

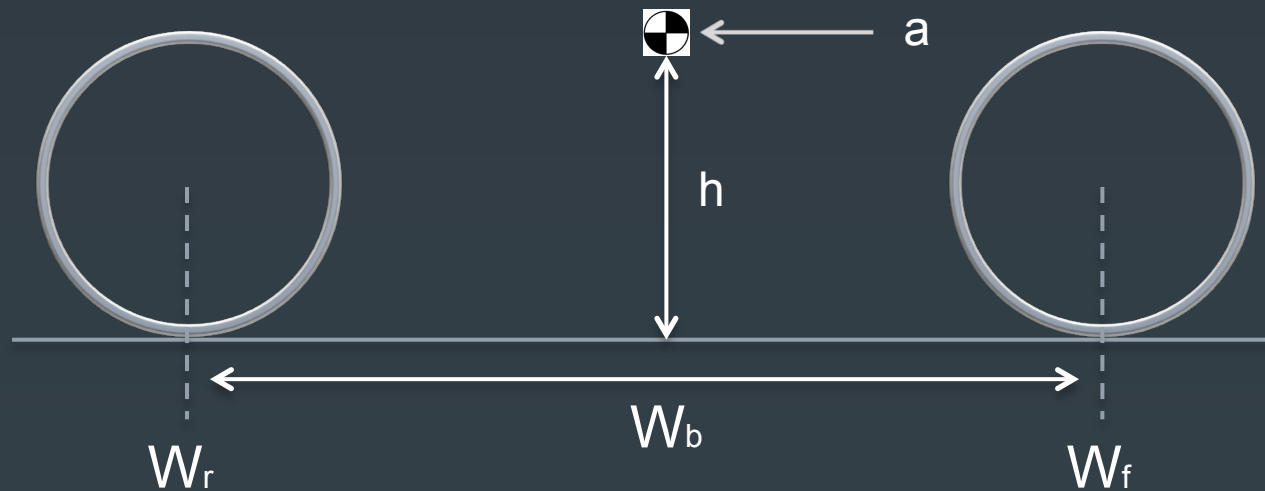
A photograph of a motorcycle accident on a racetrack. A rider in a red and yellow racing suit and a helmet with a star pattern is lying on the asphalt. The motorcycle is on its side, and a large fire is burning from the engine area. The background is a dark, paved surface.

Motorcycle Dynamics

Squat and Anti Squat

Squat & Anti Squat

Load Transfer



Horizontal force at CoG = $m \times a$

Therefore the moment due to this force = $m \times a \times h$

Squat & Anti Squat



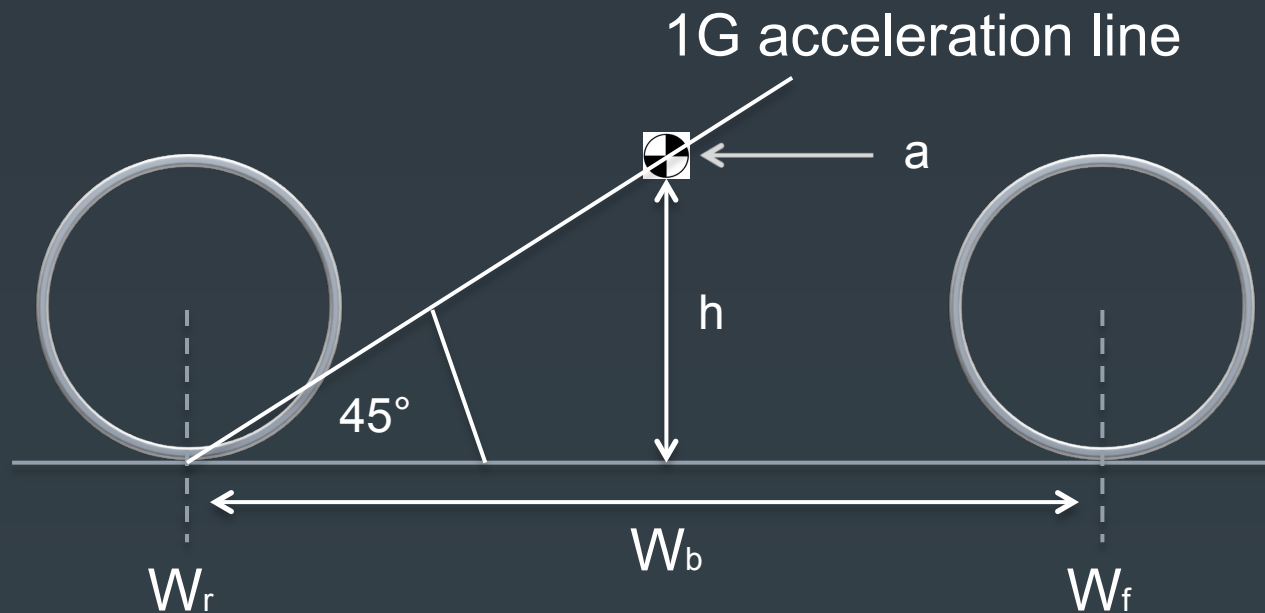
This moment must be resisted by an equal couple from the load transfer acting over W_b –

$$\text{Therefore } W_r \times W_b = -W_f \times W_b = m \times a \times h$$

$$\text{Thus load transfer } W_r = -W_f = \frac{M \times a \times h}{W_b}$$

So we can see that the important parameters are h and W_b , these can be easily changed during setup whereas m and a cannot.

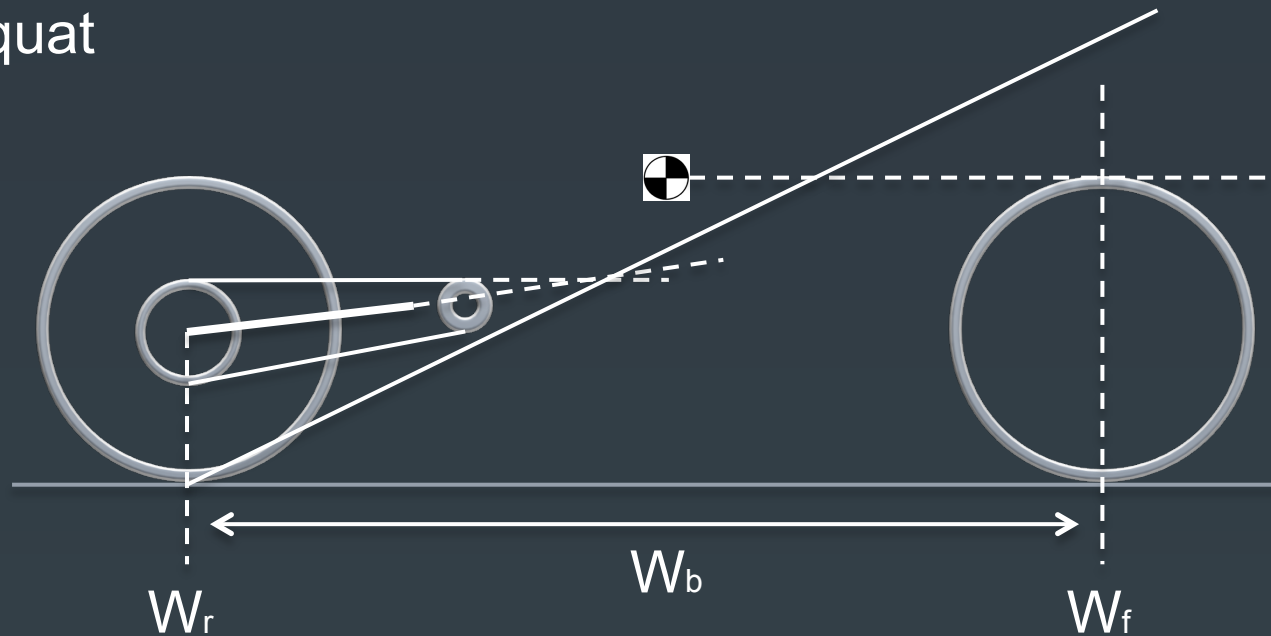
Squat & Anti Squat



Above we can see the 1G line, this is a line taken from the rear contact patch at 45° . If there is a 50/50 weight split ($X_{CoG} = W_b/2$) then this CoG is very close to the 1G line, this would make the bike very easy to wheelie.

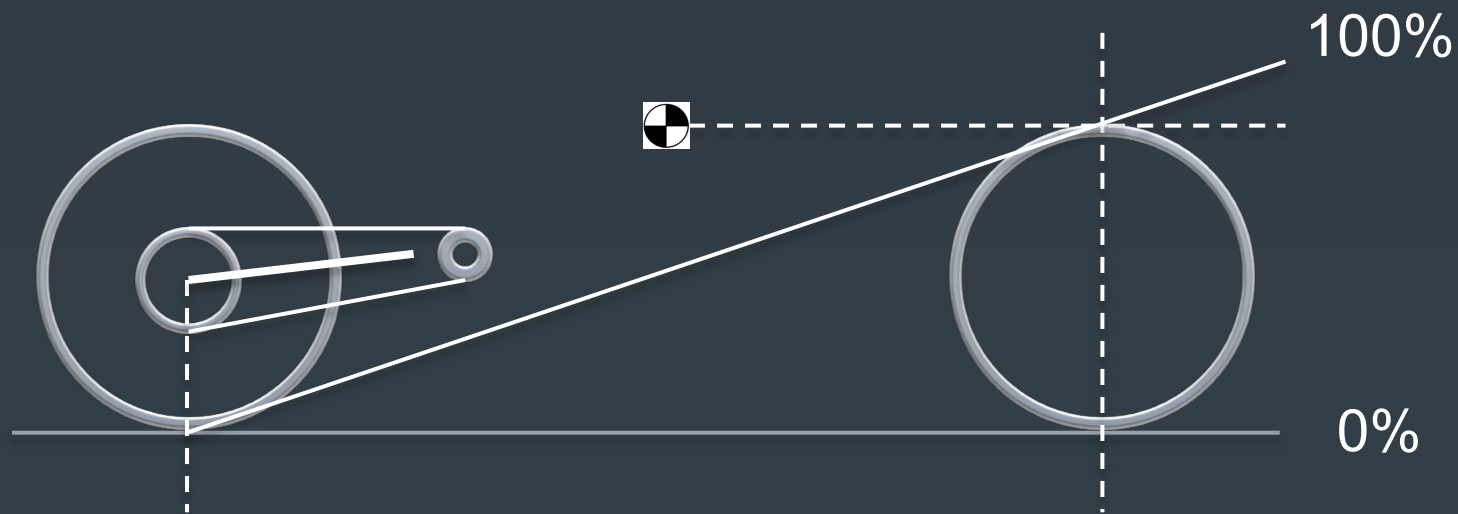
Squat & Anti Squat

Squat



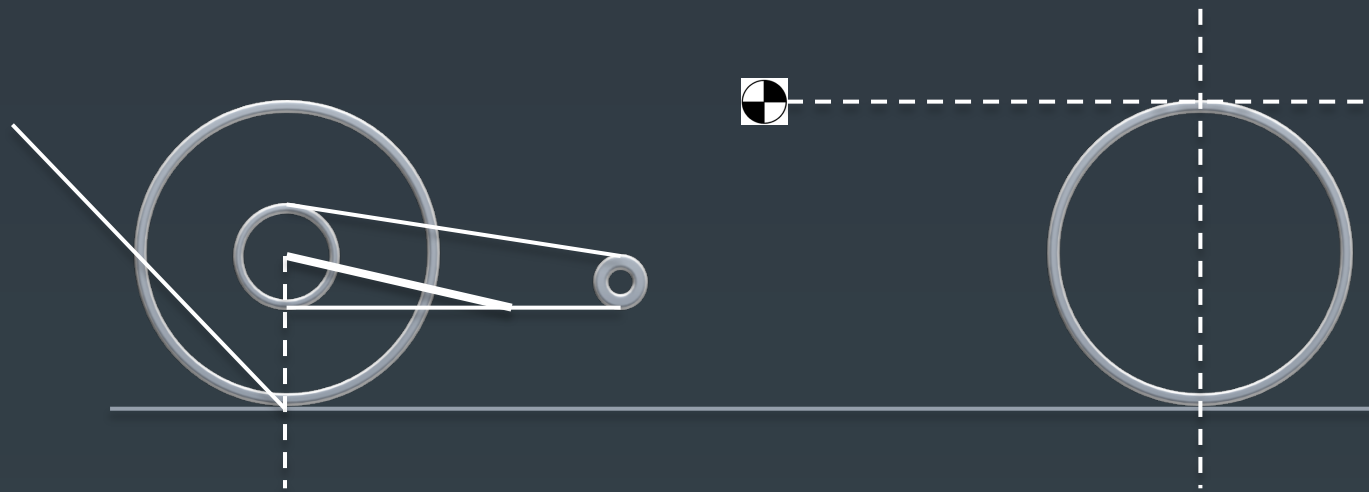
We can see from the above diagram the the Instantaneous Force Centre is created from the intersection of the chain line and the swingarm line (from the rear wheel centre to the swingarm pivot).

Squat & Anti Squat



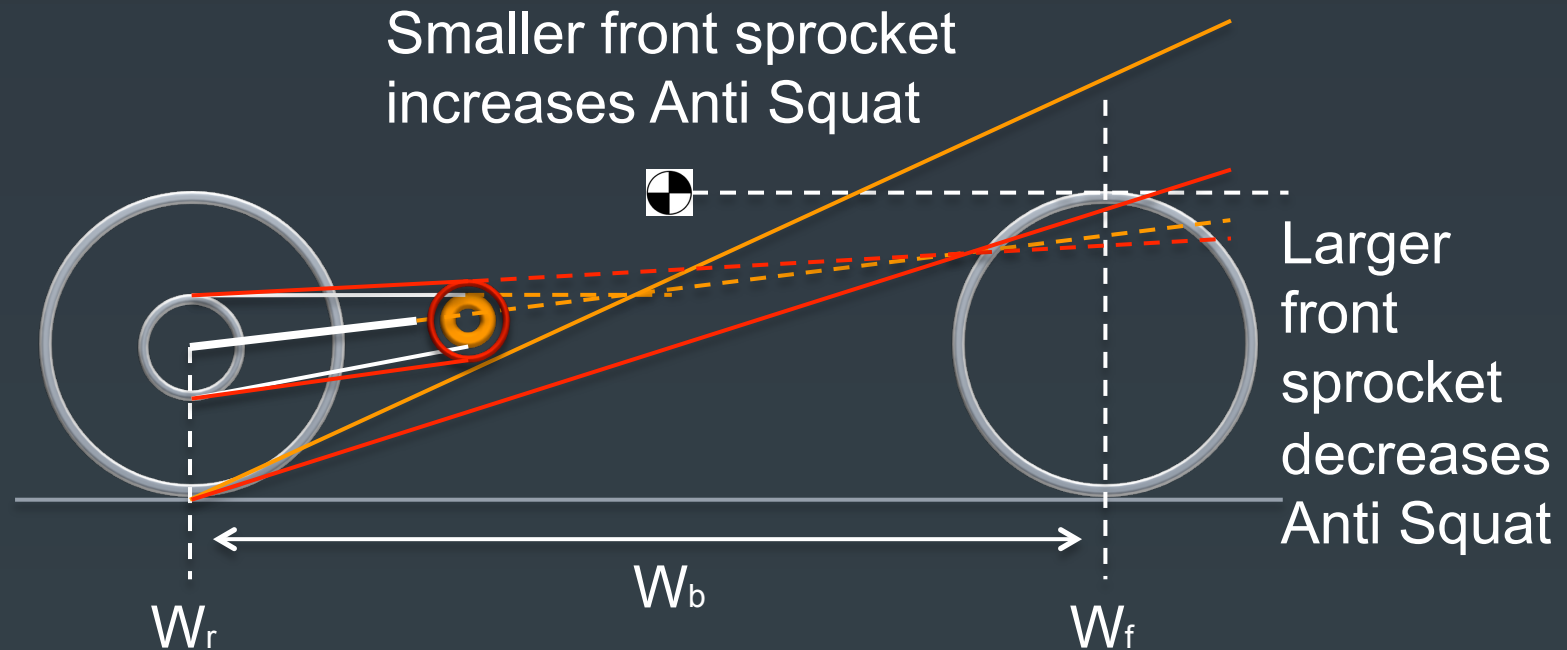
- 100% Anti Squat effectively separates the driving forces from the suspension response. So the chain and swingarm reactions cancel out the driving forces.
- 0% Anti Squat allows the full effect of the driving force to act on the motorcycles suspension causing squat.

Squat & Anti Squat



- -% would be Pro Squat, above is an exaggerated example but it shows how the Instantaneous Force Centre could be behind the rear wheel. If this occurred then there would be Pro Squat, with this the chain and swingarm reactions add to the driving force to increase squat further.

Squat & Anti Squat

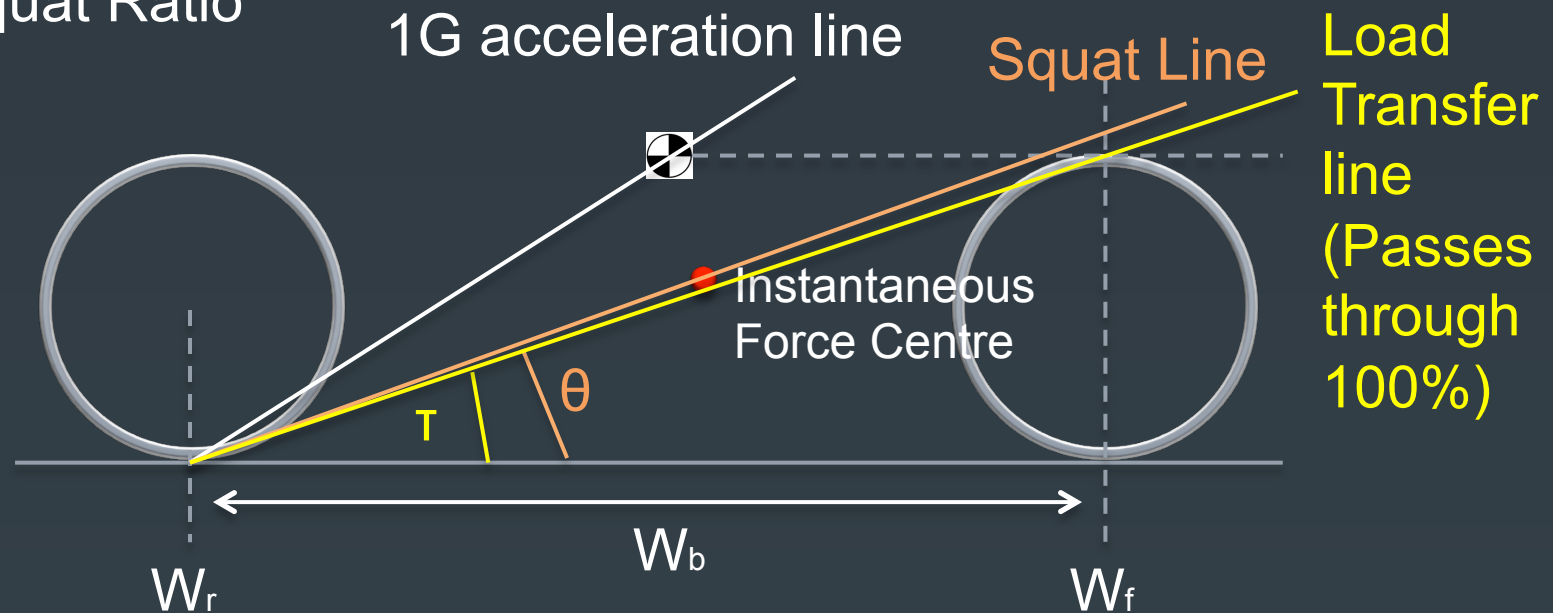


Using a larger rear sprocket has a similar effect to using a smaller front sprocket.

For example, if using 15/44 ratio you could change Anti Squat by using 14/41, this would give similar gearing but a different Anti Squat value.

Squat & Anti Squat

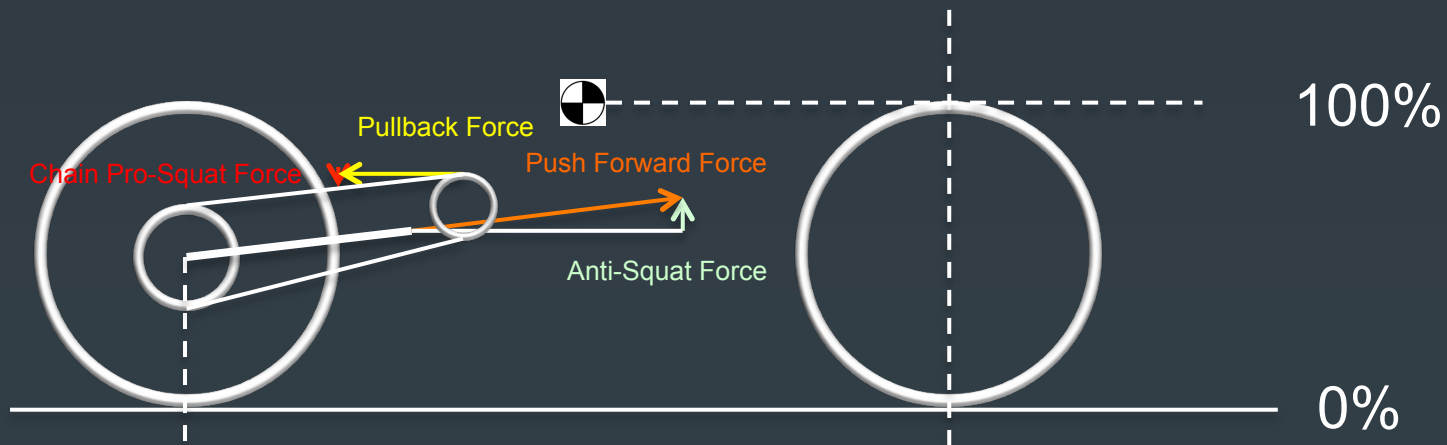
Squat Ratio



From these calculations we can also work out the Squat Ratio –

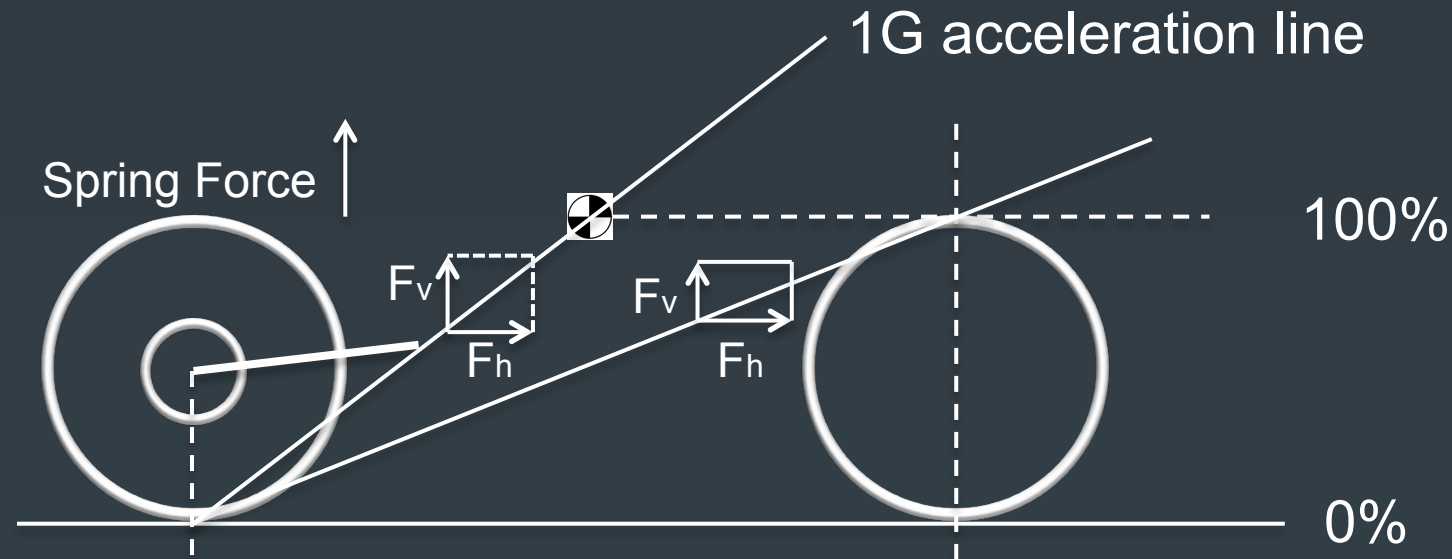
$$R = \frac{\text{Tan } \tau}{\text{Tan } \theta}$$

Squat & Anti Squat



- The swingarm push forward force must be greater than the chain pull back force to give a anti squat force that is greater than the chain pro squat force.

Squat & Anti Squat



- Above, assume a 50/50 weight split and a 45° 1G line, the F_v and F_h on the 1G line are equal and therefore the moments created cancel each other out leaving only the spring force to act on the suspension which keeps it extended.
- With the 100% line however the F_h is bigger than the F_v , therefore some of the spring force is used to oppose F_h leaving less spring force to lift the rear.