



Low Average Leverage Ratio

At Noble Bikes we believe in a low leverage ratio. Using the F4 as an example, this frame has an average leverage ratio of 2:1. This is considered a low leverage ratio in the bicycle industry. A low leverage ratio offers several benefits to the rider. The most noticeable benefit for the rider is that it allows you to run the suspension shock with less air pressure.

- Low air pressure in the shock increases service life of the seals allowing you to ride your bike longer before needing service.
- Low air pressure allows the shock's damping to work better. It is much easier for the damping to control 120 psi air pressure than it is to control 240 psi air pressure.
- Low air pressure reduces the load on the frame, allowing the use of lighter tubing without sacrificing strength or durability.

Average Leverage Ratio

When we talk about Leverage ratio we usually talk about the average leverage ratio. Calculating the average leverage ratio is easy. Just divide the wheel travel by the shock stroke. For the F4, divide 100mm by 50mm and you get a 2:1 leverage ratio. If you are interested to know why this is the average leverage ratio check the equations. This 2:1 average value does not give us any information regarding the leverage ratio at a specific point in the travel. Leverage ratio is not a constant value it varies throughout the travel. The unique leverage ratio at a specific point in the travel is the instantaneous leverage ratio.

Instantaneous Leverage Ratio

It is the Instantaneous leverage ratio that provides information about suspension performance.

By collecting the instantaneous leverage ratio at various points in the travel we can construct a leverage ratio curve. The leverage ratio curve is the tool that allows us to define the wheel rate. Instantaneous leverage ratio can be found using several methods. One way is to solve the system for static equilibrium at various points in the travel. Although a valid method, this is very time consuming and error prone due to manual calculations. It is much easier and faster to find instantaneous leverage ratios by using an assembly layout in a parametric CAD system. We can evaluate the limit of the leverage ratio at various points in the travel to create the leverage ratio curve. This is the method used by Noble.

$$\frac{\text{change in wheel travel}}{\text{change in shock stroke}} = LR_{\text{average}}$$

$$\frac{\text{Travel}_2 - \text{Travel}_1}{\text{Stroke}_2 - \text{Stroke}_1} = LR_{\text{average}}$$

$$\frac{100 - 0}{50 - 0} = LR_{\text{average}} = 2:1$$

$$\lim_{x \rightarrow S} \frac{\Delta \text{Travel}}{\Delta \text{Stroke}} = LR_{\text{instantaneous}}$$

And.... why is this important?

We believe all this is important because the leverage ratio curve is one of the parameters that defines the wheel rate. Wheel rate is the spring rate measured at the wheel and is the parameter that defines what the suspension will feel like when riding.