary plastic desktop ruler and try to pull it apart along its length. It is almost impossible for anyone to do. However, the same ruler compressed end to end bulges out at a critical buckling load. The material doesn't crack (at least not initially), but the ability of the ruler to carry compressive load is limited by the ruler bulging out from its originally straight position. That's buckling and that limits a column's ability to sustain a compressive load long before the compressive strength of the plastic in the ruler is attained.

To look at a practical application, consider this bridge over the Nith river in Paris (photo credit – Christian Kaufmann on a Sunday walk with his family). Why are the vertical columns slightly bigger than the inclined ones? Why do the inclined members change direction in the middle of the span? It is because the vertical columns are in compression so they are made larger to resist buckling. They are stubby to make that critical load where the column will elastically bulge out higher than the load they experience. The inclined members are in tension so they hold themselves straight like a guitar string.

I tell students before they even start to consider analysis, look at the sizing of the members to see if you can identify which are in compression (large members) or tension (small members). This develops that important "feel" for if a structure looks right.