

Rennen.Tech.Talk

with George Costa

Dynamics of BMX: FPE

What is FPE?

In June I explained the concept of acceleration. This month we will further look at acceleration and that article and show you a completely new measurement to the BMX community and its called **F**irst **P**edal **E**ffectiveness (FPE).

To Recap the June article: Acceleration is the rate of change of velocity versus time. This simply stated is how much Velocity (Speed) you produce in a given amount of time, see equation 1.

Equation 1. $Acceleration = \frac{Velocity}{time}$

To compute FPE we look at the time it takes to achieve max acceleration, (See Figure 1.) We then find the distance traveled at the max acceleration time. This distance shows you how effective your start is because you produce the most acceleration in that amount of time. This makes sense if you are producing lots of acceleration at the start then you should be covering lots of distance in a short amount of time and hole-shoting races. In an attempt to simplify things I have created the following formula to represent FPE.

Equation 2.

$$FPE = \frac{Distance\ to\ Max\ Acceleration}{True\ Rollout} \times 360$$

Now if we refer back to our Gear Ratio Article from one year ago (Aug 09) and use our true rollout (Not the typical gear-inch chart number!!!!) we can represent FPE in terms of our 1st pedal.

Below is a plot of Distance, Speed (Velocity) and Acceleration vs. Time. Here you can see just how the rider accelerates and what distances that correlates to. In this particular test it is clear that the rider achieves maximum acceleration in about 1 second, this correlates to about 5ft of distance and 10 mph. This is essentially the starting phase of his 1st pedal. He goes from 0-10mph in 1 sec.

Here we can see the rider achieved maximum acceleration in about 5ft out of the start which correlates to roughly 125 degrees of their first pedal. This is based on the fact that this rider was using a 44-16 with a rollout of ~14.4ft Looking back at Equation 2 we see that (5ft/14.4ft*360 degrees = 125 degrees).

Therefore 125 degrees of their **F**irst **P**edal was **E**ffective in producing acceleration. This is a number that you can try to improve upon through training, technique, coaching etc.

How does your FPE stack up?

All of this data was collected using a G-Cog, and it represents a flat ground sprint event. As you can see using a G-Cog is very powerful in providing insight to your training. In the newest version of the software we automatically compute FPE and display it on our coach level package charts.

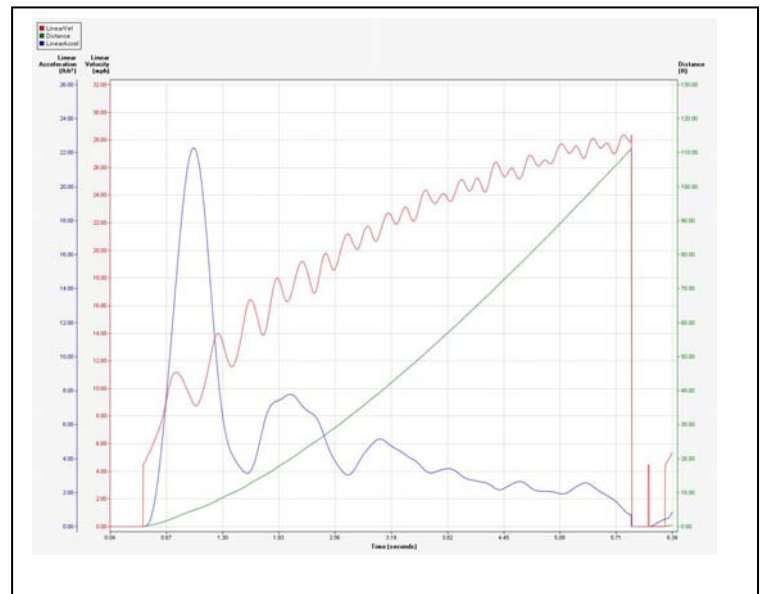


Figure 1. Plot of Distance (ft) and Linear Velocity (mph) versus Time (s)

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 Vet Pro Rider and G-Cog test pilot Mr. Tim Dinger! We actually provide a Coach level sample data set of one his rides with our software, at the next ABA national you see the Rennen Design Group booth at stop by and ask us for a free copy of the software. Hope you enjoyed the article!