

Quaker City Wheelmen Bicycle Racer's Training Manual

A Training Manual for the Beginning Racer
With Helpful Tips and Pointers for all Strong Riders
Prepared by the members of the Quaker City Wheelmen

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Basic Techniques

Basic Techniques

Getting started

by John Semmel

Position on the bike

1. You must clear your top tube when you straddle it. It is better to have an inch or two of clearance on a road bike.
2. Set your seatpost so that you can back-pedal on your heels without swaying your hips. There is a variety of opinions on how high the saddle should be placed. If in doubt, arrange to be fitted.
3. Set your saddle fore/aft so that a plumb line through your kneecap intersects the pedal spindle when the crank arm is horizontal. The saddle should be flat or turned up slightly.
4. Your handlebars should hide your front hub when you place your hands on the drops and your back is at about 45 degrees. You can usually correct a problem here with a new stem. If you have to get an extremely short or long stem to accomplish this, your bike's top tube is probably the wrong length for you.
5. Your stem should be an inch or so below your saddle.

None of these rules applies 100% except the first. The described setup is a starting point. But if you can't set your bike up to conform to these rules, it probably doesn't fit, and you probably can't achieve your optimal position on the bike.

- Make your grip firm but gentle, and change it frequently.
- Keep your wrists straight and your elbows bent.
- Keep your shoulders down and loose.
- Ease the strain on your neck by cocking your head to one side.
- Keep your back as straight as possible.
- Bend from your hips, not from the bottom of your spine.
- Your knees should almost brush the top tube as you spin.

Building a base

Before exposing your body to the stresses of a season of bicycle racing, it is important to prepare it gently and gradually in advance. This increases your aerobic capacity and gets your muscles and joints ready for hard work. The process is called building a base.

- Ride as often as possible.
- Ride as far as you can, at a pace at which you are breathing deeply but not panting; perspiring, but not sweating profusely.
- Concentrate on improving the speed and suppleness of your spin. Ride a fixed-gear bike or rollers if you can. Stay in the small chainring of your road bike.
- Don't do speed work (intervals or sprints) in the cold.
- Try to get in 1000 to 2000 miles of easy riding before your first race.

Once you have a base, avoid having to rebuild it the next year by maintaining your fitness throughout the winter.

Clothing through the year

The table on the following page shows general suggestions for clothing in different weather conditions:

Temp	Head	Upper body	Lower body	Hands	Feet
over 95	helmet, sweatband optional	light weight, light color jersey with mesh side panels	Lycra shorts	cycling gloves	cycling shoes, thin socks
80 to 95	helmet, sweatband optional	light-weight jersey	Lycra shorts	cycling gloves	cycling shoes, thin socks

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Temp	Head	Upper body	Lower body	Hands	Feet
65 to 79	helmet, sweatband optional	medium to heavy-weight jersey, undershirt below 70	Lycra shorts	cycling gloves	cycling shoes, medium-weight socks
50 to 64	helmet, sweatband optional	long-sleeve jersey with light undershirt or short-sleeve jersey with heavy long-sleeve undershirt (less to race)	Lycra shorts, Lycra tights (no tights in a race)	cycling gloves, glove liners optional	cycling shoes, medium to heavy socks
35 to 49	helmet, sweatband or thermal headband optional	polypro turtleneck, shortsleeve jersey optional, wind jacket or heavy long-sleeve jersey (less to race)	Lycra shorts, Lycra, wool or other medium-heavy tights (Lycra tights in a race)	long-finger gloves	cycling shoes, medium to heavy socks, booties
20 to 34	helmet with headband, balaclava or wool hat	polypro turtleneck, short or long-sleeve jersey, heavy wind jacket (avoid races)	Lycra or wool shorts, heavy wool or panel tights or Lycra tights with polypro long-johns	long-finger gloves with liners	shoes, heavy socks, with liners, booties
below 20	helmet with balaclava or wool hat	polypro turtleneck, layers as necessary, heavy wind jacket (don't race)	Lycra or wool shorts, heavy wool or panel tights, long-johns	long-finger gloves or mittens with liners	shoes, heavy socks, with liners, plastic bags, booties

Temperature is not the only factor in determining what to wear on a given ride. Other factors, especially in winter, are:

- Wind speed: Add 25 mpg to the wind speed on a cold day and think about what this does to the wind chill factor. On windy, cold days, wear clothing with nylon panels on all front surfaces and wear a little more bulk than normal for the temperature.
- Sunlight: Bright sun in the winter can make it seem warmer than the temperature indicates. Snow along the sides of the road reflects even more warming light at you. Cloudy conditions, on the other hand—especially coupled with wind—can make 40 degrees seem frigid. Also remember that the sun is at a lower, weaker angle in the sky through the winter. so on the occasional 60 degree winter day, it may not feel as warm as 60 does in the spring or fall.
- Intensity of the ride: The harder the ride, the less you need to wear, to a point. If you are going out on a very hard ride, plan to be cold for the first 15 minutes to half an hour, until your muscles warm up. If you are riding to a race in the cold, wear layers you can take off during the race and put back on afterward.
- Acclimatization to the weather: As the winter progresses, 40 degrees seems more and more bearable. Your body, or at least your mental attitude, changes in response to riding in the cold. The same thing happens in the summer as you get used to the heat.

Other clothing tips

- Keep your extremities warm, especially your feet. This formula seems to work on feet: thin sock liners, moderately heavy socks, stretched-out cycling shoes, neoprene booties. Don't wear so much that you cut off circulation. Glove liners do for you hands what sock liners do for feet. Headbands and turtlenecks keep your head and neck warm. Watchcaps and balaclavas that cover the whole head and allow no heat to escape can make you too warm, except in the coldest weather.
- Wear several light pieces of clothing so that garments can be added or subtracted as needed. Cyclists don't often dress this way because of the difficulty in removing and storing excess clothing while on the bike. Instead, cyclists use zippers to regulate the amount of heat retained.
- Arm warmers and leg warmers are easily removed and put in a pocket as you warm up, or put back on when the weather cools. Some gloves also have a removable mitten portion that allows you to cover or uncover your fingers as needed.
- Wear a wicking layer (polypropylene, thermax, etc.) next to the skin, a bulk layer over that to keep in the heat, and a wind jacket over all to keep out the wind.

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- Go for balanced coverage in cold weather. A layer on your head may do more for you than an extra layer on your torso.
- Avoid getting sweaty in cold weather. Open up zippers or remove layers before you get wet. Damp clothing in cold weather can chill you dangerously fast.

Cornering—Turning vs. Steering

(from *USCF Training Skills*, 1991 edition. Reprinted by permission.)

To ride a bicycle proficiently, you must understand and be skilled in bike control. One of the least understood items is cornering. This skill is applied constantly so it must be practiced constantly -- it has to become an automatic reflex. If you are still thinking about how you are going to navigate a turn or corner, you haven't done your homework and you had better go back to fundamentals. Do them over and over and over. Points that need to be made:

- Steering is using the handlebar and headset to change the angle of wheel
- Turning is the integration of factors such as weight shift and steering to negotiate a turn
- Neither is absolutely right or wrong except in a situational context.

The Difference Between Turning and Steering

Most people *turn* a bike through a corner. When you turn, the rider and the bike stay in the same plane as a single unit and lean into the turn at the same angles. The angle of the lean is determined by the tightness of the turn, the road camber, pedal clearance, the speed and the road surface (gravel, wet, bumpy). When the speed is a little too fast and the bike is leaned too much, stop pedaling and keep the inside pedal at the top of the stroke. A little more speed and the whole movement is changed: the bike is leaned more, the rider stays low but moves his weight to the outside pedal, which is in the down position, the inside knee is extended outward to accommodate the top tube.

The ultimate and fastest method to negotiate a corner at the highest speed is to *steer* through and pedal steadily -- if you can do it; very few can. Steering is something of a lost art. The risks of falling are exactly the opposite. In turning you may slide out, in steering the forces may take you *Over*. Any time you have to corner or maneuver, teach yourself to *steer* not to turn the bike. Mike Walden of the Michigan Schwinn-Wolverine club and coach to numerous Olympians and World Champions states:

I have seen some of the world's top pros riding a criterium in an old Belgian town. It was raining, making the pavement very slippery. During the race they all stayed upright by holding the bike firmly but when it would slide sideways, they would let it slide horizontally but keep it perpendicular to the street surface which was wet slippery granite blocks. Into each corner, right and left, these veteran pros would move their weight in unison—it looked like a well trained drill team or a chorus line moving sideways as a single unit. Looking straight in the sprint you could see the sideways movement of the bikes as they hit each slippery cobble; the bike would move sideways four or five inches and riders would pull it back when the wheels hit the next cobble.

Turning

To establish relative differences of rider's position on the bike when turning or when steering, let's first examine them when he is riding in a straight line. Going straight, the centerline of the bike and the rider is in the same plane. In other words, the center of fork, handlebar stem, and the rider's body are all in a vertical line, parallel to one another. When a bike is *turned*, the rider and bike stay in the same vertical plane leaning together as a unit.



*Pedaling and Turning Left
Nose is clear of inside handlebar.
Rider stays in normal position.
Rider and bike lean as a single
unit. Keep hand on rear brake.*

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In low speed situations, the rider can't pedal because the bike and rider are leaned more drastically into the direction of the turn which reduces ground clearance. In this case, the rider stops pedaling and raises the inside pedal. The rider then shifts his weight to the outside pedal which is now at the bottom of the stroke. At the same time, the rider's inside leg is allowed to move out away from the tube to help balance the weight distribution on the outside pedal and to further lower the center of gravity so the bike/rider can negotiate the corner at the highest possible speed and greatest angle of lean.



Coasting and Turning.
Bike is leaned more than rider. Rider keeps weight low, with elbows bent and locked at critical segment of the turn. Nose is directly over inside bar. Keep hands on rear brake. Inside knee is out.

Steering

To *steer* around a turn an entirely different procedure is used. The rider leans and the bike is held more upright. The straight perpendicular line is broken between the rider and the bike. The force to hold the bike on the ground is applied differently and a certain amount of rear wheel drifting (sliding) can be accommodated. To steer and pedal requires that the rider move forward slightly on the seat to make the bike a little front-end heavy so the front wheel will not break loose before the rear wheel (very few riders can handle a two wheel drift). As the rider shifts his whole body forward and starts to twist from the hips, the upper body, head and shoulders into the direction of the turn, the nose should be over the inside handlebar, knees in close to the top tube, buttocks firmly and squarely on the saddle but slightly forward from the normal pedaling position.



Pedaling and Steering Through a Turn
When steering and pedaling through a left turn, shift body forward to the left with the nose over the left brake lever. Pedaling must be steady so as not to bounce. Use hands to pull up on inside bar and push down on outside bar. If you need to brake keep hand on rear brake. Hold bike as upright as possible. If bike slides make sure that you hold it upright and keep pedaling. This is the fastest way to corner because you have more traction. Keep knees in. The easiest way to position yourself is to shift your hips on the seat.

Pedal steady in round strokes, do not jerk or thrust while in a turn. Absolutely no upper body motion (it will cause you to break loose)! Hand pressure in the maneuver is very important. Pull up on the inside bar and push down on the outside bar, nice and steady and very firm. Inside arm will be bent drastically with the elbow out a little. Outside arm will usually be straight unless you are into the turn at extremely high speed, then it will be bent as you should try to keep your weight very low and far to the inside. You must pull up on the inside bar, keep a very firm -- almost stiff -- grip on the bars at the most critical point in the turn. When a bike drifts (slides) while steering, keep pedaling and keep the bike upright -- don't panic; it will dig in and come around. Sometimes while on slippery surfaces you will have to steer in the direction of the drift but it takes a masterful bicyclist to accomplish this. Older riders who raced a lot on grass, gravel roads and cinder running tracks could broadside on a bike on the way around a turn. If you lean the bike while pedaling and the bike slides, you cannot react fast enough to recover and you will crash. Also, if the bike is leaned and starts to slide your weight will be moving down and very few riders have the strength to stop the downward movement, let alone lift it.

Some Conclusions

While cornering below the top speed that the corner can accommodate, simply *turn* and pedal through. If you are going faster than you can pedal through, still *turn* but put the outside pedal down and hold the bike down with your hands, feet and seat, with extra downward pressure on the outside bar and outside pedal. Going faster than you can coast around the corner, *steer* around and keep pressure on the back wheel by pedaling steady, keeping pressure on

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the front wheel by shifting your weight forward. Pedaling steadily keeps the rear wheel digging and the front wheel grips better as some extra pressure is transferred to it. Use hands, feet and seat to hold the bike on course. This is by far the fastest way to negotiate a corner. It also is the safest way to ride a wet surface on a turn with gravel on it.

There are many places where you can apply the turning versus steering routine. When a pack turns around a corner you should too, but if they are in the habit of jumping out of the corner try steering through and accelerating while still in the turn. It works because you have a higher cornering speed due to the extra traction of the digging rear wheel and extra pressure on the front wheel.

Bumping and Touching

(from *USCF Training Skills*, 1991 edition. Reprinted by permission.)

You should expect some physical contact in the pack and you should not be afraid or panic when it happens. This contact should never become a strategy that you should use, but you may have to react to it.

During the drills you will have a partner of similar size and weight if possible. Your handlebars should be about the same distance from the ground, this will help you to avoid locking handlebars with your partner. You will begin by riding around the course at a steady speed, side by side. Your speed should not be too slow because it is more difficult to hold a straight line. Begin to *gently* lean and bump shoulders and elbows, looking straight ahead, using your peripheral vision to keep even with your partner. The bumping should become more intense as you become comfortable with the drill. Stay in line with your bike, your body leaning towards your partner. If your partner were to disappear, you would fall over. You should maintain this contact around the corners if possible. Switch sides with your partner and repeat all bumping and leaning.

Key Learning Points:

- This is a defensive skill to protect yourself.
- Keep your elbows and shoulders relaxed as shock absorbers, for impact with other riders.
- You should *steer* rather than *turn* away from other riders.

Wheel Touching

(from *USCF Training Skills*, 1991 edition. Reprinted by permission.)

Sometimes, when riding in packs, your front wheel may become overlapped with another rider's. It is better to try to stay up than to panic. This is one of the more difficult drills as it involves doing something that we are trained to avoid at all costs, purposefully tapping your wheel into someone else's. When someone's wheel pushes against your front wheel, you must counter that force with the same amount of force, otherwise it will turn your wheel and you will go down. However, when you slow down and the two wheels disengage, you must steer straight and not overcorrect. The tendency to overcorrect will most likely be the cause of the crashes you will see.

Riders are split into pairs. One partner takes the lead and must simply ride straight and steady, listening to their partner but not looking back. You are in no danger of crashing. The second partner must match the first partner's speed and bring his/her front wheel up until just overlapping. Do not attempt tapping if the second partner's tire is at the first (lead) partner's hub. The second partner must ride inches to the left (and then right) of this lead rider's rear wheel, then gently bring it in until it brushes, then back off. The lead rider must keep steady and ride a straight line. Partners take turns, and must tap successfully on the left and right side of the lead rider's rear wheel.

You may want to double-check your stem for tightness. DO NOT over tighten or it may damage the steering column. Handlebars should be difficult but not impossible to move.

Key Learning Points:

- You need to be relaxed, elbows bent and slightly out.
- This is a defensive skill designed to protect you (the rider).
- The tendency at first to overcorrect will most likely be the cause of your crashes.
- Follow rider continues to pedal to keep traction on the rear wheel for better control of the bike.
- Always steer away from the lead rider, never *turn*, this will cause your center of gravity to be off.

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Surviving Your First Race

(from *USCF Training Skills*, 1991 edition. Reprinted by permission.)

Everyone who has ever competed on the bike can remember their first race. It's kind of like your first day of high school, filled with nervous anticipation, seeing people you have never seen before and accepting new challenges. For some, the experience is exciting and for others it's a nightmare. Your first race doesn't have to be a nightmare if you're prepared for it and the preparation is two-fold: the body and the bike.

Since competitive cycling is dependent upon a mechanical device, it is imperative that a mechanical problem doesn't impair the physical capability of the athlete. A rolled tire in the first lap of a criterium is not the way to experience your first bike race, nor is a skipping chain or a click shift that doesn't click. These kinds of mechanical hassles are frustrating and can be prevented if you follow a simple inspection procedure before every race. Start your prerace checkup by thoroughly cleaning your bike. This is important for two reasons. First, when you clean you remove dirt and grime that might otherwise hide a potential problem like a cracked frame or a deep cut in a tire. Secondly, the process of cleaning allows you to get closer to your bike than you normally do, allowing you to see those potential problems. Once the bike is cleaned, check the wheels for trueness, loose spokes, cuts in the tire's tread or sidewalls and if you're using tubular tires, make sure they're glued on properly. Next check for loose bolts, especially handlebars, stem and saddle. Remember to also check the headset and crank to make sure they're adjusted and put a wrench on the crank bolts to be certain that they are tight. Finally, check the derailleurs to see that they work perfectly in every gear and inspect all cables for frays. Don't forget to lightly lubricate all the moving parts, including the chain. After you're satisfied that everything is race ready, take the bike out for a test ride and jump hard in every gear combination to make sure that the chain doesn't skip and that the derailleur keeps the chain in the gear that you have selected. This is especially important if you have changed freewheels or cogs for the big event. If you've put on your race wheels, also check to make sure that the brake calipers are centered and not rubbing on the rim. This prerace ritual should not be done the night before an event, but two days prior to competition in case a trip to the bike shop is necessary for repairs or replacement parts.

The second step to surviving your first race is physical in nature. We'll assume that you're in reasonably good shape already or you wouldn't attempt your first bike race. Physical survival tactics start two days before the race with a training ride that incorporates a few hard efforts. Not too much, but enough to prepare the muscles and the mind for what's in store. This should be followed by a couple of high carbohydrate meals and a good night's sleep. Chances are that you probably won't sleep very soundly the night before your first race so be sure to put some rest in the bank. Also, increasing your carbohydrate intake a couple of days prior to the event will ensure that you have an adequate supply of premium fuel in your tank for the race. By the way, the liver is your body's fuel tank so keep it clean -- this means no alcohol in the days prior to the event. The day before should consist of an easy ride to check your equipment, 10 to 15 miles, nothing more. Pack your race bag and be sure to include your helmet, shoes, license, tights in case it's cold, a rain jacket, sweater and a wash cloth, astringent and towel for cleanup after the race. Buy any race food or beverages the day before so that you're not wasting time and energy trying to find them on race day. Your evening meal should not be too heavy or too late and you should try to get to bed fairly early.

On race day, be sure to arrive at the course at least two hours before the start of your race. Don't come too late or you won't have enough time to warm-up; perhaps the most important survival tactic of all. When you arrive at the race site go immediately to register and pick up your number. Confirm what time your race is to start and then get dressed, pump your tires, pin your number and find a place to warm-up. Your warm-up should begin in the big chain ring and include several short, hard efforts to raise the heart rate and fill the muscles with blood. Don't do too much, but give your body and mind a chance to experience the pain that's to come, especially in the first few laps of a criterium. Next, go back to the race course and complete your warm-up by riding the course until you're called to the line. Be sure to note the direction of the wind, any dangerous corners or potholes and pay particular attention to where the finish line is in relation to the last corner because here is where the race is usually won or lost. Tight corners and hills (particularly after corners) are where the attacks will occur, so make a mental note of them.

Soon you will be called to the line, and when you are, try to get as close to the front as possible. When the gun goes off for the start, concentrate on getting your feet onto the pedals immediately. Next, find an opening and begin to accelerate as hard as you can so that you will end up in the front 10% of the field on the first lap. The first 5-10 laps of a criterium are hell, be prepared to go as hard as you can. Don't worry, however, because things will start to slow down and remain fairly calm until about 5 laps from the finish when the pace will once again become frenzied as the riders smell the finish line. During the race, find a smooth rider to follow and stay at least midway in the pack. Avoid the back of the pack because this is where the accordion effect takes its toll on weaker riders. Keep your eyes focused well ahead, not at the rider's rear wheel in front of you. This will give you the ability to steer clear of crashes and to

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anticipate when the speed is going to increase. If the pace seems too fast, hang in there because it will eventually slow down and you'll have time to recover before the next hard effort. At the end of the race pay attention to the tactics that the better riders employ and record them in your memory banks because now that you have experienced your first race, the next step is to experience your first victory.

Training Techniques

Intervals

by John Semmel

Races never proceed at a steady rate. Someone attacks and the pace quickens; a break is caught and the pace slows. Interval work helps you to deal with such changes efficiently, to handle the speed during the jumps and to recover during the lulls.

Intervals teach you three things: to ride fast, to recover quickly from anaerobic exertion, and to handle your bike at high speeds. Of these, recovery is the most important. Nothing else you do in your training develops recovery as specifically as do intervals.

Interval Sessions

Thursdays are the best days for intervals, if you race on Sundays. You get three days to recover from your last race and two days to recover from the intervals before the next race. You can do intervals twice a week, but no more than that, if you're racing. Always warm up for at least five miles before starting to do intervals.

When you do an interval, work at 85–90% of you capacity. You must go anaerobic for it to do any good—your legs should burn. Then, as soon as you catch your breath, start the next interval. Your pulse should still be high (110 to 120) when you resume, and it should go up to near its maximum rate by the end of each repetition.

Do each interval in the set with the same intensity, so they hurt more as you go. It helps to have a cyclometer to check that you are maintaining a steady level of work throughout the set. If you find you can't recover in a normal time, you've done enough. If you can't maintain a constant level of intensity, either you've reached your maximum reps for the day, or you started too hard in the first place. Stop. There's no point in flogging yourself.

During your recovery periods, you should not stop working. Keep your cadence at 90 rpm in a moderate gear. Stretch and take a drink. Remember that if you allow yourself to recover completely, you are not stressing your recovery systems sufficiently.

Intervals are often defined by distance, each distance for its own purpose. They can also be defined by duration. The latter method may be easier to use unless you have a standard interval course, or a cyclometer. If you have a good sense of cadence, you can do intervals by counting pedal revolutions as well. This way you have nothing to look at but the road ahead of you. Some people count telephone poles.

Intervals are best done alone. No two riders have the same speed or recovery rate. Your decision to start the next interval should be based only on when you are ready. But it is better to do intervals with a group than not at all.

Finally, ride at least five more miles to cool down after you set, spinning a low gear. Intervals can be as taxing as a race, so let yourself rest completely afterward.

Types of Intervals

The type of intervals you do depends on the events you're training for. Below is a partial list of types of intervals.

- Vanilla intervals: Ride one minute hard, followed by a minute easy. Repeat up to 10 times. If you feel you can do more, you weren't doing them hard enough. If you can't do 10, you are either doing them too hard, or you need more recovery time. This is a good type of interval to do the first few times to learn your limitations.
- Criterium intervals: Find a two or three-block stretch of road (200–300 meters) that is relatively untraveled and has no side streets. Do 10 to 15 repetitions of this distance, which is about the length of one side of a square, mile-long criterium course. You should recover on the return trip from your finish line back to the starting line. If you find a loop where you can do this, you can practice cornering as

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well. This type of workout differs from sprint training in that you don't go as fast, and you don't recover completely between reps.

- Kilometer intervals: Go at nearly a sprint pace for about a kilometer (90 seconds). If you can hold it longer than this, you're not going hard enough. Such efforts help you in catching a breakaway or staying with an attack. Aim for 5 to 10 reps.
- Time trial intervals: Find an open stretch of road out of the city. Do 3 to 5 repetitions of 1 to 5 miles each, depending on the length of the time trial you're training for. Such intervals prepare you for a solo break, as well as for a time trial. You should go faster than you would be able to maintain in an actual time trial. Recovery time will vary widely, depending on your shape and the length of your effort.
- Uphill intervals: Find a hill about 800 meters in length. Climb it at near maximum effort, then rest on the descent. You might want to try different climbing styles and to time yourself with each style for comparison. These intervals increase your power.
- Downhill intervals: On a long, gradual down hill, push a large gear, then recover on the way back up. This should be as intense as an uphill interval, plus you are handling your bike at a speed faster than normal race speed.
- Mixed intervals: Do a 15-second interval, then a 30, followed by 45, 60, 75 and 90-second intervals. Then work your way back down to 15 seconds. Alternatively, do one-minute intervals, alternating between a 42x17 and a 52x17 for the intervals. The intervals in the 42x17 make you work on a fast, smooth spin.
- Fartlek: On an unstructured ride, push yourself for various periods in different situations. Muscle up that hill—attack that two-mile stretch of flat road—sprint for that road sign. This is a good way to train if you feel motivated to work hard. But it is easy to misjudge recovery and effort and hard to see improvement from session to session. This kind of interval often characterizes club rides.

As You Improve

As your strength and recovery time improve, adjust your interval program accordingly. You should be able to do each interval faster, to complete more intervals, and you should reduce your recovery time between intervals. The length and the intensity of the interval should remain constant for the type of interval you are doing.

Once you learn how to pace yourself in an interval set, be innovative doing intervals. This kind of training is great. Once you're done. But it can be hard to force yourself to hurt so much on a regular basis. Variety eases the pain a little, and builds your ability to recover from different types of fast riding.

In Conclusion

Your body adapts to its conditioning, whatever type you throw at it. If you go out every day and roll around at a good pace, sniffing at flowers and gazing at scenery, you will become fit. But you will get dropped on the first attack in a race. You must train hard sometimes to stress your body, to learn technique, even just to get used to feeling your legs burn. There is a place for easy rides. You should take three or four very easy rides a week, during racing season. But the other three or four rides a week should be tough.

The best way to train is to race. Unfortunately, there are not many opportunities to race available to us in this country yet. The next best way to train is to do structured speed work and to take fast group rides. Intervals and sprint workouts are not the most enjoyable ways to train. But the abilities they develop—speed and recovery—are what separate the good bicycle racer from the fit bicycle rider.

Sprinting

by John Semmel

Bicycle racers do two kinds of speed training—sprints and intervals. These are similar only in the fact that one of the goals of both is to ride fast. In sprint workouts, the aim is to develop acceleration and high-end speed. Once you are going as fast as you can in a sprint, you are finished with the exercise. Doing intervals, on the other hand, you are developing your ability to maintain a near-maximum speed, and to recover between such efforts.

Training Techniques

Sprints

Unless you're off the front (or off the back) at the end of a race, you will be involved in a sprint. Your ability to sprint makes the difference between placing and merely finishing with the pack.

Sprinting is a matter of timing, position within the pack, acceleration and pure speed. Riding over 35 mph is one thing. You also have to be able to go from 25 mph to 35 mph in a short time, and to initiate your sprint from the right spot within the pack at the right moment.

Position on the Bike for Sprinting

Place your hands on the drops. Keep yourself in a low, aerodynamic position. Most riders sprint standing up; some sprint balanced on the tip of the saddle. While the sprint position tends to throw you forward on the bike, you should place weight over the rear wheel as well. If you feel the rear wheel slipping or bouncing around as you sprint, you're leaning too far forward.

You should be using all your muscles to sprint: apply pressure to the pedals throughout the entire 360 degrees of each pedal stroke, pull the bike up with your arms and back in opposition to each stroke of your legs. Take care to keep your body steady over the bike—don't sway or bounce.

Gears and Acceleration

The mistake a lot of beginning racers make is to use too big a gear. You cannot get quick acceleration if you're starting at 65 rpm. Start at 100 rpm and accelerate from there. Your 52x13 won't do you any good in a sprint unless you're already going over 30 mph. Prove this with a cyclometer and a watch. Get into your biggest (hardest to pedal) gear and time an acceleration from a dead stop to 20 mph. Then use a small gear and time yourself to the same speed.

Sprints are usually done Tuesdays, based on a Sunday race schedule. Workouts are best done with others who are on your level. You sprint more competitively against other riders, plus you get experience taking leadouts and going head-to-head.

It's important to warm up before doing any kind of speed work. High levels of output can damage unprepared muscles and joints. Avoid doing speed work in cold weather. After some easy riding, start out with five to ten low-gear (42x17 or 16) sprints.

You probably have no more than 10 full-out, 100% sprints in you in a given session; you probably have fewer. You won't help your sprint by trying to do 50 of them. Also, when you first start to do sprint workouts, you will not be able to accelerate very long. Once you have reached your top speed, hold it for 5 seconds at most. At first, you might be able to accelerate for only 15 or 20 pedal revs. As you improve, this number will increase, but it will never go over about 30 or 40 revs at your maximum rate of acceleration.

Let yourself recover completely between sprints. You can't concentrate on form if you're still panting from the last sprint. Keep your legs spinning in a very small gear, and let your breathing return to normal.

- Vanilla sprints: find a 1/4 mile straight and nearly flat stretch of road with no side streets. Spin easily up to a slow race speed, then sprint. Set a finish line and try to reach your maximum speed a few yards ahead of it. If your course slopes, sprint down hill to more closely approximate race speed. Tailwinds work too. Recover completely and repeat. When your top speed starts to drop, end the session.
- Low-gear sprints: This is a good way to warm up, and you quickly learn something important about sprinting. Sprint in a 42x17. If you are using a cyclometer you should see that you spin out at 25 to 30 mph. You'll also see that you reach this speed quickly.
- Dead start sprints: Put the bike in your best sprinting gear, and start from a slow roll. Accelerate to your top speed. This seems to contradict what was said about gears, but the point is to build strength and to give you a slow-motion picture of what your legs should be doing in a sprint.
- Leadouts: This takes from 2 to 5 people. Line up front to back on a fairly long, straight stretch of road with a clear finish line. The group takes off; the leader accelerates smoothly to high speed and pulls off. The rest of the line pulls through and sprints to the finish. The group rotates like a pace line and goes

Training Techniques

again, with each member taking a turn leading out. This drill approximates a race situation. Each rider is helped through the beginning of the acceleration by and leadout rider and sprints starting from a high speed. Timing and position come into play.

Sprint Tactics in Races

Setting up for a sprint in a criterium starts the middle of the second-to-last lap or even earlier. The last lap is likely to be at top speed, so if you are not near the front going into it, you are sunk. Other factors determine your strategy in a field sprint:

- Distance from the last corner to the finish line. If this is short, you must be first going into the last corner to win. The real sprint is to get to the last turn first. If it is a long way from the last corner to the line, you want to be somewhere else in the top 10.
- Presence/absence of teammates at the front of the pack: You may want to give a leadout. If you're a good sprinter, you may get one. If you are alone, look for an unfriendly wheel to latch onto.
- Crashes: In every type of race, from Cat IV crits to professional road races, crashes happen in sprints. These are the most dangerous type, due to the speed and number of riders. You can't be a successful sprinter without taking risks. All you can do is keep your head up, ride straight, avoid mistakes like striking a pedal in the final turn, and go for it.
- Never give up during a sprint until you've crossed the line. You can often gain a placing or two just by working till the very end. It's much better to be 20th than 21st, even if there are only 10 places. and you can lose valuable placings by being overconfident at the end.

Speed Work

By John Elgart

Did you ever notice that in the typical Cat IV race most of the riders get dropped in the first 5 to 10 laps. The reason is speed. The field has it, the dropped lack it.

So given this elementary fact, I have a simple question: Why do nearly all beginning riders train for endurance rather than for speed and power?

Why those 100 mile rides at 18mph? Are they training for the Race Across America? Do they have any 100 mile races? How about 50 miles? How about 25? The fact is, most Cat 4 races are in the neighborhood of 20 miles, and they are pretty fast. So, if you are riding slow 100-milers, you are training for a race that you'll never ride in.

So what sort of speed work should the beginning rider do? There are many possibilities, and Eddy B's *Bicycle Road Racing* should be consulted, but generally your speed program should be built around three types of effort: the 15-second sprint, the kilo (about 90 seconds), and the 4000-meter pursuit (about 6 minutes).

You should mark off courses where you can do these distances uninterrupted. For the kilo and pursuit remember to time yourself, and to keep track of your times in your training diary.

Remember, bike racing is a jam and recover sport; speed is the essence.

A week of speed training

There are many different possibilities here. What follows is just a sample—adapting it to your circumstances is essential.

To be specific, you should make the basis of your speed workouts three types of efforts: the 20-second sprint, the 90-second time trial (about a kilo), and the 5-minute time trial (3 to 4 kilos). Find flat areas where you can do these distances uninterrupted and mark them off, with paint on the road if necessary.

You will do most of your speed work on these courses. For your kilo and pursuit, you will want to time yourself and to keep track of your times in your training diary.

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Keeping this in mind, a week for an inexperienced rider riding 8 to 10 hours might look like this:

Monday: Day off or no more than an hour, very easy.

Tuesday: Sprint and Kilo

1. 30 min. easy warm up
2. 20 min. low gear sprints, one/minute, not all out.
3. 3 to 4 big gear sprints, all out, complete recovery
4. 20 minutes easy spinning
5. 2 to 3 kilos, increasing intensity (optional)
6. 20 min. warm down, easy spin.

Wednesday: Tempo (If over trained, make this an easy spin day.)

7. 30 min. warm up, easy spin.
8. 30 min. at 80% anaerobic threshold (heart rate 130-150)
9. 20 min. warm down.

Thursday: Pursuit

10. 20 min. warm up, easy spin.
11. 20 min. low gear sprints and surges.
12. 3 to 5 pursuits with increasing intensity and gear size. Complete recovery between each. Final pursuit should be all out.
13. 30 min. warm down.

Friday: Day Off.

Saturday: An hour or so with a few sprints and surges. Mostly easy spinning.

Sunday: Race or race simulation.

Indoor Trainer Workouts

by Pat Liu

To maximize the benefit you get from your indoor trainer workouts, it is important to take advantage of the unique properties of the machine. Because there are no hills to climb and no shifting winds to fight, you can get the most consistent workout of your life on an indoor trainer. This makes it the perfect machine for anaerobic threshold (AT) training, which is the type of training used by Francesco Moser when he shattered the one hour world distance record.

During exercise under increasing work loads, the athlete's heart rate (HR) increases as the heart tries to supply more oxygen-laden blood to the working muscles. It has been found that the rate of increase in HR slows past a certain work load, when the athlete has reached the AT. Lacking sufficient oxygen, the muscles begin to produce lactic acid, and the legs will burn and soon tire out.

The best way to push your AT higher is to train at 80-90% of your AT pulse. You can do complex tests to find your AT HR, but for most people this means working out at a HR of between 160-180 bpm. The workout I developed is similar to that used by Moser in his preparation for the hour record:

- Easy: Warm up with easy effort for ten minutes to get HR in 100-120 range, using a cadence of 90-100 rpm.
- Hard: Shift to a higher gear to get HR in target range 160-180 bpm, keeping cadence at 90-100 rpm. Ride at this work load for 20 min. Use your gears to find the right work load.
- Easy: Ease up and just spin easy for 5 min.
- Hard: Another 20 min. at your target HR 160-180 bpm using the same gear and cadence as before.
- Easy: Warm-down spin for 5-10 min.

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If you find during the hard 20 minutes, you're really breathing pretty hard but your legs are not burning up, you're at the right HR. If you're not breathing hard, go for a higher target HR, and if your legs burn too much to complete the 20 minutes, go for a lower target HR.

If you work hard, you will sweat a lot. Studies have shown that overheating is a major limiting factor in indoor exercise. A fan can keep you from overheating and will allow you to work to your true potential. A towel draped over your bike's stem and top tube will keep the sweat from corroding the bike, and drinking a full water bottle during your workout will keep you from dehydrating.

As your training progresses, you will find yourself having to shift to a higher gear to reach your target HR. This means you are capable of doing more work at that HR, and you are pushing your anaerobic threshold higher.

Types of Racing

Types of Racing

criterium Racing

by John Elgart

The pack goes round and round, and each lap riders are burned off the back: in the confusion of the start, at prime sprints, coming out of corners, when they crash all alone, when other riders crash in front of them, when gaps between riders form, when the break is being chased, in the final sprint

At the same time, riders will briefly get off the front: after prime sprints, after crashes, after a break is caught, when the pack moves too slowly, when the pack goes at a pace too fast to sustain, before the final sprint

Or just for no good reason. But almost always these riders will get caught. Meanwhile other riders will be blocking or chasing. Everyone else just hangs on or waits for their moment.

Most of the top places are taken by those riders who stayed out of trouble and who conserved enough energy to have a good sprint on the last lap of the race. The fact is, **most top places in criteriums are taken in the field sprint.** This is especially true of Category IV criteriums. If you can't sprint, you won't place.

The position of the new rider

The new rider will probably have all the bad things mentioned above happen to them and very few of the good things. The Cat IV novice should not expect to have a particularly positive experience in his/ her first criterium. Success is just finishing in the pack. Getting dropped is the norm. Most good Cat II riders started their racing careers by being dropped.

The skills that you need to develop for criteriums, more or less in order of importance, are:

- Recovery and the ability to change speeds
- Jamming for short intervals
- Jump sprinting
- Top end sprinting
- Cornering
- Close drafting
- Reading the race
- Placement in the pack
- Basic fitness

You should train for criteriums by simulating the actual conditions you will encounter in race situations. There are training routines for each of the skills above. In general, your training should be really fast for short periods of time and then really slow so you can recover to go fast again. Most novices do not train like this: their maximum speed is not close to top racing speeds and average speeds that are too high that don't allow real recovery for the fast-pace work. The ability to ride at 24mph for several hours will not help you if the race goes at 32mph for several minutes on each lap of a 1 hour race. If you are training at 24mph, **you are probably training for a race you will never be in.** Always ask yourself:

What specific training methods should I be using to help me become a better racer?

Road Racing/Hill Climbing

by Maria Collazo

Types of Racing

Road Racing

Racing tactics are a combination of all the skills you've learned in cycling and a dose of psychology. Before starting a race, you should know something about the race course and racers (your competitors!). It would be very wise of you to contact the promoter of the event to get a course description and a gear recommendation.

Unfortunately, I have discovered that some promoting clubs provide misleading gear recommendations causing the racers to show up over or under geared.

Case in point: I did a criterium in Ossining, NY described as a European type course. The promoter said that there was a hill and suggested a 42 x 22. Being the skeptic that I am, I decided to set up my bike with a 38 x 21 combination. It's a good thing too, because the hill turned out to be a 3-level climb similar to "The Wall". Needless to say, the race became a ride of attrition.

Upon your arrival at the race site, scope out the course either by car or better yet, riding on it (if at all possible). If the course is not open to riders for inspection, talk with people who have already ridden it.

Know your competitors. If you plan to do a lot of racing, get to know the racers who consistently finish well. Watch these people and use your observations to improve your own style of riding.

Keep in mind that once you are in racing condition, the name of the game is patience and wits. Cycling is a sport of circumstances. Unpredictable elements will dictate your course of action. Strategy is something you want to keep in your back pocket.

During a race, it is important to keep your "Radar" on. At all times, you want to be looking around you -- be aware of all the elements in your race: the competitors, the course, wind direction, temperature, and whatever lies ahead. Calculate any risks you're willing to take, because as mentioned previously, circumstances tend to dictate strategy/tactics.

Hill Climbing

Hill climbing is personal; two people will usually go up a hill differently. Andy Hampsten may remain seated during a climb and spin a low gear, while Lucio Herrera (a Columbian) will stand up and ride toe-to-toe with Andy, in a bigger gear. They're both going at the same speed but by different methods.

The way you approach climbs—your technique, mental attitude, preparedness for the climb and pace—are the most important things in making the best of what you've got.

You have to start out climbing slowly and steadily so that you can stay within your technique and limits. Jamming or sprinting up every hill in sight won't allow you to develop a fluid style or suppleness. With cycling, you have to start out slowly and build it layer by layer until you really get to know your body inside and out.

How do you develop this suppleness or fluid style? Two ways. The first is to find a hill (challenging but not so grueling) and go up once in a very low gear, spinning easily. Think about your first climb up the hill. Was it too easy? Too hard? Did I start off too quickly? Go up the same hill a second time and make any modifications based on your first ascent. Hill repeats are a good way of improving your technique. The second way to develop suppleness is to ride with someone who is a good climber. This person can watch your technique and provide you with some tips.

Handlebar Positions

You should become familiar with different handlebar positions. Find the most efficient position for the terrain you're riding. There are two handlebar positions for climbing:

- Gripping the brake hoods. This position allows you to alternate from sitting to standing or vice versa while climbing.
- Placing your hands on the "tops" or flat portion (extending out from the stem) while sitting. (Standing in this position may cause you to lose control of your bike.) This position allows you to take in more oxygen easily.

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Remember, climbing is a power exercise. When you are riding uphill, you're fighting gravity and lessened momentum.

Technique for Climbing

- Slide back in your saddle. This in effect raises the saddle and increases power to the pedals.
- Pace yourself in a comfortable gear that allows you to spin easily and efficiently. Rhythm is crucial in reaching the top.
- Concentrate on conserving energy by keeping your upper body relaxed.
- Breathe. Getting into rhythmic breathing can help you pace up the hill.
- Occasionally, you'll want to stand up in order to stretch your muscles. This also gives your legs a partial rest.

Short (steep) Climbs

You may want to get out of the saddle. These types of climbs generally require short bursts of power and speed that can best be exerted by standing up. This effort will be short enough not to tire you.

Choosing a Gear

Most people tend to ride in big gears. Smaller gears keep you fresher for the long haul. Learn to listen to your body and adjust the gears accordingly. There will be times when you think that it's crucial to hang in with the lead riders. Calculate your risks and hope that they pay off.

Final Note

As a beginner racer, you will be overwhelmed with all types of information and advice. Absorb each little bit of information each person has to offer and discard all the information that does not work for you. Be patient. It can take years to perfect a good climbing style; it doesn't happen overnight.

Time Trials

by Scott Steketee

Why time trial?

- It's the ultimate test, the race of truth—you against the clock. There is no drafting, no shelter, no excuses.
- Provided it's not overdone, training for a time trial is excellent for your over-all conditioning and for the rest of your racing program.
- Time trial techniques can be invaluable in crits and road races—either in solo or two- or three- rider breakaways, or if you get dropped and need to catch.

Training

- Practice riding in an aerodynamic position, with your hands on the drops and your elbows well bent. You must be able to maintain a low, aerodynamic position for the duration of the race. If you have time trial bars, practice riding them. The position is different, and you need to give your body time to adjust to it.
- Hard intervals are excellent. Longer (two- and three-minute) intervals should be mixed with the short intervals you are used to doing.
- You can practice for time trials on group rides, but not if you stay in the shelter of the group. If you're not strong enough to stay near the front and take frequent pulls, let yourself come off the back and then chase. Or get two or three other riders to go with you, separate from the main group, and ride a hard pace line.
- Actual practice time trials should be used sparingly, very intensely, and over a shorter distance. Do *not* train yourself to ride slowly!

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- Train at shorter distances than the actual competition—but with the same speed and intensity you want to race with. Fifteen-kilometer practice time trials are fine to prepare you for a 40 kilometer race. Better to practice for 15K at 25 mph than to practice for 40K at 24 mph.
- Practice your turns by yourself. Downshift before the turn, come in hard on the right side of the road, brake hard, come close to the cone, and come out of it on the far side of the road accelerating hard.
- Practice with a heart-rate monitor. Determine your aerobic threshold (AT), and keep your heart rate at or near your AT for an extended period. This will help you build your aerobic capacity for an extended effort.

Technique

Proper aerodynamic position is the single most important element of time trial technique. VeloNews published an article on time trial positioning (February 19, 1990) which discusses the advantages of proper aerodynamic positioning, complete with diagrams. Basing their work on wind tunnel testing, the researchers found that some of the extreme positions beginning to be adopted by some triathletes are of questionable value, and that experienced elite racers have generally already adopted positions which are near-optimum. It is the less experienced, local racers who have the most to gain from improving their positions on the bike.

- Stay consistently low. Ride on the drops with your elbows bent.
- At the start, use your small ring to accelerate quickly. Shift, accelerate again, and get into position as early as you can. The time you save by accelerating in the small ring more than compensates for the extra shift. (If you doubt this, try it with a friend: do a side-by-side practice start, one on the small ring and one on the big, and see who gets up to speed more quickly.)
- Ride hard. The first quarter is not too hard because your adrenaline is going; the same is true of the last quarter. The trick is to maintain your consistency, concentration and speed through the second and third quarter. You should ride so hard during this middle part of the race that it takes everything you have left to ride the last quarter without slowing down.
- During the race, stay low. Don't come up out of your time trial position to shift, to drink, or even to climb unless it's a very hard, out-of-the-saddle climb.
- Fight fatigue and numbness. Get slightly off the saddle briefly (10 pedal strokes) every 10 to 15 minutes. Vary your hand position for a brief period every few minutes.
- Ride a smooth straight line; you should have no wasted motion. If traffic and safety permit, use an inside line on curves—but never cross the middle line!
- Ride a lower cadence than you normally do—in the 80's is fine. Try to find a groove—riding hard with no wasted effort, feeling one with the bike, feeling your energy flowing through the bike. You'll know the feeling when you get it!
- Position is crucial. Check yourself continually to make sure you're as low and aerodynamic as you can be.
- Don't blow yourself out at the start, but make sure you have nothing left when you finish.
- Make a fast clean turn. Some riders lose precious seconds by coming into the turn-around too fast and over-shooting it by as much as 20 or 30 meters! Come in fast on the very right edge of the road, and downshift before you start braking. As you near the cone, brake hard to a speed at which you can negotiate the turn. Cut the cone reasonably close, and come out of the turn near the far shoulder of the road. Accelerate hard, and in not too big a gear. The ideal speed as you go around the cone is the maximum speed at which you can negotiate the turn from one shoulder of the road to the other.
- Compete with a heart-rate monitor. The time trial is a race of concentration, and the monitor will let you know when you're losing concentration and easing up. Your heart rate should stay at your AT for the entire race.
- Stay low.

Equipment

Every observer of the 1989 Tour de France knows that Pedro Delgado threw away almost three minutes, and his chance for victory, by showing up late for the prolog time trial. But not nearly as many observers realize that Laurent Fignon also threw away several minutes, and a sure victory, by riding the wrong equipment in the time trial stages. And so Greg LeMond was able to take advantage of the mental mistakes of his two main rivals and win the tour not just by riding strong, but by riding smart.

Types of Racing

You may not be able to ride as strong a time trial as LeMond, but at least you can ride a smart one.

Superior aerodynamics is the key which makes a difference of many seconds, and even minutes, in a time trial. At typical time trial speeds, about 90% of your energy is used to overcome air resistance. (The remaining 10% is accounted for by the rolling resistance of your tires, losses in your bearings, etc.) Anything which allows you to slice through the air more cleanly will improve your time.

- Proper position on the bike, regardless of equipment, is crucial. You must reduce your frontal area, which means you must get low and stay there. Train to be able to adopt and maintain a low position for the duration of the time trial. With regular bars, your bars should be adjusted as low as they go, and you should stay on the drops with your arms bent as much as possible without causing excessive fatigue and loss of concentration.
- Time trial bars allow you to adopt a lower position, reducing your frontal area. The hand position also helps to break the wind for your head and body. Some riders have trained themselves to keep this low without the time trial bars, but few of us can maintain this position for a full 40 kilometers, and the strain of maintaining this position takes a toll. With time trial bars, it's easy. The time savings in a 40-kilometer time trial is about 90 seconds, depending on your previous position. Clip-on time trial bars are almost as good, and are a lot easier to install and remove.
- Staying narrow is almost as important as staying low. There's nothing you can do about the width of your shoulders or hips, but your arms are important. Wind tunnel studies show that keeping your arms very close together, so the forearms are almost touching along their full length, results in significant time savings.
- A helmet, almost any helmet, is more streamlined than a bare head. An aero helmet is even better. (Savings: 36 seconds.) Without his helmet, Greg would have lost the Tour!
- Disk or tri-spoke wheels give a significant advantage compared to normal spoked wheels. (Savings: 66 seconds for a front disk, 33 seconds for a rear disk.) Crosswinds can make handling difficult with a front disk, so most time trialists prefer a spoked wheel in front. Many believe that wheel covers confer nearly the same advantage as disks for a fraction of the cost, but there is some controversy on this question.
- Aero rims, narrow tires, and radial bladed spokes are the way to go if you're not using a disk or wheel covers. (Savings: 44 seconds using 28 spokes and an 18 mm tire.) A 24" front wheel (i.e., on a funny bike) is more aerodynamic than a 27" wheel.
- A skinsuit is faster than separate jersey and shorts. (Savings: up to 30 seconds, depending on fit.)
- Finally, do sweat the small stuff. Removing your water bottle and cage saves 26 seconds. (But expiring of dehydration costs you considerably more than this savings.) Alternatively, an aero bottle and cage saves 15 seconds. Tape over your shoelaces for 7 seconds, or wear Lycra shoe covers for 13 seconds. Shave your legs for 5 seconds, and shave your face as well. And wear Lycra-backed gloves—they'll save you 2 seconds!
- A common misconception is that light-weight equipment is faster in a time trial. But the weight of the bike does not contribute directly to the drag, unless you're riding uphill. There is no particular advantage to light-weight equipment in a flat time trial, unless that equipment is also more aerodynamic. It is true that light wheels accelerate more quickly. This gives an advantage in a crit, in which you accelerate and decelerate dozens of times. In a flat out-and-back time trial, you only accelerate twice, and the advantage to be gained from lighter wheels is negligible.
- Similarly, there is no great advantage to light tires or tubulars in a time trial. Performance differences between tubulars and clinchers are much smaller than they used to be. Important factors are tire width (which affects the aerodynamics of the wheel) and inflation pressure (which affects the rolling resistance). Tires 18 mm wide, inflated to 140 lb pressure, are fast! But be warned—a flat tire is a slow tire!
- All the fancy time-trial equipment costs money, which is a scarce resource for most of us. If you can afford a special time trial bike, by all means go ahead and buy one. If you can afford special wheels, buy a rear disk and a front wheel with an aero rim and radial bladed spokes. But if you're on a tighter budget, here are three suggestions for getting the maximum reduction in time with the minimum reduction in bank account:

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- Buy a rear wheel cover, and mount it on a wheel you already own. You can leave the clips in place, and mount and remove the cover in a matter of minutes. Now that wheel covers are legal, you can buy nearly the same advantage as a disk wheel for less than \$50!
- Use clip-on time trial bars, which are as good as regular time trial bars, but significantly cheaper.

An article in the June 30, 1989 VeloNews purports to give the low-down on aerodynamic advantages of special time-trial equipment, especially wheels. Some of the information is interesting and helpful. In particular, we can expect to see more of the tri-spoke wheels and radical frame designs described by the article.

Other portions of the article seemed questionable. The research cited found that disk wheels were fastest, with tri-spoke wheels and several more conventional wheels built with bladed spokes and aero rims nearly as fast—and all about 30 to 40 seconds faster than a standard 36-spoked wheel over a 25-mile time trial. This is consistent with the results of other studies. But the study also found that wheel covers were slower than standard 36-spoke wheels! No explanation was given for this supposed aerodynamic difference between disk wheels and wheel covers. Could the wheel covers have been improperly fitted and stretched? Perhaps we should wait to see independent confirmation of this particular result, since Steve Hed, the designer of the Hed disk wheel, was one of the people involved in the research.

One conclusion from all the research into aerodynamics and time trials is not in doubt: a racer who hopes to win the Tour de France can ill afford the foolishness of riding the time trial stages without time trial bars and an aero helmet.

But when all is said and done, the fastest time-trial bike in the world is no substitute for good conditioning and technique. Anybody can buy fancy equipment, but your preparation and your form will make the difference between you and similarly-equipped competitors.

Team Time Trials

by Scott Steketee

The Team Time Trial is an exciting and satisfying race for competitors, if not for spectators. It has much of the rider-against-the-clock challenge of the Individual TT, but with less pain and with the satisfaction of precision riding with team-mates. The objective is not how fast you cross the line yourself, but rather how quickly you bring your entire team across. There are no stand-outs, no prima donnas in this race; the rider who drops his team-mates has failed.

The rules are simple: your team must cover the distance as quickly as possible, and the team's time is determined by the time, not of the lead rider, but of one of the following riders. Which rider is actually timed is determined by the size of the team; in a 2-person TTT, the second rider is timed; in a 4-person TTT, it is usually the third rider.

The emphasis in the race, then, is team-work. It gains you nothing to set a fast pace and drop riders. You must find a way to make the entire team go as fast as possible, but without dropping anyone. Ideally, all team members should be fully spent at the end of the race. To achieve this objective, you must communicate with each other and you must adjust your pace-line as the race progresses. You must make it easy on your team-mates by pulling through smoothly, by maintaining an even pace during your pull, and by regulating the lengths and speeds of pulls so all team members are working to their capacities. There is no room for ego; the rider who accelerates every pull and sets too fast a pace will drop his team-mates; the rider who insists on pulling when he should be resting will be dropped or will force the team to slow for him.

Proper team time trials techniques are basically good pace line techniques, but refined and carried to an extreme of precision, cooperation and speed. Even if you never ride a team time trial, it's worthwhile practicing the techniques to improve your pace line riding.

Training

Training for the TTT is different than training for individual time trials. The emphasis is more on speed and fast intervals than on steady endurance. In fact, a team time trial involves fast, intermittent efforts, similar to a crit or road race but without sprints or hills. Emphasize interval training and pace-line work, at 27 mph or faster. Do train with your team-mates, and do practice some turns.

Types of Racing

Equipment

As for an individual TT, good aerodynamic position and equipment are important. Aero bars (regular or clip-on), aero helmet, a time-trial bike, a disk wheel are all helpful. But you will not be breaking the wind for the entire race, and so the importance of aero equipment is somewhat less. You can ride a very fast TTT with no aero equipment at all. So if you have it, use it, and if you don't have it, don't worry about it.

Strategy

To get the entire team across the line as fast as possible, you need to maintain as even a pace as you can—from rider to rider as each rider takes her pull, and from the beginning to the end of the race. This requires you to pay close attention to your body—how tired are you, how hard can you go at this stage of the race and be sure that you will neither be dropped nor have too much left at the end. If you are feeling tired, don't slow the pace; take shorter pulls instead, or skip several pulls if you need to. If you are feeling strong, don't push the pace to a level that will drop your team-mates; take longer pulls instead. If your team is uneven, it may be appropriate for the weakest rider to sit on the back and never pull. That rider can still make an important contribution if someone flats, or by pulling as the end of the race nears. If you're having trouble getting back on after your pull, don't be embarrassed to sit at the back for a while and then take shorter pulls; the alternatives are to either slow the pace when you pull or to be dropped—and neither helps your team!

The Start

The start is a chance to gain a few seconds by being smart. Everyone should be lined up abreast at the starting line, with the chains on their small rings. Start together and accelerate hard, then shift and accelerate again. By this time some riders will be ahead of others. Try to fall into a pace line as smoothly as you can during this process. If you have a desired order in your pace line, don't worry about it yet; you want to get up to speed quickly, and make your adjustments once you're moving at race speed. Be alert, though, to make sure you don't drop anyone at the start, and talk to each other. You may need to slow briefly to allow someone to catch up. (This costs precious seconds, though, and you can probably avoid it with some practice starts.)

If you do have a desired order in the pace line, readjust after you're up to speed. Certain riders may need to skip pulls until they're in the right place in the line. It's probably best to skip just one pull each cycle, keeping the workload even, until you're in the right spot.

Be ready for your pull

A team time trial requires a fast, tight, smooth pace line. Anticipate the start of your pull when you're second in line: shift into the right gear, based on wind and the terrain ahead, and get down on the drops. You should have all your adjustments made and be ready to pull through smoothly as soon as the rider in front pulls off.

Take your pull

As you start your pull, be sure you to maintain the same speed. If you accelerate, you'll open a gap that others will have to expend energy to fill; if you slow down, you disrupt the pace line, possibly causing team-mates to touch wheels and fall. If your speedometer has a cadence setting, watch your cadence as you start your pull and make sure it doesn't change. (The cadence is a more sensitive indicator that you're maintaining the same pace than speed is.) It is permissible to accelerate if the pace is too slow, but be sure you do it very gradually throughout the pull. Be sure not to slow the pace during your pull; if you slow down, it means you've pulled too long and you should get off the front! Your pull can be anywhere from 15 to about 50 pedal strokes, depending on how strong you feel compared to your team-mates.

Road or weather conditions, of course, may dictate changes in pace. If a strong headwind comes up, or you come to an uphill, the pace will have to slow. If the headwind or hill is severe enough to require a shift, it's usually best to pull off and let the next rider pull through rather than shift yourself while you're on the front. (You will slow perceptibly as you take the pressure off the pedals to make the shift.)

Types of Racing

Between pulls

As you pull off at the end of your pull, make sure you don't slow down in anticipation. This is the most dangerous moment in a team time trial; the natural tendency is to glance back to make sure it's safe to pull off, and to slow down slightly as you look. But if you let your concentration and effort lapse, you may brush or cross wheels with the rider behind you. (You will likely escape injury yourself, while the rest of your team crashes as a result of your error.) To be safe, take a couple of slightly harder pedal strokes as you make sure it's safe to pull off. This should increase the gap between you and the rider on your wheel by several inches—enough to provide an extra margin of safety. To prevent surprises, signal the rider behind that you're about to pull off by moving your right elbow out and back. Pull off smoothly—not suddenly, but decisively enough that the next rider knows to pull through. Maintain your speed until you're sure that the rider behind you is clear of your wheel, and then take a few light pedal strokes to allow your speed to drop significantly. Your objective now is to get to the back of the line quickly, but without losing so much speed that you have trouble catching the last wheel.

Stay close to the rest of the line as you fall back, since you can gain some shelter by staying near the pace line. Also stay on the drops until you're back in line. As you draw even with the last rider, accelerate to catch the wheel smoothly, without ever allowing a gap. You may want to get out of the saddle as you accelerate, just for a change of position. Now that you're at the back and securely on a wheel, this is the time to take a drink, to change your hand position to avoid fatigue, and so forth. You may also want to change to a slightly bigger gear while you're resting.

If you use aero bars, don't stay in the aero position in the middle of the line; your control is not as good and you can't reach the brakes. Drop down into the aero position as the rider in front of you pulls off, and stay down through your pull and until you drop back and pick up the last wheel. Then ride in a position where you have good control and access to the brakes until you come to the front again.

Skipping pulls

If you are having trouble with the pace, it's better not to pull through at all than to take the chance of being dropped. You must do this without working harder than necessary and without confusing your team-mates or interfering with their rhythm. The obvious method, of dropping back to allow space for the next rider to pull into line in front of you, is wrong on both counts. Instead, stay close to the wheel of the rider in front of you. As the next rider is dropping back, move left onto her wheel just as she comes even with the rider in front of you. You'll have to adjust your speed slightly as you do this, but you'll always be on a wheel, and your team-mate won't see you and wonder whether or not you're just trying to close a gap. (If you can, it also helps to call out to your team-mate to let her know what you're doing.) As your team-mate accelerates to catch the wheel of the rider who used to be in front of you, be prepared to accelerate slightly also.

Hills

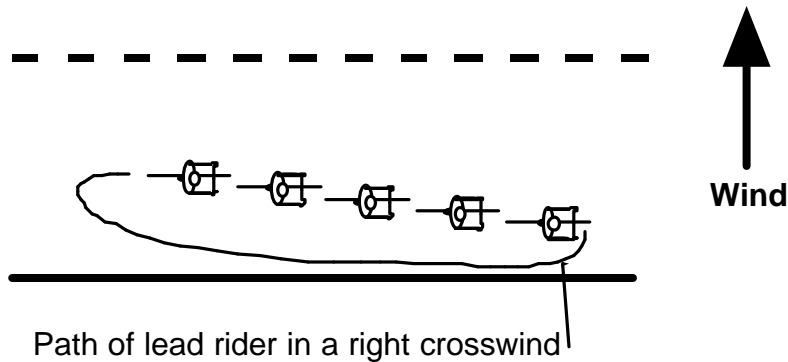
If a time trial course has hills at all, they're usually gentle ones. Going up, try to maintain a good pace; this will require extra effort from the entire line to make sure no gaps open up. Coming down, use the hill to increase your pace; this will require significant extra effort (and shorter pulls) from the front rider. If the front rider is not pulling extra hard on a downhill, the rest of the team will be soft-pedaling or even coasting, and losing a chance to gain important seconds. The heaviest rider on the team is a good one to have at the front on a downhill.

Cross-winds

In a strong cross-wind, you'll want to form an echelon, in which each rider rides to the down-wind side of the rider in front. (You take up much more of the width of the road this way, so be especially alert to overtaking traffic!) If the wind is from the left, the front rider needs to be far enough from the shoulder to allow the rest of the line to take shelter to the right. If traffic is light and the road is clear, riding in the middle of the lane is fine.

If the wind is from the right, things get more complicated. The lead rider will be near the shoulder, and should not pull off to the left; to do so might cross wheels with the second rider and cause a crash. In a strong cross-wind, always pull off into the wind. In this case, pull off to the right, further toward the shoulder. An elbow signal is especially helpful here. Signal with your left elbow when you are pulling off to the right.

Types of Racing



If wind conditions are changing, be sure you and your team-mates are talking, so nothing unexpected happens. In particular, the entire team must know ahead of time when the change from pulling off left to pulling off right is taking place. It helps to have a designated team leader who can say, "Starting with my next pull, we pull off to the right."

Turn-around

The turn-around is also a spot where you can easily gain or lose precious seconds. The object, of course, is to take the turn as quickly as possible, as close to the cone as possible, and come out of it accelerating hard and with no gaps in the line. Simple, no? There are likely several different ways to approach the turn-around, only one of which is described here. In this method, a change of lead takes place at the turn. The lead rider stays straight ahead near the shoulder and overshoots the turn slightly, by around 15 or 20 meters. This allows the remaining riders to go inside, near the cone, and for the (former) lead rider to emerge from the turn at the rear. The remaining riders spread out, with each succeeding rider taking a slightly wider (and therefore faster) turn. Thus rider #2 is following the slowest line through the turn, and the last rider is following the fastest line. Rider #2 has no concern but to get through the turn quickly. Rider #3 can brake earlier than Rider #2 and drop back slightly to provide a safety margin, and still come out on the wheel of Rider #2 due to her faster line. This maneuver requires practice; few time trial teams devote the time and effort to perfect it. But even imperfectly executed, it's likely to bring you out of the turn in less time and with smaller gaps than you could otherwise achieve.

