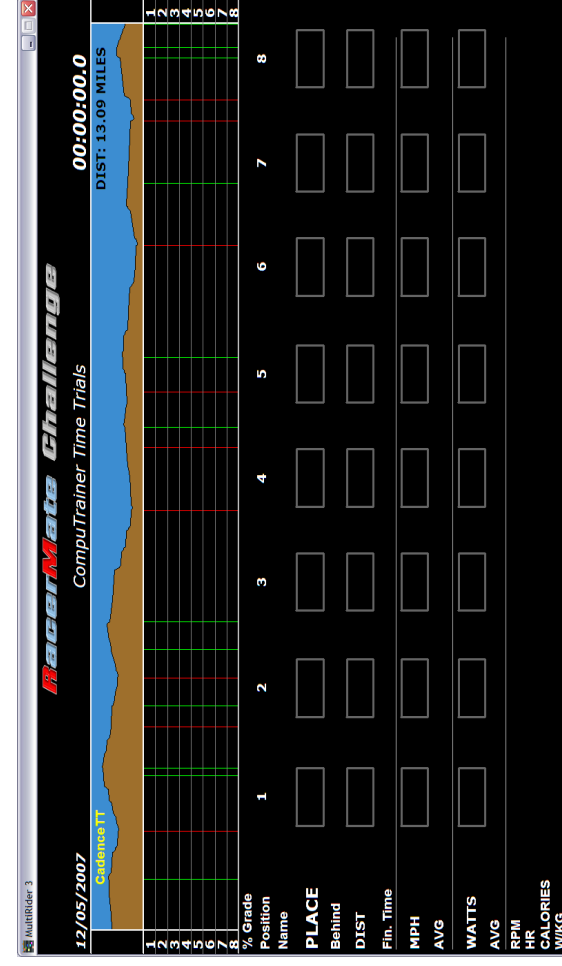


## Time Trial Pacing Strategy Over Rolling Terrain: Power Analysis of a rolling 13 Mile Time Trial Effort

By Chad Butts, MS, Exercise Physiologist  
Cadence Cycling & Multisport Centers

The last TT we analyzed was a flat 10 mile TT. Pacing for such an effort is best done starting off slightly below threshold for the first 1-2 miles and building throughout the workout, but for the most part a very steady pace centered at your threshold power. As long as you do not start off to far below your threshold you should end up within 2-3 percent of your previous best (also assuming you are recovered, adequately fueled, etc.).

This TT is a 13 mile rolling course with grades no greater than 4%. While this is not considered an extremely hilly TT course, it is more “technical” than a flat course. You can see the rolling nature of the course on the left.



So how should you pace for such a TT course?

Unlike flatland riding when a constant power output will yield the best results (under constant environmental conditions), on rolling to hilly terrain your power will be more variable. How variable depends on how steep and how long the hills are.

On a technical TT course more of your cycling time is spent climbing (your speed is lower as the grade increases and you spend less time on the downhill, where your speed is much quicker). It makes sense that you try to push a little harder on the uphill portions where the increased effort will have more of an impact on your overall time. Going downhill, the major resistive force is wind resistance. It takes about 3 times as much

power to increase your speed when you are traveling 20-30 miles an hour so it does not make sense to try and *gain* time while descending. *However*, this does not mean you should recover or not keep power output steady on the downhill sections. A big mistake many cyclists make is not keeping torque even over the top of a climb by not immediately downshifting gears in preparation for the downhill portion. Many times this is simply the result of pushing too hard on the uphill portion and needing a recovery.

Your threshold power is the single best pacing tool you have. So, on a variable course how high above your threshold should you try and hold for a climb and how easy should you go on the downhill portions? The answer depends on the steepness and length of those uphill portions. In general, the steeper the hill, the higher the percentage of threshold you should try to maintain. But, it also depends on the length. If the climb is a 6-8% grade and lasts for 1.5 miles your wattage should only be slightly above your threshold. If a climb is so steep that you find yourself in the lowest gear pushing very high above your threshold then it is time to

think about a compact crankset so that you will be able to moderate your effort. Losing weight will also help. There is a delicate balance regulating power output near threshold on variable terrain. In general this variability should never be much more than 10%.

Here is an example of OK pacing on rolling terrain. This athlete did go a little too hard the first half of the race. During the first 2 climbs (about 5 minutes) this athlete was about 5.8 percent above threshold, which ultimately led to the sub-par second half of the race. In this case they should have eased off a little more on the downhill portions of the course.

You can see after the climbs in the first half of the race they didn't really slow down to recover from their brief forays above threshold, this eventually caught up to them and forced a long recovery toward the middle of the course. A 10-15 watt reprieve on these sections would have allowed them some recovery to maintain their pace on the climbing sections later on: instead, they kept digging a hole. You can see that their power drops below the average the second half of the ride. It is apparent where the hills are in the ride based on the blue speed line.

A key factor of good time-trialing is the ability to keep power steady, even when heading downhill. One of the benefits to using higher gearing for time-trials is that it offers a bigger gear for downhill sections. Normal gearing may spin out on a 5-6% downhill, but adding a 55 tooth front chain ring and an 11 tooth cog in the rear will give you the ability to produce productive torque on a downhill longer.

