Section One:

Time Trial Start

As any seasoned Time Triallist will tell you: dosing your effort is the hardest part of the ‘race of truth’. Choosing the right exercise intensity (either just below or just above Threshold) is crucial for optimal performance at all points of the Time Trial. But does the speed and intensity of the first few kilometers make a difference to your overall performance?

In this study a group of elite cyclists were required to complete four 20 kilometer Time Trials in 30\(^\circ\) degree heat. The first test was conducted at a self regulated pace from start to finish. For the remaining 3 tests each rider was required to start and hold 10\% above anaerobic threshold (AT) for the first 2.5km. Then 10\% below AT and finally at an intensity which equates to AT. The results showed that as far as overall performance over 20km in the heat it makes no difference if you leave the gate house like a shot from a gun or choose to gradually crank up your effort. Both strategies will deliver good results while exercising in the heat.


Cycling vs Running Fitness

The principle of specificity states that to be good at any one activity you must train your body in a range of motion that is similar to that sport. If you want to be a good cyclist you must train specifically on the bike. To be a good runner you need to leave your bike in the garage and hit the road in your running shoes. However since both sports use similar muscle groups and the same heart you would think that training by either modality would produce similar fitness benefits. But this is rarely the case.

The obvious group of athletes for this comparison are Triathletes. In this population there are only slight differences in \(\text{VO}_{2\text{max}}\) when they are tested either running or cycling. But when cyclists are required to perform a treadmill test of maximal aerobic capacity they do not score as high as when tested on the cycle ergometer. Interestingly, running appears to have some transfer effect for cycling. This may explain why many professional cyclists resort to hiking and mountain running in their off season. If you are looking to do some cross training or have some travel planned where it’s impossible to take your bike, a jog of 30-45mins every second day will help you maintain some cycle fitness.


Cold Water Baths

The use of ice baths after exercise in the heat is a popular recovery strategy. Rugby, Soccer, Hockey and Cycling teams all use this technique. However, aside from making your legs cold does it offer any metabolic benefit? To answer this question researchers at the AIS tested 11 cyclists over a 40minute Time Trial. Blood samples were taken after cold water immersion and tested for: lactate, glucose, pH, catecholamines, cortisol, testosterone, creatine kinase, C-reactive protein, IL-6, and
IGF-1. Heart rate, rectal temperature and skin temperatures were also measured throughout the recovery process.

The results of this study show that skin and rectal temperature will decrease after cold water immersion. However all other variables showed no significant change. It is interesting to note that the cyclists in this study reported feelings of wellbeing after the cold water immersion protocol. So if you are thinking of using cold water baths as a part of your own recovery be aware that their benefit is limited to reducing body temperature only.


Bone Density in Masters Cyclists

One of the primary ways that our bones maintain their strength is through continual load bearing throughout our normal activities of daily living. Standing, walking and running all place large compression and torsional stress on our bones which stimulates calcium deposition. Since cycling is a non weight bearing sport it has been observed that some recreational Masters cyclists have below average bone density. This anomaly becomes less pronounced when you consider racing Masters cyclists in either sprint or endurance based events.

One possible mechanism for this is the increased load that racing places on muscle. Explosive starts and long periods of sustained muscle tension cause the bones of racing cyclists to endure greater absolute loads. These loads ultimately converge on tendons that are attached to bone. While under load a tendon will exert a distraction force on the bone which simultaneously sends a small electric current down the surface of the bone. It is this small electric charge which assists the deposition of calcium into bone. This mechanism suggests that competition-based cycling and the associated training regime is beneficial in preserving average or above-average bone strength in Masters level cyclists.


Gastrointestinal Upset

Whether you are a high performance sportsperson yourself or you work with athletes that train hard you will know that gastrointestinal distress is a common by product of high intensity training. Acute strenuous exercise can provoke heartburn, nausea, vomiting, abdominal pain, diarrhea and even gastrointestinal bleeding.

The cause of these symptoms is broadly attributed to a range variables such as meal composition, inadequate hydration, some medications and of course the intensity of the training session. But which one of these is the most common cause? It appears that strenuous exercise in a dehydrated state is the primary cause of gastrointestinal distress, accounting for 70% of all cases. Restricted blood flow to the stomach (ischemia) is the next main contributor which can induce nausea, vomiting, abdominal pain and (bloody) diarrhea. A simple way to avoid GI distress is to check that you have been drinking the right amount of fluid. Around 250-300ml of sports
drink every 20mins should be sufficient to help you avoid this situation. Note that the frequency of gastrointestinal upset is almost twice as high during running than cycling.


Section Two

Article

A Comprehensive Approach to Your Best Ever Time Trial

The format of a Road or Track Time Trial is outwardly simple: you must ride from point A to point B in the fastest possible time. Where this event becomes extremely complex is in how you manage the internal struggle between searing pain and the tantalizing pleasure of registering your personal best time. Of all the cycling disciplines the Contre la Montre is the purest test of cycling fitness and a clear indicator of a riders ability to endure hard work. It is no wonder that the world’s most revered riders have all been exceptional in this race of truth. If you want to Time Trial like the best of them you’ll need a comprehensive program of strength, endurance and speed work which will see you spending just as much time in the hills as you will on your aero bars.

The basic requirement for Time Trial success is an ability to hold the highest power output for the longest possible time. That is it. By framing this event in such basic terms and keeping this statement front of mind it simplifies the process of designing a winning Time Trial program. The key ingredients here are Strength, Power and Speed. Let’s look at these 3 competencies in isolation and then I’ll knit them together into a progressive and logical Time Trial Training Plan.

Table 1: Periodised Training

<table>
<thead>
<tr>
<th>General Phase</th>
<th>Preparatory Phase</th>
<th>Specific Phase</th>
<th>Pre-Competition Phase</th>
<th>Competition Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-12 Weeks</td>
<td>4 Weeks</td>
<td>4 Weeks</td>
<td>4 Weeks</td>
<td>4 Weeks</td>
</tr>
</tbody>
</table>

Your TT training should be performed here in your Periodised Training Plan.

Strength

Strength Training for a Time Trial starts way back in your General Preparation Phase. If you have been reading my series of articles for Bicycling Australia you may recall an article I wrote in May-June 2009 on Slow Tension Efforts (S.T.E’s). S.T.E’s are a tightly controlled series of slow seated hill climbing repetitions which will build strength. S.T.E’s are performed by selecting a big gear (53x15-17) then climbing a long hill at very low speed. Although these efforts are performed at low velocity, they
form a basis of strength which translates into Power now that you are increasing the intensity of your training. Without a base of strength developed via S.T.E’s you’ll be lacking the low-down torque you need to power your way through the back end of a Time Trial.

**Power**

Assuming you have laid a solid base of strength via S.T.E’s or an equivalent workout, you now need to convert your newly acquired strength into Power. Power is the rate or speed at which work is performed. It is one thing to be able to apply force to the pedals, but in a Time Trial it is essential that this force be applied quickly. To make a seamless transition from S.T.E’s into higher velocity and higher intensity Time Trial work I recommend you continue to climb hills but progressively increase the speed of each ascent. This can be achieved by a 4 week block of Two and Three Phase Climbing which incidentally was the feature topic in the July-August edition of this magazine.

If you missed this article; Two Phase climbing requires you to divide any hill, large or small, into two equal parts. The first half of the hill is to be ridden seated at a low to moderate intensity. The remaining fifty percent of the hill is then completed at a significantly higher cadence and higher power output while you remain in the saddle. Three Phase climbing is merely an extension on the Two Phase method. When performing Three Phase climbs each hill is divided into 3 separate parts. The first 1/3 of the hill is ridden seated at low to moderate intensity. Remain in the saddle for the next 1/3 of the hill while lifting the intensity to a maximum of 85%. For the final 1/3 of the hill you are required to get out of the saddle and power your way to the top.

So far in the pursuit of Strength and Power for Time Trialing you have spent most of your time climbing hills. My rationale for this is simple: while you lay a base of strength (via S.T.E’s) and add then add a Power component via Two and Three Phase Climbing you have actually spent many weeks already riding at or above your anaerobic threshold. Isn’t this what you do in a Time Trial? Wouldn’t it also be logical to assume that if you can ride at or above threshold on an incline for sustained periods of time, when road suddenly becomes flat you’ll be riding fast. And speed is the next ingredient that must now be added to the mix.

**Speed**

With a base of Strength and Power now firmly established it’s time to start your Time Trial specific Speed workouts. Speed is a measure of how fast you can cover any given distance. In a Time Trial this concept is great, but it cannot be adopted verbatim because as you will know it’s impossible to go ‘full-gas’ for more than a minute. So speed needs to be tempered by pacing and this is where ‘sustained high-speed’ sessions become critical. By riding on a flat course at sustained high-speed you will convert the work done from your previous hill training into high velocity muscle contractions. It’s these high velocity muscle contractions that develop your speed by conditioning your nervous system to work at a higher rate in the presence of increasing amounts of lactic acid. But just like any other phase of training, your Time Trial specific Speed work needs to be progressively overloaded. So start with shorter sustained efforts of 5mins and gradually build up to 20minute sessions in a 4 week block. It is also a good idea to add some sustained high-speed intervals into
your longer weekend rides. By completing these efforts on tired legs (say in the middle or at the end of a 100+km) you'll develop a Time Trial specific strength/endurance competency. This 4 week speed block is where everything comes together. The previously separate elements of Strength, Power and now Speed will rapidly coalesce.

**Putting it all together**

Let’s have a look at the intricate detail of the final 4 weeks of your Time Trial preparation. To convert the Strength and Power developed during the previous 8 weeks of training (4 week S.T.E block + 4 week Two and Three Phase Block) it’s recommended you set aside 4 days per week to develop your Time Trial. On each of these days you will be adding depth to your strength on a flat course while simultaneously increasing the rate at which you transfer power to the pedals. The recommended weekly outline looks like this:

**Table 2: Four Week – Four Day TT Program**

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tuesday</th>
<th>Wed</th>
<th>Thursday</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>REST</td>
<td>Sustained High-Speed workouts on a flat course</td>
<td>Sustained Threshold Hill Repeats</td>
<td>Incremental Workouts on a Flat Course</td>
<td>REST</td>
<td>Long Ride Staggered Efforts</td>
<td>Recovery Ride 60+mins</td>
</tr>
</tbody>
</table>

**Tuesday – Sustained High-Speed Workouts**

- Week 1: Easy Warm Up Ride (20-30mins) + *Flat TT (5x5min@85%) with 5mins rest between sets.
- Week 2: Easy Warm Up Ride (20-30mins) + *Flat TT (5x6min@85%) with 5mins rest between sets.
- Week 3: Easy Warm Up Ride (20-30mins) + *Flat TT (6x6min@85%) with 5mins rest between sets.
- Week 4: Easy Warm Up Ride (20-30mins) + *Flat TT (3x10min@85%) with 10mins rest between sets.

*Flat TT = find a flat course, adopt a Time Trial position (TT bike or road bike) and hold each effort for the recommended time.

The easiest way to start improving your Time Trial is to break the task down into smaller more manageable portions. If you are coming out of your last week of Specific Preparation and into your first week of Pre Competition training, the thought of doing a 25 minute Time Trial at 85% of your maximum (heart rate or power output) will be daunting. However, if you break the task down into smaller portions you stand a better chance of achieving the total time goal. Tuesday is a great day to practice these small but very focused blocks of high intensity training and if you have planned your training program well you will be coming off a rest day (Monday) so your legs should be fresh and ready to work. It is recommended that this workout be completed on a long flat road.
**Wednesday - Sustained Threshold Hill Repeats**

- **Week 1:** Easy Warm Up Ride (20-30mins) + (3 x 5min@85-88%MHR Sustained High Power Hill Climb). Big chain ring; any gear you can handle.
- **Week 2:** Easy Warm Up Ride (20-30mins) + (4 x 8min@85-88%MHR Sustained High Power Hill Climb). Big chain ring; any gear you can handle.
- **Week 3:** Easy Warm Up Ride (20-30mins) + (5 x 12min@85-88%MHR Sustained High Power Hill Climb). Big chain ring; any gear you can handle.
- **Week 4:** Easy Warm Up Ride (20-30mins) + (3 x 20min@85-88%MHR Sustained High Power Hill Climb). Big chain ring; any gear you can handle.

If you can’t find a long hill for these high power, high cadence hill ascents use your indoor trainer/ergo. Place a brick under the front wheel to give you the body position of climbing a hill.

After the Flat course Time Trial efforts of Tuesday it is recommended that you head into the hills on Wednesday for sustained high power hill repeats. Sustained seated hill repeats are any hill climbing effort performed continuously for greater than 5mins at high intensity. The load that this type of riding places on your cardiovascular and musculoskeletal system is similar to that which is achieved during a Time Trial on a flat road. The obvious difference here is that while riding hard uphill you are generating more power to overcome the variable gradient of the climb. Since the **basic requirement for Time Trial success is an ability to hold the highest power output for the longest possible time**, hill training is a perfect fit when it comes to developing the strength you’ll need while racing for your Time Trial PB. This sustained power session also forms a bridge between the work done in your STE’s and your Two and Three phase workouts ensuring a seamless transition of strength on hills into power on the flat.

**Thursday – Incremental Workouts**

- **Week 1:** Easy Warm Up Ride (20-30mins) + Flat TT (5 x 5min Flat Efforts: 3mins@85%MHR + 1min@90% + 30sec@95% + 30sec@100% (4min recovery between sets)
- **Week 2:** Easy Warm Up Ride (20-30mins) + Flat TT (6 x 5min Flat Efforts: 3mins@85%MHR + 1min@90% + 30sec@95% + 30sec@100% (4min recovery between sets)
- **Week 3:** Easy Warm Up Ride (20-30mins) + Flat TT (7 x 5min Flat Efforts: 3mins@85%MHR + 1min@90% + 30sec@95% + 30sec@100% (4min recovery between sets)
- **Week 4:** Easy Warm Up Ride (20-30mins) + Flat TT (5 x 5min Flat Efforts: 3mins@85%MHR + 1min@90% + 30sec@95% + 30sec@100% (4min recovery between sets)

*Flat TT = find a flat course, adopt a Time Trial position (TT bike or road bike) and hold each effort for the recommended time.

If you think the Time Trial is a simple process of finding your *Threshold and sitting on it for x amount of time, you would be guilty of over-simplifying this complex event. There will be many times in your Time Trial when intensity goes way above Threshold. When you climb a small hill, power out of a tight corner or throw everything at the last 3 minutes to make up time you will 'redline'. So your Time Trial specific training needs to include periods of sustained power that gradually ramp-up into shorter periods of unsustainable agony. Thursday’s Incremental Workout schedule is one example of how you can rehearse holding a high power
output (for 3minutes@85%) then gradually build a tolerance to lactic acid accumulation by increasing the intensity close to maximum heart rate/watts. Thursday’s session follows the same ‘small chunks’ principle of Tuesday’s short, focused intensity session. This session helps you to gradually build strength, power and speed.

**Saturday - Long Ride Staggered Efforts**

- **Week 1:**
  80+km Hill Ride: Total of 40mins sustained effort
  (@20km do 1 x 5min@85-88%MHR Flat) +
  (@60km do 1 x 10min@85-88%MHR Flat) +
  (@80km do 2 x 10min@85-88%MHR Flat)
  10 minutes easy spinning in between each 10 minute effort at 80km

- **Week 2**
  100+km Hill Ride: Total of 40mins sustained effort
  (@40km do 1 x 10min@85-88%MHR Flat) +
  (@80km do 1 x 10min@85-88%MHR Flat) +
  (@100km do 1 x 20min@85-88%MHR Flat).

- **Week 3**
  140+km Hill Ride: Total of 50mins sustained effort
  (@20km do 1 x 10min@85-88%MHR Flat) +
  (@60km do 1 x 10min@85-88%MHR Flat) +
  (@80km do 1 x 20min@85-88%MHR Flat) +
  (@140km do 1 x 10min@85-88%MHR Flat).

- **Week 4**
  100+km Hill Ride: Total of 40mins sustained effort
  (@60km do 2 x 20min@85-88%MHR Flat)
  10 minutes easy spinning in between each 20 minute effort at 60km

So far your workouts have been performed in short, bite sized pieces. However, the reality of the Time Trial is that it’s performed over a much longer distance. It is therefore essential that you learn how to... **hold the highest power output for the longest possible time.** One way to develop sustained power output is to perform a series of staggered efforts inside a longer ride. The efforts themselves should last between 10-20minutes with the intensity set slightly above race pace (85-88% maximum heart rate or power output). Look for a hilly route for this long ride and perform each effort on whatever road presents itself at the designated time. The random nature of each start point will ensure you are always confronted by a challenging section of road which requires you to break *Threshold. It is these forced spikes in intensity which will link with the threshold busting components of Thursday’s Incremental workout and ultimately combine to equip you to ride any kind of TT course. These longer efforts are best performed on the weekend when most people have more time to ride and recover.
### Summary Table

#### Table 3
Four Week Time Trial Program

<table>
<thead>
<tr>
<th>Four Week Plan</th>
<th>Mon</th>
<th>Two Phase Tuesday</th>
<th>Wed</th>
<th>Three Phase Thursday</th>
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<td>Recovery Ride 60+mins</td>
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</table>

#MHR: Maximal Heart Rate

**Conclusion:**

By following this carefully linked sequence of training sessions over a 4 week period you will be ready to race your best ever time trial. For maximum benefit, you should complete 8 weeks of strength work on the bike (S.T.E’s and Two + Three Phase Climbing) and where possible try and use your Time Trial specific equipment. That means bike, wheels and skin suit. The more familiar you become with your aerodynamic equipment and the more specific you can be with your body position, the better the result.
*Threshold*
Threshold is defined as the point at which more Lactic Acid is produced than can be consumed. Once you have exceeded your Threshold lactic acid will accumulate to levels that are uncomfortable for the competitive cyclist. For our Time Trial specific workouts Threshold is a very important physiological landmark. All sustained efforts must be performed as close to this points as possible.

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**About the Author:**
Daniel M. Healey is a Senior Sports Nutritionist working with the New Zealand Academy of Sport, North Island. In 2007 & 2008 Daniel was Consultant Nutritionist to the successful Australian Junior World Track Cycling Team. A keen Cyclist Daniel has trained Road, Track and Mountain Bike cyclists to success in UCI Professional Competition, National and World Championships. Daniel holds a Bachelor of Health Science and Masters of Science (Exercise Physiology & Nutrition) from the University of New South Wales. He is a Registered Nutritionist (R.Nutr), Accredited Exercise Physiologist (AEP) and Member of the Australian Association for Exercise and Sports Science (MAAESS).

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