Centre of gravity is a point of a body or a system at which the whole mass may be considered as concentrated. The centre of gravity lies at the geometrical centre of a body whose weight is uniformly distributed. In other word we can say that the centre of gravity on each little bit of an object is “gm” where ‘g’ is local gravitational constant and ‘m’ is the centre of mass.

**A1.1 Reasons for the stability of balancing bird and the leaning tower of Pisa**

Firstly, lest talk about the balancing bird, we all know what is unique in this balancing bird. But the main concept behind it, is the centre of gravity. The bird is balanced due to the uniform centre of gravity. This is because of the structure of it. Centre of gravity depends on the uniform distribution of mass in a body. And the uniform distribution of mass depends on the design of the body. So, in the balancing bird, the centre of mass comes right on the balancing point, right on the tip. Which means the bird is at equilibrium i.e. no force or rotation. Now there are two kinds of equilibrium one is stable and another is unstable. If the centre of gravity or centre of mass is above the pivot, then a body act like unstable. But if somehow, we managed to get the centre of gravity below the pivot point, then the body will be in the stable equilibrium i.e. it always maintains a particular position. Our bird do the same thing. The outstretched wings have weights located at the tips. The wings of the bird are just ahead of the beak and that is where the extra weight is located. this location allows the weight to exert a good bit of torque to the entire bird. So the bird has two things needed to be balanced:

1. The centre of gravity should be at the pivot point. Which make the bird in equilibrium i.e. no forces, accelerations and no torque.
2. The centre of gravity may be in the right below the pivot point to make the position stable.

Now, talking about the stability of leaning tower of Pisa.it is also based on the centre of gravity. According to science, anything will remain stable as long as the vertical line drawn from the centre of gravity passes through it base. Till today the vertical line from the centre of gravity has been falling within the base of this tower. Ans still the centre gravity is not get much affected by the leaning of the tower. One of another reason behind this, is that, the centre of gravity of anybody get affected by its base and height i.e. if the base area of an object is less than the height of that object should be less and vice versa. Thus, in the leaning tower of Pisa the base area and height is in the stable ratio. That is why the stability of the centre of gravity of the tower is still maintained.

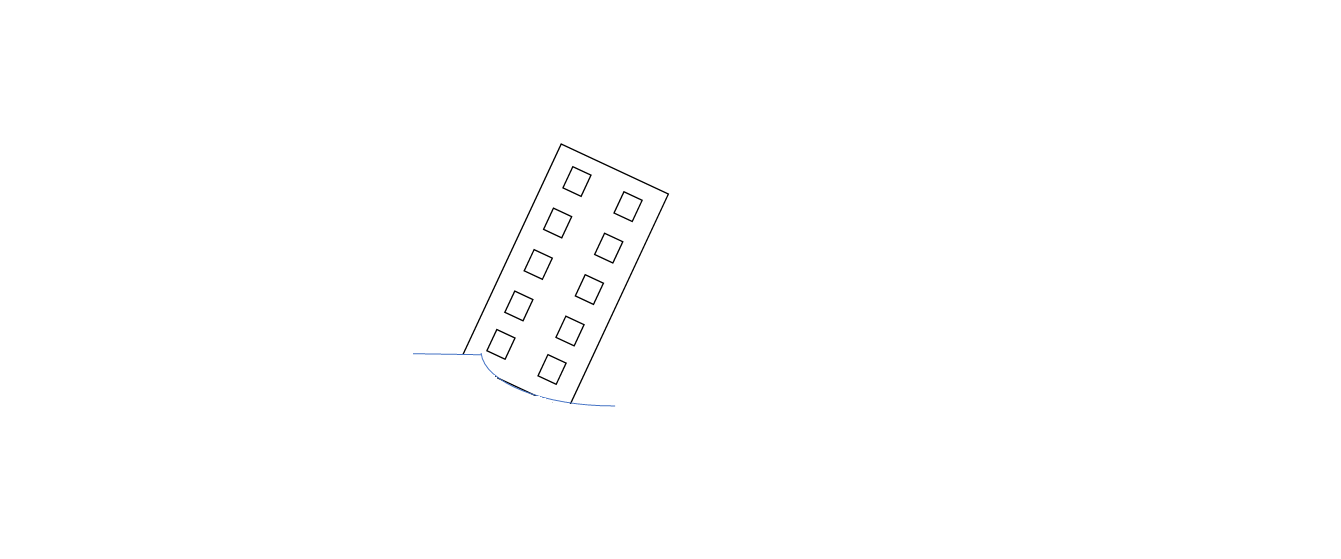
**A.1.2 Importance of centre of gravity with the help of other examples from civil engineering**

Centre of gravity is very important in every field, whether it in sports, structure of a building or any moving object. The stability of anything in earth or in another planet is depend on the centre of gravity. If the centre of gravity of any object get disturbed or not stable, then it will fall. Like in news, we use to listen that a building fallen down due to any phenomenon. That phenomenon is the first cause, but the main cause of that incident is due to the shifting of centre of gravity. Like a building fallen down due to soil erosion under the ground of that building. Due to this the building lean with some angle and the centre of gravity get disturbed or and get shifted. Which results the destruction of that building. Taking an example to understand the importance of centre of gravity:

on 11t December 1993 in Taman Hillview, Ulu Klang, Selangor, Malaysia. The highland tower collapse, due to the water content in the soil had turned viscous, by which the soil of the ground of the building became muddy. One side of the building lean down due the breakage of foundation of that side. The upper part of the building was much Havier than the lower part which exerts large amount of force on leaned side. the equilibrium of the building gets disturbed due to which the centre of gravity get shifted towards another side or we can say that the vertical line drawn from the centre of gravity passes through it base is no longer stable (as shown in the figure A1.2) . And due to the height of the building, the moment of inertia effects the centre of gravity heavily. As the result the building collapse completely.

The centre of gravity of building was in equilibrium before fallen down

CG



moment

The centre of gravity of building get disturbed due to which moment of inertia produce

CG

Fig A.1.1 rough diagram to demonstrate how the disturbed centre of gravity affect the stability of building (collapse the building).

CG

**A.1.3 Stance taken with justification and conclusion**

According to me Location of centre of gravity is the only factor that governs the stability of any structure. Without taking measurement of centre of gravity none of the structure can be made. If one makes a structure without keeping in his mind about centre of gravity, he/she can never build any structure. Centre of gravity is the basic stability of any structure. Keeping in the mind about this a best structure has been made. For example, burg Khalifa, the tallest building till now. It is very stable because the engineers took all the centre of gravity or centre of mass on its middle base. And the according to the height, the base of the building is very large, which promotes a stable equilibrium and maintain a stable structure with stable centre of gravity.