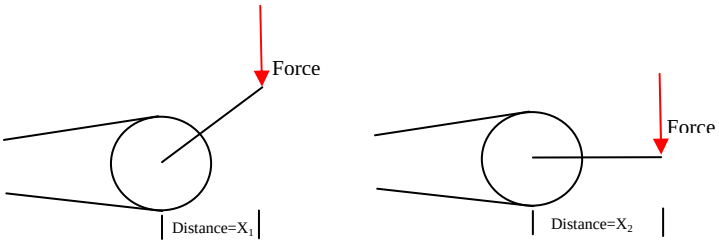
# Rennen.Tech.Talk

*with George Costa*

## Dynamics of BMX: Torque

What is Torque?

This month we will discuss the concept of torque. In simple terms torque is a measure of the amount of force that is applied at the pedals. One thing to keep in mind is that Torque is only effective when the force is perpendicular (90 degrees) to the crank arm. The following illustration will help clear things up.




In the above illustration $X_2$ larger than $X_1$. If the Force is equal in both situations then by using Eq. 1 we can see that the torque on $X_2$ will be larger than the torque on $X_1$.

**Equation 1.** $Torque = Force \times Distance$

Now in reality we cannot deliver constant force from our bodies. In addition we cannot deliver perfect force applied to the pedals that is always 90 degrees to the cranks. Therefore the concept of torque is very difficult to measure. We will again use G-Cog to help us see the actual torque applied to the bike in a real sprint application. See Figure 1.

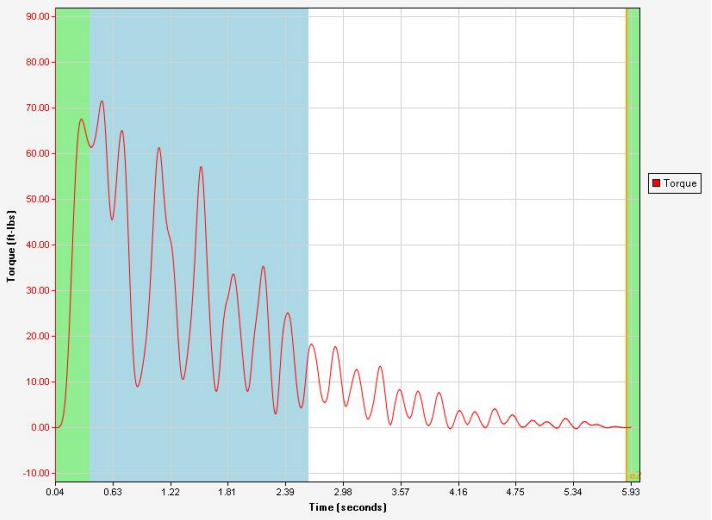



**Figure 1. Torque (Ft-lbs) versus Time (s)**

Figure 1 shows torque data collected for a sprint. Here we can see at the start the rider outputs a maximum torque value of 70 ft-lbs. This particular rider was using 180mm (7.09in) cranks. We can use Eq 1 to determine the maximum amount of force this rider applied to the cranks assuming that this peak torque was at the start and when his cranks were horizontal.

$$Force = \frac{70\,ft-lbs}{(7.09\,in)\times\frac{1\,ft}{12in}} = 118.48lbs$$

This particular rider weighs 160lbs so he was able to apply almost 75% of his body weight to both pedals in the correct manner. Now if we follow the rest of his sprint we can see how much of a role strength actually applies to his sprint. At 1.6 seconds after the start his torque production is reduced in half. This occurs at a distance of roughly 14 feet or roughly one full crank out of the start. At a distance of 2 full cranks out his torque is only at 20% of where his max occurred. Through the use of G-Cog we can actual see the decline of torque through the pedal stroke and this information can be used to change your training regimen.

We will continue to use G-Cog in upcoming Tech Talk installments to help us really examine some of the dynamics of racing. For those of you interested the data presented in Figure 1 is of your Vet Pro Rider and G-Cog test pilot Mr. Tim Dinger! Hope you enjoyed the article!