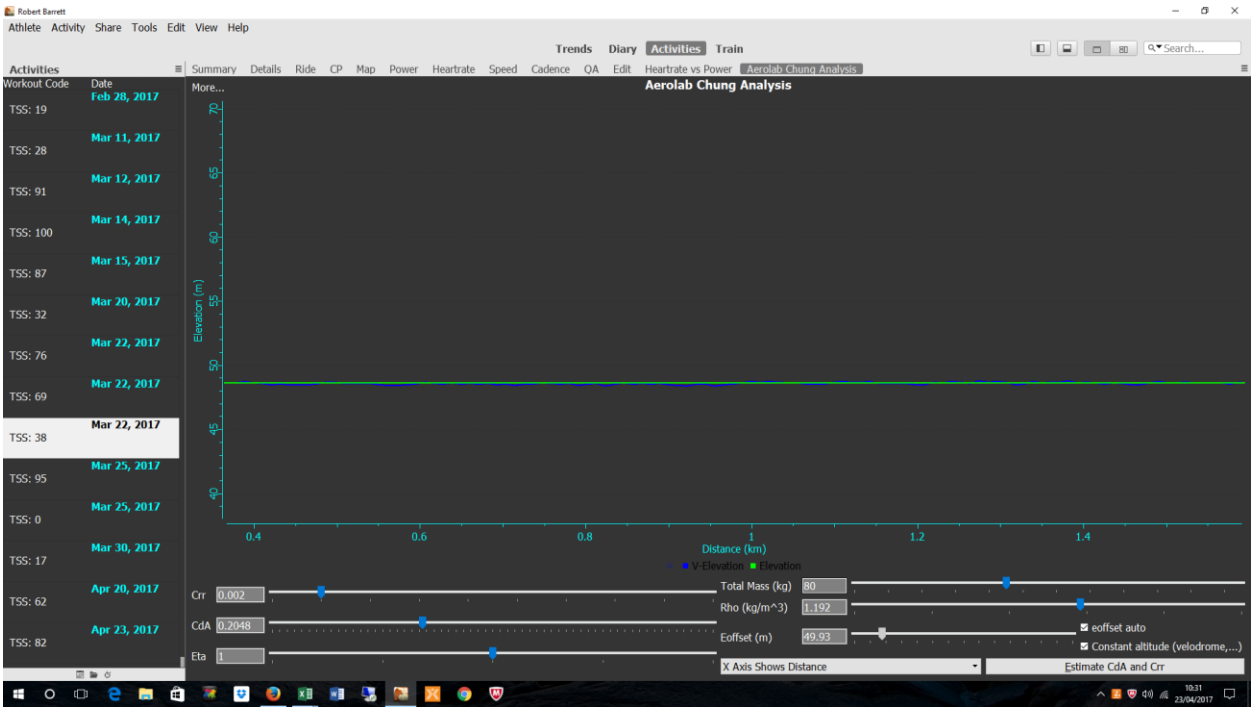
Cross-calibrating test venues

We don’t always test at the same venue, so how do we compared results under these circumstances?

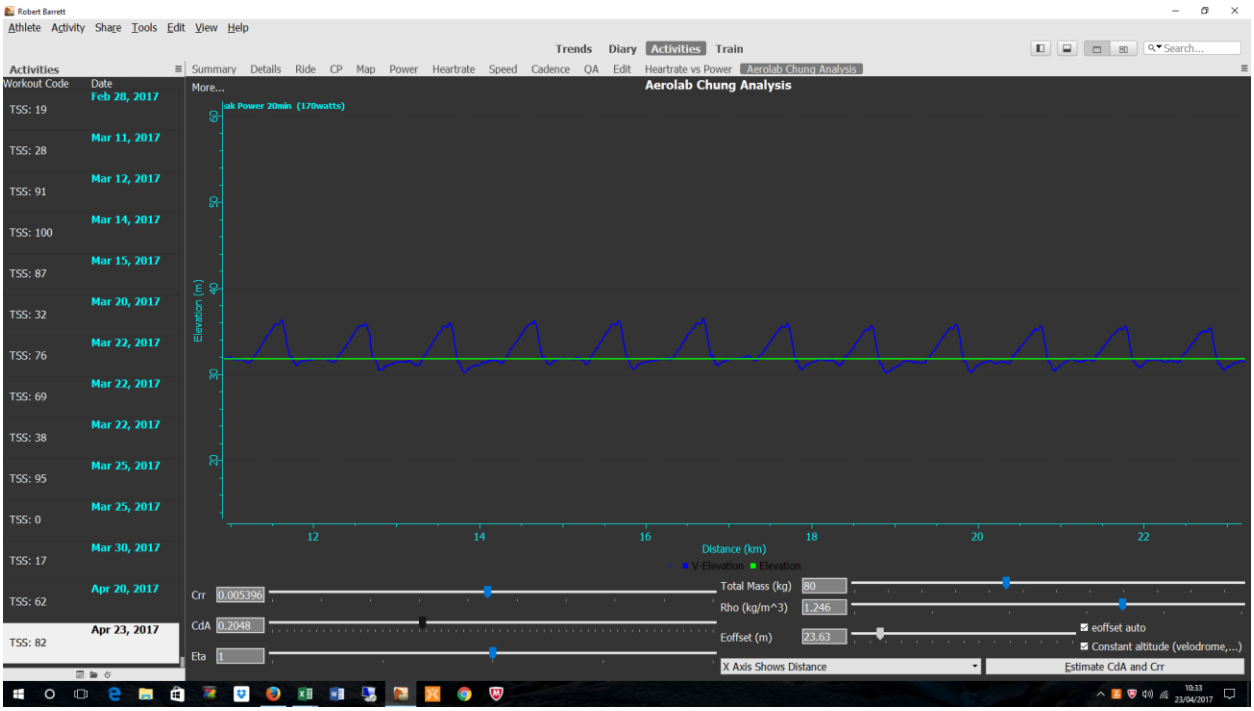
One way of doing this is to test the identical set-up at both venues. We need to know the air-density accurately for both tests. We set that parameter in Aerolab for the second test venue, and then set the CdA value for the second venue to the same value as that obtained at the first venue. We then use the Crr slider (instead of the usual method of adjusting the CdA slider) to get the two lines on the Aerolab graph to match.

Here is a trace of my standard (winter kit) set up from Newport Velodrome:



I’m using a Crr of 0.002000, which is lower than others might use for this surface, however, there is a reason for that: a friend of mine who had been to a wind tunnel session did a cross-calibration test of his wind tunnel set-up to Newport and found that using a Crr of 0.002000 gave him the same CdA result as he obtained for an identical set-up at the tunnel session.

Here is a trace of my standard (winter kit) set up from Hillingdon:



This is using an identical set-up with winter kit over 12 laps of the shorter circuit, which is about one kilometer, so a test duration of about 20 minutes. The temperature and air density were recorded on-site for both this and the Newport test. Tyre temperatures were recorded immediately before and immediately after each test. In both cases the benchmark tests were carried out after 20 minutes or more of riding to get the tyres and the power meter to equilibrium with the environment.

At Newport, I use a Crr of 0.002000 for a nominal temperature of twenty degrees Celsius. The test at Hillingdon was done at a temperature of eleven degrees Celsius, so the Crr number of 0.005396 becomes the relative Crr value for Hillingdon at eleven degrees Celsius. The rule of thumb for Crr variation with temperature is an increase of 0.6% for every degree below the reference point, and a decrease of 0.6% for every degree above the reference point.

This rule of thumb works over a range of between plus or minus five to eight degrees. Once the temperature gets below four degrees I wouldn’t be testing anyway, because of the risk of ice, and it being so cold I’d need extra layers. Once the temperature gets above about 25 degrees the tyres and tubes start to get a lot more flexible (in my experience) and the relationship between temperature and Crr becomes non-linear.

The relative Crr value for Hillingdon is higher than the value that I’ve estimate from doing multiple runs at different speeds and plotting the results out to get a Crr value. That value (adjusted for eleven degrees Celsius) is 0.005257. I put this down to the fact that Hillingdon isn’t flat (so power delivery isn’t going to be as smooth as at a Velodrome), the corners are quite tight (so you will lose energy in the corners), and there is usually some breeze.

The actual Crr value isn’t that important, as what we are interested in is comparative results i.e. “is option A better or worse than option B”. The purpose of cross-calibrating is to approximate the result to a number that we would expect to see from a wind tunnel test.

Comparing CdA results from events

When we are riding an event, we introduce several more variables. The road surface is unlikely to be consistent over the whole course. The traffic density will vary. The direction we are riding in compared to the wind direction will change. The degree of shelter (from trees, hedges and possibly buildings) will change. And then there is air density on the day.

So, the best we can do is compare events that are on the same course. With any luck the surface will be the same for every event and the shelter will be similar. Wind, traffic and air density will likely be different. We just have to take a view on that. We can ride our standard race set-up, which we’ve tested in a controlled environment of course. What we will likely see in an event is a lower CdA than our controlled environment test because of traffic assistance.

In terms of Crr for a particular course, you just have to use your best estimate. If we take H25/2 as an example, half of it is DC with a pretty good surface (same as H10/22) and the other half is SC with a pretty awful surface (same as H10/2). I’d estimate Crr of 0.003000 at a nominal 15’C for the DC section and Crr of 0.004500 at a nominal 15’C for the SC section. If you use the same estimated Crr values for a course, adjusted for temperature on the day, and an air density from a near-by weather station you will be able to compare CdA numbers across events on the same course.

Comparing CdA numbers from events on different courses doesn’t really work. If you are really keen you could attempt to cross-calibrate several courses using the relative Crr method but you would be dependent on traffic conditions. That’s probably a step too far. We shouldn’t forget that the objective is to complete the measured course at the highest average speed. Measuring CdA, and optimizing you average power divide by CdA number, is just a means to that end.

Ends

