

TRACK CYCLING – AN INTRODUCTION

*What a roadie needs to know
to start racing on the velodrome*

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All photography by Matt Johnson, © 2009

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Twenty years ago, every American road racer had a copy of *Bicycle Road Racing* by Eddie Borysewicz. It had everything you needed to know to get started in the sport, and it's a good thing that it did. It was pretty much the only guide to road racing available in the U.S.

Now, of course, there is a flood of information available about road racing- which is great. But when a road racer decides to start racing on the track, there is nothing to explain the basics of track racing all in one place. This is an attempt to solve that problem.

This is no *Bicycle Road Racing* - and I'm no Eddie B. But the challenge of helping road racers to start racing on the track is pervasive. Unlike a novice road racer, an experienced roadie in his first race on the track presents a dangerous mismatch of strength and skill. He has the legs to compete with an elite track field, and just enough skill to hurt himself and others in the process.

Why is *starting* on the track dangerous?

Because track racing appears to be much like racing on the road - and that's misleading. Track racing can be very dangerous when someone in the field *thinks* he has enough experience to race aggressively, but is really making assumptions from road racing that don't apply on the track.

Getting started in track racing doesn't need to be dangerous, and for most people it isn't. If you aren't really comfortable in a race or training session

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on the track, hold your line, be extra vigilant, and consider yourself a student driver.

Category 1 or 2 road racers usually want to spend one evening on the track and then be ready to race at an elite level. It's not that fast. Give yourself more than just a few weeks to climb the learning curve. It will take a while to master the essentials, and even longer to conquer something truly difficult like the Madison. But every effort on the track – even one evening as a learner – will develop muscle sets and skills that will pay major benefits on the road. So, read on, and dive in. It's one of the world's great sports, an Olympic treasure, and a longstanding American sports tradition.

WHY RACE ON THE TRACK?

If you like racing on the road, you'll like racing on the track. That's probably the main reason to race on the track. But here are some other considerations as well:

- **Strength & Skill Development:** Track racing is used by many elite road racers to develop top-end speed, smooth pedaling at high cadences, and better bike handling skills. Especially for criterium racers, there is perhaps no better training for the road than periodically racing on the track. For professional road racers, one of the staples of road training is motor-pacing to develop high-end speed. Most amateurs don't have the resources to do much motor-pacing, but track racing can provide an equally intense speed workout. And you simply can't race on the track without improving your sprint – it's essential to the sport.
- **No Equipment Needed:** Most tracks have loaner bikes, either on-site or with a local shop. If you want to try out the track, you can use a loaner bike. Sometimes it's free, sometimes it's \$5 or so. Show up with your pedals, shoes and clothes and you're ready to ride.
 - *I'll discuss this more below, but a simple steel track bike (which the loaners invariably are) is perfectly good for training and racing. You don't need to be riding \$3,000 worth of carbon when riding on*

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the track; an expensive bike just doesn't make as much difference on the track as it does on the road.

- *As an aside, if you travel for business and want to get a training ride in, see if there's a velodrome with loaner bikes in the area you're traveling to. Packing shoes and pedals is a whole lot easier than lugging your bike along. I've done this all over the country.*
- **Shorter Training Rides:** Training for track racing can be less time-consuming because the races are shorter. Most races are 10km or less, and the longest races at your local velodrome are probably 25km. If you never train for more than 60 or 90 minutes at a time, that's OK as long as the training is intense. So it can work well with a tight work schedule.
- **You Might Be Better At It:** If your body wasn't designed to go fast uphill, well, I've got good news for you. Velodrome designers have cleverly omitted hills altogether. You might just be better at track racing. (Though I'll note that the opposite isn't true - many good track racers are small, and great climbers.) Similarly, if you don't have great aerobic talent, it's likely that you will do better on the track than on the road, particularly in the short events.
- **Location:** If there's a velodrome in your area, you can do a whole lot of racing without ever having to drive to Muscatine or fly to Tulsa. It's all there in one place.
- **Timing:** Races tend to be on weeknights in the summer (at least in the USA), so if you have a family, track racing frankly fits in better because there's little or no racing on weekends. And if you race on the road on the weekends, you can do both.
- **Spectating:** Your friends and family aren't very likely to come see you race on the road, particularly if the race is in Muscatine or Tulsa. But they can come out to the velodrome, and even kids can appreciate what's going on - because they can see all the racing, all the time.

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BUT ISN'T IT DANGEROUS?

Some roadies appear to think that track racing must be just like a criterium with no brakes. *That* would be a crash-fest. Fortunately, track racing is nothing like that.

I think it's fair to say that track racing is about as dangerous as road racing, minus the risk of hitting a lamp-post or a parked car. (Velodrome designers have cleverly omitted those, too.) In other words, crashes happen, perhaps more frequently than on the road, but some of the worst-case scenarios have been eliminated on the track. You can't go flying over a highway guardrail, and race organizers will never have to spend 30 minutes looking for you in a ravine.

By way of illustration, in the Beijing Olympics, by my count, there was one crash in all of the mass start track races combined. About 1,000 laps of the track in total – and one crash.

Another take: as a road racer I would expect to crash two or three times in a full season of 50 races or so. On the track, I would expect about the same.

IF YOU ONLY REMEMBER A FEW THINGS . . .

- **Don't Lose a Finger.** Fixed gear bikes have no slack in their drivetrains, nor freewheels to let off pressure if you get your finger stuck in the chain. No shortage of mechanics and (more likely) amateur dabblers have lost a finger (as in, chopped right off) by getting it caught in the drivetrain while the wheel was spinning. Don't do this. A track bike's spinning drivetrain (i.e., when it's on the repair stand) is a very dangerous thing, and for goodness sake, keep your kids away from it.
- **Track Bikes Have Two Brakes.** You have two brakes – your left leg, and your right leg. Because the gear is fixed, you can slow yourself down by putting reverse pressure on the pedals. Just like riding a trike when you were a kid – that thing didn't have

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“brakes”, did it? But stopping was never really a problem; you just couldn’t stop on a dime. Same thing here.

- **Learn to Use Your Brakes.** Using the “brakes” on a track bike requires some advance planning. You can’t jam them on at the last minute; they don’t work that fast. So you need to be thinking about when you may need to slow down, and start easing up in advance. What you’re doing here is analogous to a truck downshifting to go *down* a big hill – the gear itself controls the vehicle, but it can’t quickly bring it to a halt.
- **Plan Ahead.** Because of how you modulate speed on a track bike, you can’t come screaming up behind someone and figure on slowing down once you get there. If you are chasing down a rider or group in front of you, hammering up towards them from behind, be careful. On the road, you would tend to freewheel as you were approaching their slipstream, and perhaps cheat out into the wind a little bit in order to take some of your speed off – or feather the brakes. Well, on the track, you can’t freewheel, it’s a little harder to just roll out into the wind to slow yourself down, and you don’t have those kinds of brakes. So, the first time you chase down a breakaway on the track, you might be in for an unpleasant surprise when you catch them and your bike starts naturally accelerating into the slipstream of the rider ahead.

So, plan ahead. As you start to catch the rider in front of you, back off the pedals, and *ease* yourself into the slipstream. It’s certainly more efficient *not* to have to put back-pressure on the pedals, so best thing is to time it just right so you don’t have to. Just gently ease into the draft.

- **Learn to look over your *right* shoulder.** American (and continental) roadies are accustomed to looking back over their *left* shoulders on training rides to gauge traffic coming from behind. (You may never have thought about it that way, but you’ve probably looked over your left shoulder thousands of times, but rarely your right.) Well, on the track, you need to be in the habit of constantly looking behind you on the *right* side, since that is your natural blind spot, and it’s also where riders will tend to

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accumulate behind you. If you're looking to pull off the front of a group, or just move to the right ("uptrack"), you need to habitually and *always* look over your right shoulder ("do a shoulder check"). Most track crashes occur when a rider moves uptrack (to the right) without checking his blind spot, taking down the rider behind him. You need to make sure the space is clear.

- *Looking over your right shoulder actually does two things. Obviously, it lets you see who's there. But just as importantly, it signals to riders behind you that you are going to be moving uptrack soon - and they'd better clear out. An exaggerate shoulder check - really visibly twisting your head to the right - is the safest route.*
- **Ride fast in the corners.** For tracks with a steep banking - all tracks 250 meters or shorter, and even some 333-meter tracks with a steeper banking - if you ride too *slow* through the corner, you will crash. Very, very hard. A few further points:
 - Short tracks have steep bankings, and it's steeper in the corners than on the straight. It's so steep that your tires won't hold the surface of the track without the assistance of inertia - a centripetal force that keeps your tires planted on the track as you go through the corner.
 - *Don't ride slower than 25kph (16mph) on a steep banking.* This truly is the lower boundary. If you are slower than this, your tires may at any time instantly disappear from underneath you, and you will fall like you've been dropped out of a second-story window. If there are riders to your left, you will sweep underneath them perpendicular to their line of travel, and great carnage will ensue.
 - If you go slow through the corner, your *outside* pedal will clip the surface of the track, because your bike is too upright, because you are going too slow. This will lift one or both tires off the track, and might cause a crash.
 - So - if you're going slow, and come to the corner, what should you do? Two choices. Either speed up - *fast* - or

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drop down to the “apron” – the flat part of the track that’s usually painted blue (also called the *cote d’azure*). Since you are going slow, this is fine, and it’s perfectly legal. If you watch elite match sprinters, they commonly proceed along the apron when they are marking each other in the first few laps, because it’s physically impossible to ride through the banking at a walking pace. When in doubt, drop down onto the apron.

- This is actually a mistake that even elite riders make when they are racing on a new track – perhaps most notoriously, the ADT Velodrome in Carson, CA. It’s a 250-meter track with a fairly slick wood surface. It’s a beautiful track, and it’s often used for national championship events, but riders coming to it for the first time tend to crash at low speeds in the corners. At elite nationals in 2007, there were at least four or five crashes like this – and these are Cat. 1 and Cat. 2 track riders. But they were used to longer tracks with a relatively shallow banking, and they took it too slow in the corners. This is most likely to happen in warm-ups, match sprints, or for relief riders in the Madison.
- **Pass on the outside (right), never the inside (left).** The second-most common cause of crashes in track racing is when a rider gets down *underneath* – to the left of – another rider who is already low on the track. This invariably happens on the straightaway, as an inexperienced (or too-aggressive) rider tries to jump through a gap on the straight. Well, when those two riders arrive at the corner, the rider on the inside is going to be forced by simple inertia to come *uptrack* into the rider he’s just tried to pass. This usually has the effect of taking one or both of them down. It may also have the effect of quickly pushing them both uptrack into the wheel of a rider behind. It’s a mess no matter how you cut it.
 - Passing on the inside when you are anywhere near the bottom of the track is really a cardinal sin – you should always bias towards passing on the outside, unless there is a very significant amount of space for you to pass through.

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- **Ride at or above the blue line when you are training or warming up.** The blue line (or “Stayers Line”) that encircles the midsection of the track doesn’t really have a formal function in most races. But the convention is that when you are training, you should stay at or above the blue line unless you are making a hard effort – i.e., going very fast. If you’re flying, you can be down in the sprinter’s lane (bottom of the track); if you’re cruising along anywhere below 40kph (25mph) or so, you should be at or above the blue line.

THE TRACK



Tracks vary in length, banking and other characteristics. The picture above is of the 250-meter indoor track at the ADT Center in Carson, California where many elite races are held in the United States. Looking at the picture, you can see pretty clearly how steep the banking is – just shy of 45°. The straightaways are also banked, but not nearly as much. Shorter tracks can be even steeper than this one, and longer tracks are invariably less steep in the corners.

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Whatever the pitch of the corners, some elements of every track are the same. You can see them with reference to the picture above.

- **Apron:** The flat interior section of the track is called the apron. It is not used during races, since riders at speed cannot get around the corners on a flat surface. Riding on the apron during races is illegal - and dangerous, even on the straightaway. Not all tracks have an apron like this - it's there for convenience when warming up, and for getting on and off the track.
- **Cote d'Azure/Blue Line:** This wide blue line at the base of the track defines an area that is "out-of-bounds" for competition. As a practical matter, if you momentarily stray onto the Cote d'Azure during a race, you will probably not be penalized for it. If however you pass a rider on it, you will almost certainly be disqualified and may be penalized for dangerous riding. This kind of pass is dangerous, because you will have to come up-track into the rider you've just passed when you hit the next corner, and that's likely to cause a crash. So - at speed in a race, stay away from the Cote d'Azure. Having said that, two important notes. First, when proceeding slowly during a neutral starting lap, it is fine to drop down the banking right onto the Blue Line if you haven't got enough speed to hold the banking. This is the safe thing to do, and there's nothing wrong with it - it confers no advantage. Second, if you watch elite match sprinters, they always drop down to the Blue Line in the first lap when they are not carrying enough speed to move through the corners on the banking. This is perfectly fine, and far safer than attempting to ride the banking through the corners at low speeds.
- **Black Line/Pursuiter's Line:** This black line along the lowest perimeter of the track defines the distance of the track, and is located 20cm up from the Cote d'Azure. In auto racing, this would be called the pole line - the shortest distance around the track. It's called the pursuiter's line in track cycling because it is the fastest line for pursuiter's and other time triallists.
- **Red Line/Sprinter's Line:** The next line up the track from the black line is red. The red line is the upper boundary of the sprinter's

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lane. The sprinter's lane has a great deal of significance in track events, particularly in the match sprint - so much so that I can't attempt to describe all the rules that apply to it. But the essence of these rules is that a rider in the lead occupying the sprinter's lane has a right to the lane - another rider can't cut underneath him, come down onto him, or impede his progress. If you are passing a rider in the sprinter's lane, as a general matter, you must be clear of him before moving down into the sprinter's lane. The flip-side of this is that once a rider occupies the sprinter's lane during a sprint, he must continue to stay in the lane - no coming up-track to impede another rider's progress.

- **Stayer's Line/Motor-Pacer's Line:** A little less than halfway up the track is a blue line that serves no purpose in most races - but it's a very important line to know about. First, the intended purpose of the line is to provide a sort of second measuring line (like the black line) for motor-paced events. In Europe, particularly in Six-Day races, races paced behind motorcycles are common, and because of the speeds involved the racers use the top part of the track only - above the blue line. This sort of racing is uncommon (unheard-of?) outside of Europe, but the Stayers' Line remains. Why does it matter to us? Because it nicely divides the track during training and warm-up sessions between those who are riding at a moderate pace (above the blue line) and those who are making hard/fast efforts (below the blue line). The rule is simple: unless you are making a hard effort, you should be above the blue line. This keeps the lower part of the track clear for those who *are* making hard efforts. This is an important point of etiquette and safety, which is why the blue stayers' line is ubiquitous on tracks even where motor-paced events never take place.
- **Railing:** Along the very top of the track is the railing, which you can see here sitting high above the apron. In the corners the railing doesn't have much significance - you won't be up there very often on the banking. But on the home straightaway (and the back straight during a Madison) the railing is used at the start of mass-start races to line up the riders before a neutral lap. Typically riders will be "called to the railing" at the start of a race; the railing is something to hang onto while getting clipped into your pedals,

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and a place to idle while the officials issue race instructions before rolling the group off. After this, riders complete a neutral lap, and the race will be started if the group is reasonably compact at the end of the neutral lap.

EQUIPMENT

As I alluded to above, while there is no shortage of expensive track equipment available, the advantage of a high-tech track bike is arguably less than the advantage of a high-tech road bike. Much of what makes a road bike expensive (brakes, gears) doesn't exist on a track bike. Because of this, all track bikes tend to be fairly light, so that even a cheap track bike won't be that much heavier than the UCI lower weight limit. Many experienced track racers do very well on classic steel track frames and classic components; you don't see that very often on the road.

Having said this, the devil is in the details when it comes to track equipment, and understanding the equipment will help you to understand the sport. So, let me cover the bike piece-by-piece. I'll start with the things that are generally the same as on the road, and then discuss the things that are always different.

Pedals

Pedals in use on the track are basically the same as those in use on the road. True, some trackies still ride toe clips and straps, which you would never see on the road these days, but you don't need different pedals on the track than on the road, and most track racers use standard road pedals.

You will notice that some track racers have fitted their clipless pedals with toe straps as a belt-and-suspenders measure. It has to be said that pulling out of your pedal on a fixed-gear bike is particularly disastrous, since you can't stop pedaling. It's hard to re-engage, and you might go down. But this isn't that much of a risk with most current pedal systems. And while many top sprinters still use the extra toe strap, some top riders (e.g., Theo Bos, a world champion in the Keirin and match sprint) just use stock

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clipless pedals. Bos can generate as much or more power than anyone in the world, and apparently Shimano clipless pedals are good enough for him.

A final note - cornering clearance. Most pedals nowadays have plenty of cornering clearance, and this is important on the track. In the old days, the difference between track and road pedals was that track pedals had the outer part of the cage removed. This is *not* because you might clip your inside pedal when going fast through a corner, as on the road. It's the opposite: this is because you might clip your *outside* pedal when going slowly through a corner on the track. Having said that, modern pedals all have good cornering clearance compared to, e.g., Super Record pedals of old.

Seat & Seatpost

These are the same as on the road. Some sprinters will show a preference for certain older-style saddles because they are more solid. But for the most part, elite track racers have saddles that are about what they use on the road.

Handlebars & Stem

Track bars traditionally curve more sharply downward into the drops in order to make room for your forearms when your hands are on the drops. Track bikes invariably come equipped with such track-style handlebars. But in truth, different racers have different preferences, and not all prefer that format. If you watch elite international track racing, you'll notice a growing minority of riders with unusual bar formats that allow them to hang on to the bars at a point where the brake levers would be on a road bike.

The one consistent feature of track bars is that they are narrower than what you might ride on the road. Smaller riders will ride 38cm bars, and larger riders will ride 40cm bars - even if on the road they would be riding 42cm or 44cm bars. Given the tight spacing of riders on the track, it makes sense to have the narrower bars.

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Tires

It is fairly rare to see a track racer racing on track-specific (*pista*) tires. Mostly, track racers ride road tires. Yes, there are tiny 19mm tubulars out there being sold as track-specific tires, and I've even seen *pista* clinchers, but they are *not* the typical thing that track racers use. Those tires are well-suited for sprint events on very smooth, often indoor, velodromes. But most velodromes are not nearly that smooth. And track racers tend to do a wide variety of events, putting a lot of miles on their tires; they aren't just specializing in sprint events.

So - what do experienced track racers use? Most elite riders use tubulars, and they often just use road racing tires like a Vittoria CX or Continental Sprinter or Competition. In an ideal world, you could ride larger (22mm) track-specific tires like the Continental *Sonderklasse*, but those are very hard to find, and they aren't really necessary.

Clinchers are fine for track racing too, and while all the usual advantages of tubulars still apply on the track, many track bikes come equipped with clinchers. Mavic Ellipse track wheels are quite nice, and come with clincher rims, for example.

One tiny detail that might save you a crash if you race on wood is between rubber-carbon and rubber-silica tread. It seems that rubber-silica tread grips less well on wood surfaces, so rubber-carbon tread is preferred. Especially for slick indoor tracks (in the USA, the ADT Center in Carson, CA), but also for other wood tracks, the best thing is said to be a rubber-carbon tread. (The reason rubber-carbon isn't universally used is that it wears poorly compared to rubber-silica; you have to look for it.)

Cranks

Track cranks are shorter than road cranks. Smaller riders will ride 165mm cranks, where on the road they likely ride 170's. Larger riders will ride 167.5mm or 170mm cranks, where on the road they might ride 172.5mm or 175mm cranks.

The main reason for this is the higher cadence of track racing. Much more on that below. But suffice it to say that if your typical racing cadence on

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the road is 90-100rpms, a typical cadence on the track is 120-130rpms, with accelerations up to 150rpms. For that, shorter cranks are more efficient.

But crank length affects pedal clearance, too. Short cranks have better clearance on the outside pedal in the corners.

Chain

The chain on most track bikes will be a 1/8"-width chain. These chains are visibly wider than any chain you would find on a road bike. The idea is that they are stronger and flex less.

That said, entry-level track bikes (e.g., a Bianchi Pista) will often come with a 3/32"-width chain, which is narrower and closer to what a road bike uses. (More precisely, road bikes used to have 3/32" chains, before the chains started to get narrower still in order to accommodate more cogs in the rear.)

The only practical thing you have to remember about track chains is that while the larger 1/8" chain will work with any chainring or cog, the narrower 3/32" chain will *not* work with the wider cogs or chainrings designed for 1/8" chains. So if you end up with a mixed collection of chains and cogs, just be aware of that.

A final note - some six-day racers in Europe use 3/32" chains on their track bikes because the chains are a little less rigid, and they say it's easier on their legs. Since I ride on both types of chains, I'll say that I find this believable. The narrower, more flexible chain makes the ride a little more comfortable, though I wouldn't attempt to explain exactly how.

Chain Tensioner

One optional item on a track bike that has no analogue on a road bike is called a chain tensioner. If you tend to have problems with your wheel slipping forward in the rear dropouts, it will solve that problem. This problem would tend to arise on standing starts (chariot races, time trials, match sprint), where the effort you put into the pedals has the effect of pulling the right side of the rear axle forward, and you "pull a wheel".

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This stops the bike dead, and you fall over, and you look silly. It's embarrassing, and incredibly frustrating.

The problem of pulling a wheel is most likely to arise if your rear dropouts are shiny or too rigid. Because the grip of the rear axle bolts into the rear dropout is the only thing keeping the wheel in place, the best bolts are big and grippy, and the best dropouts are of a somewhat softer metal, and painted - it grips better than chrome. That said, if you have a wheel/dropout combination that doesn't seem to hold very well, just cranking down on the right-side axle bolt will eventually cause you to strip the axle threads, the bolt faces, or both. Don't do that. Just get a little device called a chain tensioner, and you'll be all set. You can't pull a wheel with a chain tensioner on. It also may make it a little easier in general to get the right chain tension and wheel position when you're switching gears.

Frame & Fork

Track frames tend to be stiffer, heavier, and less comfortable than road frames, which is natural given what they are being designed for. But a few features merit special mention.

Higher bottom bracket. Again, for better pedal clearance.

No bottle braze-ons. Water bottles are never allowed on the track. On a wood track in particular, any water on the track surface is treacherous and will cause crashes. (Incidentally, this is an easy way to know if a fixed-gear or single-speed bike being sold in a shop is laid out with an actual track geometry. Most single-speeds are not set up for track - the bottom bracket height, seat and head angles, etc., are road angles. But if there are bottle braze-ons, it's a dead giveaway - you know it's not meant for the track, whatever the marketing materials say.)

Stronger Forks. Especially on short, steeply banked tracks, the G-forces a rider will generate in the corner are not inconsiderable, and that weight comes bearing down onto the front fork disproportionately. So, the fork and steerer tube need to be nice and strong to hold their shape and avoid breakage. Any good road

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fork would probably be fine, but track forks are a little beefier for this reason.

Rear-facing dropouts. This is the necessary feature of a track bike that makes it impossible to adapt most road frames to track use. Because different gear combinations result in different rear-wheel positions, any fixed gear bike needs to have long, rear-facing dropouts so that the rear wheel can be positioned differently for each gear.

Sizing. Depending on various factors, you may ride a smaller bike on the track than on the road. I ride a 59cm road frame, but a 59cm track frame is too big; I ride a 57cm on the track. This isn't true for everyone, but it's not uncommon.

Wheels

Track wheels are built to be stiffer and withstand more torque than road wheels. So, high-flange hubs, stiffer rims, and beefier spokes are common. But given the quality of most standard road wheels these days, the differences in strength and stiffness between track and road wheels perhaps aren't as great as they used to be. In fact, if you could get rid of the quick release on a front road wheel, you could probably use it on your track bike without a problem.

Why *can't* you have a quick release on the front wheel of your track bike? In the "old days", quick releases were straight and were liable to poke riders in the event of a crash. So they weren't favored for track racing, since a quick wheel change at the side of the road was never necessary. That convention stuck.

Perhaps more to the point, you really can't have a quick release on the rear wheel, so why bother having one on the front? You'll need a wrench either way. For the rear wheel, a quick release would likely not hold the dropout solidly enough to prevent the wheel from pulling on a standing start or hard acceleration. So you really do need bolt-on axles on the rear wheel; it's not just tradition.

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Of course, the fact that there are no quick releases on track wheels means that the axles are solid (quick-release axles are, of course, hollow), and solid axles are stronger. Axle strength isn't the *reason* track bikes don't have quick releases, but at least for the rear axle, it's a nice benefit.

Lock-rings

One of the items you won't find on a road bike is a lock-ring that prevents the rear cog from loosening up as you put back-pressure on the pedals. Given that back-pressure is your only "brake", it would seem that the lock-ring is pretty important.

And in some cases, it probably is. As one person told me, if you had a problem and caused a crash, and the race official saw that you didn't have a lock-ring on the rear wheel, you might be in trouble. And it doesn't hurt to have a lock-ring on there; it just takes a little longer to change the rear cog.

Having said all that, track racers rarely use lock-rings. Once a cog has been tightened onto the rear wheel (a few hard pedal strokes will ensure that), experienced riders seem to figure that it won't loosen up.

So, if you're wondering whether to use a lock-ring, use one.

Tools

With so few components on a track bike, your toolkit can be pretty lean. Go to Home Depot and get yourself some 15mm box wrenches for the wheels; they are cheap and you can never have too many. You'll need chain whips, some allen wrenches, perhaps a spoke wrench, and - well, that's about it. There's not much to adjust.

One note on chain whips is that most chain whips these days are designed for pretty narrow cog teeth - and they won't work at all with 1/8" cogs. They'll just slide right off. Either get a track-specific chain whip, or you can make your own by taking the chain off a stock chain whip and installing a length of 1/8" chain to replace it.

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GEARS

A special nod to Mike Sherman's bicycle gear calculator (Google it - it's great), which made the analysis below very easy to do. Special thanks also to several Minnesota track racers who shared their approach to gearing as I developed this section.

The biggest difference between track and road racing is the attitude towards and use of gears. Gearing on the road isn't thought about all that



much, except perhaps for juniors who have to comply with gear restrictions. At any given time, riders commonly don't know what gear they are in. By contrast, on the track, gears are a precise matter, and gears are chosen very specifically for each event.

As an opening note, track racers talk in gear inches - not teeth. It's much more precise and frankly easier to say. A roadie at the track is easy to spot because they will talk about gears in terms of teeth rather than inches. If you're going to get into track racing, it's worth learning and thinking about gears in terms of inches. To help you do that, I'll make reference to both systems below.

Track racers invariably use much smaller gears (and therefore, pedal at much higher cadences) than their peers on the road. When Tom Boonen winds up a sprint on the road, he is in a 53 x 11 or 53 x 12, which yield 126" and 116" gears, respectively. If his sprint tops out at 60kph (37mph), his cadence will max out at either 100 rpm's exactly (in the 53 x 11), or 109 rpm's (in the 53 x 12).

By comparison, elite track racers commonly hit 60kph, but would never use a gear larger than 50 x 14 (94"), and more likely would be riding a 49 x

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14 (92") or 51 x 15 (90"). So, at 60kph, their cadence is between 134rpms (50 x 14) and 141rpms (51 x 15). To put this in road terms, for an elite track race - say, the World Points Race Championship - the world's top riders will do the entire race in a gear just a little bit *smaller* than a 53 x 15.

That's a pretty big difference in approach. A road racer would never limit himself to a maximum of a 53 x 15 - but that's what the top track racers do.

The real difference between road and track racing is best understood when you realize that track racers don't just provide *short bursts* at 140rpms. Because elite track races commonly proceed at 50 - 55kph (31 - 34mph) for long periods, track racers sustain 120 - 130rpms *throughout much of the race*, and *then* accelerate to over 140rpms for the sprints. Hitting 140rpm's for a sprint isn't hard - any roadie can do that. Sustaining 120 to 130rpm's for an entire race (no freewheeling!) and *then* hitting 140+ rpm's in the sprint is impossible for most roadies - it takes some training.

So - understandably, when they start out on the track, many experienced roadies just figure that the track racers must have it wrong, and choose an enormous gear (say, a 51 x 14 - 95.5"). That's what I did. It doesn't work. After a while, they come around.

So, why do track racers use such small gears? There are probably other explanations beyond what I will offer here. I am neither a physicist nor a physiologist. But I'll give you my angle on it.

If you're going into a race with only one gear, you are going to optimize that gear to the most critical moments in the race. But the most critical moments in a race aren't just the sprints; they are the accelerations, too. The problem with riding a relatively large gear on the track is that it accelerates more slowly (a distinct disadvantage when you need to jump hard to stay near the front), and ramping that gear up for repeated accelerations will burn your legs out over the course of a race.

So, in simple terms, you want a gear that can do two things: efficiently get you through repeated accelerations from 40 to 50kph, and also get you up to 55 - 60kph for the sprints. In a typical 92" gear (49 x 14), when the field is proceeding along at 40kph (25mph), you will be turning 91rpm's. When

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there's an acceleration up to 50kph, you will need to produce 114rpm's. To accelerate again up to 60kph, you will hit 137rpm's.

These accelerations are easier to do in a smaller gear than in a larger one. A true roadie might choose a 53 x 14 (99") for a perfectly flat race where the speeds range from 40 to 60kph. Certainly, for the 60kph sprints, that gear will wind up to a respectable 126rpm's. But at 40kph, a 99" gear will be grinding along at 84rpms, and at 35kph (22mph) the gear would truly be in slow motion at 73rpm's.

Now, I suspect this analysis won't be entirely satisfying, especially to roadies who haven't tried the track. I won't claim that this is the whole story - there are surely more and better explanations for *why* experienced trackies all use smaller gears than road racers do. Other factors may include the fact that there is no freewheeling - so track racers never get to rest their legs altogether between major efforts. Or the fact that it's harder to get out of the saddle on the track, particularly in the corners of a steeply banked track, so simply accelerating a large gear by standing up and using your body weight for leverage isn't as easy to do.

In any event, the fact remains that track racers *do* all use smaller gears. And while Tom Boonen may be more likely to turn a 53 x 11 than a local amateur roadie, world champion trackies are *not* more likely to use large gears than local amateur trackies. If anything, elite track racers tend to use smaller gears than amateur trackies do.

So, what does track gearing look like in practice? The table below shows a typical selection of chainrings and cogs that a track racer would keep in stock, and the gear inches they produce with a 700 x 23 tire, rounded to the nearest half-inch.¹ For easy comparison to road gears, I have included the gears on a 53 chainring in the far-right column, even though a 53 would be an unusual (though not unheard-of) chainring to find on a track bike.

¹ A half-inch fluctuation is well within the margin of error on gear calculations anyhow, as two different tires, even "officially" the same size, will yield different gear inches.

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Chainring →	48	49	50	51	53
14	90	92	93.5	95.5	99
15	84	85.5	87.5	89	92.5
16	78	80	82	83.5	87

The gears that might actually be used in races are shaded in gray. The gear combinations that yield gears lower than what is shaded might be used for warm-up. The largest gear shown here (96", 51 x 14) would likely only be used for a Keirin or another unusual event like the 200 meter time trial; it would rarely be used for mass-start track races.

Looking at this, the short answer to how track and road gears compare is that track racers generally use something roughly equivalent to a 53 x 15, give or take, for most everything they do. They would almost never use anything as large as a 53 x 14, and would occasionally go down as low as a 53 x 16 - but that would be the lower boundary for most track racers.

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For a little more detail on this - because it's near and dear to track racers - I asked a local elite track racer (Brian Crosby, Speedfix Racing) to discuss his approach to gearing in different races. His answer was so thorough and helpful that I'm just reproducing it below.

Here's how I generally do it for different types of races:

Scratch: 48x14 [90"]

Match sprint: 51x15 [89"] (I like having a little more acceleration)

Team sprint:

51x15 [89"] (starter)

48x14 [90"] (second)

52x15[91"] (anchor)

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Chariot: 51x15[89"] or 48x14 [90"], depending on how I feel

Points: 51x15 [89"] usually, sometimes a 48x14 [90"] later in the season

Madison: 51x15 [89"] here (see Euro stuff below)

If I'm racing at altitude, like at Colorado Springs, I'll usually go up a tooth on my chainring, and race scratches in a 49x14 [91.8"], and points in either a 48 or a 49 depending on the strength of the field. I haven't done any sprint stuff at altitude, so I can't really say if that changes.

As for the little Euro track [note: six-day tracks in Europe are commonly between 150 and 200 meters - very short and very steeply banked], I go much lower in gearing. Particularly for madisons, and for multi-day events. In the 6-days we're capped at either a 49x15 [85.7"] or a 52x16 [85.2"] (they're nearly equivalent). In Geneva we didn't have a gear restriction, so I tried going up to a 50x15 [87.4"]. By the third day my legs were so blown that I had to go back down to the 49x15 [85.7"]. It sounds like a tiny gear, but you can really get that thing moving. We'd regularly get our mid-race sprints into the 64-65 km/h range, and the finish would sometimes crest 66-67 km/h. [Note: in a 85.7" gear, 66kph requires 161rpm's.]

The highest speed I ever hit in Blaine was nearly 69 km/h behind the motor, in a 48x15! [That's just over 170rpm's.] You don't need a huge gear to really get flying, just good, smooth form. If you can pull that off, all the accelerations in a points race, madison, or scratch become much easier to handle, and you don't load your legs up as quickly.

Another funny story: I won the state Madison a couple years ago in an 86" gear. [48 x 15] I didn't know at the time that I was still in my warm up gear, and didn't figure it out until I tried to find my 15 tooth cog the next week at training. That really drove the point home for me: it's all mental. You don't need big gears to go fast.

As for the real legit guys, all the 6-day pros race on a 49x15. I haven't really heard of anyone going smaller than that at a really high level event, but that's smaller than pretty much anyone stateside runs. The largest I've heard of is probably a few pursuiterers who have been known to push gears in the 51-52x14 range, but that's really getting up there.

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Because it relates to this topic, particularly how you train on the road if part of your goal is to race well on the track, I'll make a few notes about road gears in general.

Twelve-tooth and eleven-tooth cogs only became available in the last few decades, even though they seem obvious now. Eddy Merckx won his races with a 53 x 13 [107"] top gear. What should be obvious now - and can easily be confirmed with an online gear calculator - is that any amateur roadie who claims to use his 12-tooth cog for anything much is actually slowing himself down. In general, an 11 is a waste of space.

A little more arithmetic. A 53 x 12 at 90rpm's is going 50kmh (31mph). Most amateur roadies will turn a flat, fast time trial no faster than this, and frankly, much slower. A Cat. 1/2 road racer who turns a respectable 55:00 40km time trial has just averaged 43.6kph (27.1mph) - which, in a 53 x 12 translates to a grinding cadence of 79rpm's. He has no need for this gear at all; even a 53 x 13 is too big (average cadence of 85 rpm's). He should be riding in his 14 and 15 cogs most of the time, with an occasional dip into the 13 for fast sections. The uselessness of an 11, or of chainrings larger than 53, should be apparent.

Lance Armstrong operated at cadences between 100 and 110 rpm's with some success. If you do the math, working backwards from his time trial average speeds, his cadences suggest that he didn't use his 11 or even his 12 very often. And while this will not work for everyone, there is simply no reason to let your cadence drop much below 90. It turns out that Eddy Merckx's old 52 x 13 will basically do everyone fine. At 64kmh (40mph), a 52 x 13 is turning at 128rpm's. This is about the right cadence for road sprinting, and it's fully 30rpm's less than elite track riders turn during accelerations. Oh, and most amateurs have never gone 40mph in a road sprint before in their lives - and even today, most pro road sprints max out at or below this speed.

So much for needing a 12. But more to the point, training on a gear cluster that has such high gears will encourage you to grind in low gears rather than train where you should - at 100rpms or higher.

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RACING ON THE TRACK - HOW IT'S DIFFERENT FROM THE ROAD

To think about how track and road tactics are different, it's worth asking – how is the event different in general? Let's take the example of a 50-lap scratch race (i.e., no points awarded, first rider to the line wins). How is that different from a criterium – since a criterium is also a scratch race? There are several key differences:

1. **In a Sense, The Track Has No Corners:** This seems like a strange observation – but it is actually a very important difference. One of the effects of a track's banking is to eliminate the thinning-out effect of a corner that takes place in a criterium. In a criterium,



riders slow down a bit in the corner, tend to thin out to double- or single-file, and have to accelerate coming out of the corner – particularly in the middle and back of the field. Experienced criterium riders use this as a device to get off the front, to shake other riders, and as everyone knows, to

position themselves for the sprint. In some criteriums (most notably in the USA, Downers Grove), the race is really for positioning in the final corner; the final straightaway is sometimes a formality.

So a track has “no corners” in the sense that the banking allows the whole field to proceed through the corners at full speed with no thinning out and no slowing down – and thus no acceleration coming out of the corner. True – the outside line is a longer line, so in a sprint you are better off (all things being equal) down in the sprinter's lane, but your competitors aren't at nearly the same disadvantage taking the outside line that they would be on the road, in part because the line isn't that much longer, and in part because, unlike on the road, the line is just as “clear” going forward as the inside line. On the road, the inside-line rider can

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impede the outside rider's progress by boxing him off into the curb, which is a critical tactical advantage particularly in a sprint. On the track, it's not really possible to impede someone's progress that way.

- 2. The Track Has Short Straight-aways:** While we are talking about corners – they do matter, just differently. Like criterium racing, it's still best for most riders to win a sprint from behind – and on the road, typically you want to pull out of the lead rider's draft *after* the last corner. And that's ideal on the road, because in a criterium you still have 200 or more meters from the last corner to the finish line in which to pass the lead-out rider. On the track, there's certainly less than 100 meters, and on a 250-meter track there is only 50-60 meters in which to pass that lead rider. In short, there isn't enough time to come around a lead rider if you only start your pass *after* the corner has concluded, meaning that you need to pull out of his draft and start taking the longer line *in* the final corner or even before it. This is a natural enough point to understand in your head, but when you are going 60kph in someone's draft through the final corner, it feels counter-intuitive to pull out of that draft and into a *longer line* in order to start your pass. Riders tend to make the mistake of waiting for the final straightaway to make the pass – but there just isn't enough room there to get it done. At typical sprint speeds (55 km/h, or about 15 meters per second), the final straightaway (60-75 meters) is going to last *four to five seconds*. That's very little time in which to come around your leadout rider.
- 3. Races Are Shorter:** Nearly all track races are quite short compared to any road race. The main implication is that more riders will be able to hang in there until the end, making it harder for strong riders to thin out the field before the final sprint. And it also arguably makes it harder to get away, since even relatively weak riders can put out a good amount of power for ten or fifteen laps. So tactically, non-sprinters need to think and work harder to make a short race hard on the sprinters than they would have to on the road. The other implication is that, for a shorter race, you basically have a handful of opportunities to try to get away; you just don't have a dozen different opportunities

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to attack. The up-side to this is that it's easier to reverse-engineer the race from the outset. If you've got a 12-lap scratch race (one of the shorter races), you can plan out your approach to it in advance, and as often as not you can stick to that approach.

4. **Smaller Fields:** Fields on the track are usually capped at around 25 or 30. The smaller the track, the smaller the field limit. In any event, you'll never be looking down a straightaway of 100 riders. Teams tend to be smaller, so as a result teamwork may play a more muted role. This is not to say that teams don't matter, but also given the shortness of the races, teamwork doesn't have an hour of racing in which to play itself out. But the real implication of the smaller fields is this: when a breakaway happens, if it is four riders or more, it operates more like a split in the field than a breakaway. It does depend on how the rest of the field reacts, of course, but it's not as if you have 100 riders chasing five. Far more likely that you have 15 chasing five, and if not all 15 are working together - it starts to feel like the field has split, and the "pack" has missed the split. This relates to the next point - which is that the track is short, and that is an enormous difference between road and track racing.
5. **The Track is Short:** At typical racing speeds, it takes 17-19 seconds to do a lap on a 250-meter track. On a 333-meter track, it will take 23-25 seconds. And in nearly every track race (basically, anything other than sprint races or the the miss-and-out), the goal is to lap the field - and prevent getting lapped. In principle, this is no different than a criterium - lapping the field in a criterium is not uncommon, and certainly ensures a top finish. But to lap the field in a criterium, you need to be at least 60-90 seconds ahead of the field (on a very, very short course), and probably more like 90-120 seconds ahead. In a criterium, it's pretty common for a breakaway to get a 15-20 second lead before the field even starts to get serious about reeling it in.

But the shortness of a track changes all of this. On a 250-meter track, if you have a 15-20 second lead on the field, you have *already* gained a lap - it's game over for the chasers.

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What does this mean in terms of race tactics and strategy? A few things. First, reactions to breakaways have to be very quick. If the field hesitates for more than a few seconds, the breakaway is very likely to gain a lap. Second, breaking away is far more rewarding on the track, because 60 seconds of very hard effort can bring you around on the field entirely. Also, it means that on the track, breakaways don't usually stay off the front for very long - they either take a lap on the field, or decide that it's not going to happen and drop back. And finally, attacking on the track is a more explosive affair - the attack needs to be extremely hard, blowing more energy in the first few seconds than would be wise on the road. It's basically an all-out sprint effort for the first lap, followed by a few more laps to establish whether taking a lap is possible.

6. **No Hills:** Getting off the front on the track can be harder to do. On the road, attacks usually come out of corners, on hills, or at some juncture that makes it easier to get away or less likely that the field will want to chase. But because the track is essentially a continuous strip of wood with no corners and no hills, attacking is far more a matter of sensing the field's willingness to respond, the energy level of potential rivals and positioning the attack in the right sequence vis-à-vis other attacks that have already come or may yet come. There's also the matter of using the banking effectively.
7. **The Track's Banking:** The more steeply a track is banked, the more the banking itself matters tactically. Riding at the top of the banking is an easy way to store potential energy, so that when an acceleration is required, you can descend the banking (move down-track) and accelerate into the attack with far less effort. In fact, if you watch an elite race on a 250-meter track, when the pace slows down, the entire field moves up-track, preparing for the next acceleration. In this situation, the riders are all taking a longer line around the track - but in a much better position tactically than if they were further down-track. In fact, when things slow down, there is nothing worse than being stuck down in the sprinter's lane while the rest of the field is riding higher on the track. You know the next acceleration will come eventually,

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and when it does, you will have to expend enormous energy to mark the acceleration. So - when things slow down, move up-track.

As for how to attack effectively, basic technique on the track is similar to the road. Attack from several riders back, ideally coming past five or six riders to build up a head of steam. If the field is already down in the sprinter's lane, obviously you'll have to attack on the right. If the field is riding slower and higher on the track, the opportunity to attack is ideal - drop down the banking with a hard acceleration from several riders back of the lead riders. The field will have the advantage of perfect visibility into what you're doing - another benefit of riding up-track - but you'll have the benefit of using the banking to assist your acceleration, and the added benefit of taking a shorter line than the field for a few seconds while they organize the chase.

- 8. Teamwork:** Teams tend to be smaller on the track, but fields are smaller too. For example, three riders on a team in a field of 25 is typical. In that scenario, those three riders make up 12% of the field. By comparison, a team of 9 riders in a road field of 200 is less than 5% of the field. So team tactics can matter on the track a great deal. Team tactics mirror those used on the road: sequential attacks, lead-outs for strong sprinters, chasing breakaways where the team isn't represented, and slowing down or breaking up the chase for breakaways with a teammate in the break.

DIFFERENCES BETWEEN TRACKS

Track racers can discuss at great length the differences between tracks, and I certainly won't attempt a detailed discussion here. The first thing one notices on any track is the idiosyncrasies of the surface itself - bumps and cracks and other oddities to look out for. For any but strip-wood tracks, these imperfections are inevitable and impossible not to notice. For strip-wood tracks, the surface tends to be very good, with only a few issues around loose boards.

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In any event, problems with the track surface don't matter much tactically - but differences in length and banking make a significant difference. Three differences between different tracks would seem to matter the most:

(1) Banking: Tracks with steep banking are dramatically different than tracks without much banking. In fact, much of the commentary above presumes a relatively steep banking - because it's the banking that really distinguishes track racing from road racing, at least on a steep track. The thing to be aware of is this: if you're accustomed to racing on a steep (typically, less than 333-meter) track, making the transition to racing on a shallow-banking track is easy. But it doesn't go the other way. Very competent track racers who are accustomed to the relatively shallow banking of a 333 track have a major adjustment to make when transitioning to a 250. This is evident every year in America when top riders converge on the 250-meter ADT Center in Los Angeles - because many of those riders have never (or rarely) raced on a steep track. When racing on a steep track, there are the obvious issues of not sliding down the banking, and a generally "tighter" feel to the racing, as riders "stack up" above and below one another on the banking in a way that takes some getting used to. But the bigger significance of a more steeply banked track is that it is generally shorter - which matters a lot to racing tactics.

(2) Length: Track length matters for two reasons: it changes the amount of time and distance a breakaway needs in order to take a lap, and it means a longer straightaway in which to pass during a sprint.

So - moving to a shorter track makes the racing that much more intense because breakaways can go around on the field much faster. Indeed, on most six-day tracks in Europe and a few tracks (e.g., Burnaby, BC and London, ON) in North America, the track is under 200 meters, and the field can turn a lap in around 10 seconds. Longer tracks are a different affair - lapping the field is fundamentally harder to do, which may mean that your approach to the race changes altogether. Where you might pursue an approach of taking laps on a shorter track, the same race on a 333-meter track might involve no breakaway attempts at all.

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As for straightaway length, this has been discussed above – but a longer track affords more space within which to pass a lead rider after the final corner. Conversely, with ultra-short tracks, it's just not possible to come around a lead rider on the final straight; you have to start the pass much earlier.

- (3) Position of the Finish Line:** This is a detail, but worth knowing about. Different tracks will position the finish line in different places – even if the tracks are otherwise identical. Basically, the finish line can be at the very end of the home straight, or it can be a little closer to the middle (though never truly in the middle) of the straightaway. The benefit of having the line closer to the middle is that it allows spectators (and judges) to see the finish more clearly. The benefit of having it nearer the end of the straightaway is that it allows more space between the final corner and the line.

One obvious implication of this is that the position of the line affects how early you need to start your pass in a mass-start race. The other, far less obvious implication is that for 200-meter time trials (the only time trial measured against the finish line instead of the pursuiter's line), the position of the finish line affects where the 200 meters *starts*, and that affects technique coming into the 200 meter effort. I won't get into a discussion of this, other than to say that using the banking effectively is an important key to success in a 200-meter time trial, and you will use the banking differently depending on where the 200 meter line is positioned – and that depends on where the finish line is.

CRASHING

There are a few things worth knowing about crashing on the track. Perhaps most importantly, most crashes happen (just like on the road) when one rider 'hooks' another by moving into their front wheel. On the track, this generally happens when a rider is moving up-track, and a rider behind him can't get out of the way in time. To be sure, this isn't the only way crashes happen – but it's the main thing to watch out for.

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In practice, this means two things. First, before you move up-track, check over your right shoulder for a rider that might get 'hooked'. Second, beware overlapping your front wheel with the rear wheel of the rider in front of you - particularly on the outside. It's natural for him to move up-track at some point, and when that happens, you may go down. If you are overlapping on the inside, it's less of an issue in practice - he can come down on you, but usually not as far or as fast as he could if riding up-track.

One note for road racers on this point - specifically in relation to sprinting. It's fairly common to "pull up" in a road sprint if you figure you have no chance of success, and on the track it might be tempting to do the same - and pull up-track when you do so. Of course, if you do this, there are likely other riders sprinting over top of you - and you'll cause a crash by changing your line. So the advice on the track is the same as on the road - when in doubt, hold your line, and let others work their way around you.

Once a crash happens ahead of you, the only reliable way to avoid it is to go up-track. The steeper the banking is on a track, the more crashing riders will naturally fall down-track as they slide forward, taking out any riders coming through underneath them. The track is, in that sense, self-cleaning: it's not possible for riders to wind up lying in the middle of the track post-crash. They all wind up on the apron or, at most, in the sprinter's lane. Which means that trying to ride "under" a crash is almost certain to end badly - the riders will come down into you. So - *when a crash happens, always go up-track.*

Beyond that, I will say only that if you crash on a wood track, get some tweezers. And it's best if your wife/girlfriend is an EMT or vet tech or something - some minor procedures will be required. And a tetanus shot is recommended.

TRACK EVENTS

There are literally dozens of track events, with combinations and variations of each. I haven't tried to discuss them all below, but have focused on the most common events in the sprint and endurance categories.

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SPRINT EVENTS

Sprint events on the track are, by road standards, incredibly short. At the elite level they are contested by people who look more like linebackers than cyclists. The physical and mental aspects of these events are indeed similar to American football, power lifting, or perhaps martial arts - they require explosive efforts over very short periods of time. Training can be highly specialized, and doesn't necessarily involve riding many miles. The emphasis is on top speed.

200 Meter Time Trial – This event is generally used only to seed riders for a match sprint tournament. It is a flying-start all-out sprint for 200 meters, and takes around 11-13 seconds for most amateurs to complete; the world record is around a 9.9. Because it is flying-start, technique for how to use the banking of the track to gain speed *before* the start line is important. Otherwise, it's just an all-out effort for 200 meters.

Match Sprint – Match sprint is well-known for being the “slow race” where riders pace one another around the track at a casual pace before exploding into a full-on effort. There are so many rules and idiosyncracies to match sprint that I won't get into it here - but among aficionados of the sport, the match sprint is considered one of the most suspenseful and exhilarating spectator events. The race is three laps long, though often the sprinters won't fully engage the sprint until the last 200-300 meters. A good way to get familiar with match sprinting is to find some match sprint videos online - there are dozens of good ones available.

Chariot – A chariot race is contested by a group of riders over a short distance (commonly two laps of the track). The riders are held at the start, so that they can immediately accelerate away from the line. Tactics in this form of racing are not nearly as prominent as in Match Sprint or Keirin, as the race can be won on brute strength - but drafting still matters. Because the race is from a standing start, a strong acceleration (and a well-tightened rear wheel) are important.

Keirin – Keirin is a uniquely Japanese form of racing, but has been fully adopted by the international track racing community. The race is contested by five to seven riders over two and a half laps - so it's a medium-distance sprint event - but its distinctive feature is that the riders are paced by a motorbike or derny bike up to 50kph in the laps leading

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up to the “start”. In other words, it’s a flying-start sprint event with a group of riders. Tactics are very important, given that the race is too long for most riders to win in an all-out effort from the front. And because the track is relatively crowded with riders competing at top speed, the Keirin has a reputation for being relatively dangerous.

Kilometer Time Trial – The “kilo” is just a 1,000 meter standing-start time trial. Like the 400 meters in running, it’s a bit too long for an all-out sprint, but too short not to sprint . . . it’s just painful. It no longer appears in the Olympics, but is contested at World’s, Nationals, etc. Sprinters and Keirin riders with a lot of endurance can be successful in this event, but most match sprinters don’t have the endurance for it. Some pursuit riders have enough explosiveness and speed to be good at the kilometer, too - so it’s an event that sits right at the intersection of sprint and endurance events.

500 Meter Time Trial – Women and masters don’t generally contest the kilometer, but ride the 500- (or 750-) meter standing-start time trial instead. The 500 is so much shorter than the kilo that it *can* be taken as an all-out effort, and the speed of the standing start is that much more important.

ENDURANCE EVENTS

Endurance events are not very long compared to road races, of course – but they deserve to be called “endurance” events in comparison to the sprint events, which generally last less than a minute. Endurance events range in distance from 3,000 meters (womens/juniors pursuit) to 40km (an unusually long, but not unheard-of, distance for a mass-start race). Most endurance races are between 5km and 20km, which would be 20 laps and 80 laps, respectively, on a 250-meter track.

Individual Pursuit – A pursuit pits two riders against one another in a time trial in which they start on opposite sides of the track. In some pursuit formats, the race ends when one rider catches the other, but in modern racing this is rare. More typically, both riders compete over a fixed distance, even if one rider is caught by the other, to record the fastest time.

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Typically, women and juniors will ride 3,000 meters and men will ride 4,000 meters.

Team Pursuit- Team pursuits are contested with teams of three or four riders per side, with riders working together to record the fastest time. Mens' distance is generally 4,000 meters and women/juniors ride 3,000 meters. The time is usually recorded on the third rider to cross the line.

Scratch Race- The basic race format - a "scratch race" is simply won by crossing the line first. It has a separate name because so many other race formats on the track are calculated by points or other mechanisms. Scratch races can be any distance, but do tend to be shorter than points races.

Points Race - At many tracks, the points race is the heart of the racing schedule. Because of the focus on sprinting and lapping the field, points races capture several essential features of mass-start track racing. Riders score sprint points for periodic sprints during the race, and also score points for lapping the field. Because the result is calculated on points and not the final finish order, it is possible to win a race even if other riders are a lap ahead of you, and it is possible to win a race even if you score no points in the final sprint. Distances and formats vary, but a typical points race might be 60 laps, sprints every 10 laps, points awarded 5-3-2-1 to the top four riders on each sprint, and 20 points awarded for lapping the field. There may or may not be double points (10-6-4-2) awarded on the final sprint.

Tempo Race - A tempo race is a form of points race, but with points awarded either every lap or every other lap, usually to only the top one or two riders. It's called a "tempo" race because, with points awarded so frequently, the riders can't really sprint all-out for every points award; the race tends to be a fairly sustained effort with tactics determining who is at the front when points are available.

Snowball - Another form of points race in which increasing numbers of points are awarded as the race wears on. Formats vary, but a 10-lap snowball might award points on every second lap to the first rider only, with points available as follows: 2, 4, 6, 8, 10.

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Miss-And-Out—The miss-and-out is distinctive to track racing, and at many tracks it is one of the cornerstones of the racing schedule. The miss-and-out, as its name suggests, is a race at the *rear* of the field to avoid being the last rider across the line. The distance of the race is determined by how many riders there are, because only one rider is eliminated at a time, so the field needs to keep going until nearly all of the riders are eliminated. Formats vary, but a typical arrangement on a 250-meter track might be to eliminate the last rider to cross the line on every second lap until the field is reduced to three, and from that point to have either two or three laps remaining for the last remaining riders to sprint for the top three places.

The miss-and-out deserves a few extra words about tactics, since it is so different from other races. The natural dynamic of a miss-and-out is for the back of the field to accelerate into the front of the field on each elimination lap, compressing forward and up-track as they approach the line. Riders at the front have no incentive to accelerate as this compression takes place, since they are safe from elimination. In the early stages of a miss-and-out, eliminations are largely a tactical matter, and most riders are eliminated not because they lack the strength to move up, but because they were “boxed in” and couldn’t get forward from their current position. In most early eliminations, the elimination comes as a surprise to the rider, and he leaves the track without having expended much energy in the race – he just got stuck, usually low on the track near the back of the field, and was unable to get up-track and forward fast enough to avoid elimination.

There is much more that could be said about miss-and-out racing, but an early lesson for most riders starting out is that riding low on the track inside the field is a dangerous place to be, because the natural movement of the field on an elimination lap is to go up-track and forward. Riders feeling safely positioned in the sprinter’s lane in the middle of a field of 20 will very quickly find themselves boxed in low on the track with the entire field rushing past them to the right. These are the riders who get eliminated early. Put another way: stay up-track and keep your options open. The best place to ride in a miss-and-out is two or three riders back of the very front, *but never on the inside* of the riders in front of you. Keep your wheel placed up-track (meaning you only get a partial draft) and defend your position aggressively – don’t get boxed in. Once the field

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narrows down to five or six riders, eliminations will happen on strength rather than positioning.

Win-And-Out— The win-and-out is an unusual format, and there are many variations. The idea is to award the victory to a single rider on the basis of a sprint – and then that rider leaves the race. The rest of the riders – whether they were last in the sprint or got second place by half a tire – are left to duke it out for second place in the next sprint. Naturally, riders need to gauge which sprints to go for – when to expend their energy. There are variations on this format, including versions in which the lower places are awarded first – i.e., fifth place is awarded to the winner of the first sprint, then fourth, then third and so on. Obviously this introduces a very different set of tactics.

Madison—The Madison is a points race contested by two-rider teams, with only one rider competing at a time while the other rider – called the “relief rider” – circles the top of the track waiting to come into the race. The distinctive feature of Madison racing is the hand-sling; a relief rider enters the race by grabbing hands with his partner and being physically slung into the action. Because of this, and some of the complexities of how exchanges are to be conducted in a field of riders, a full discussion of the Madison would fill a small book. For riders who want to compete in the Madison, it is important to study and practice the event intensely before competing in it. But for now I will note that the essential rules are much like a points race. To get a feel for what a Madison looks like, it’s worth finding some Madison videos on the internet – Madison racing has a very different feel than any other type of race.

TRAINING FOR TRACK RACING

An extended treatise on training for track racing would be fascinating – and well beyond my abilities. I will make a few comments though from the layman’s perspective, and hope that something comes around in the English language explaining how best to train for track racing.

There are a great many similarities in how track and road racers train, so roadies will do fine for the most part by keeping to their old training

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habits. But there are three ways in which training for the track commonly varies from a good road training program:

- (a) **Higher cadences:** Because track racing proceeds at much higher cadences than road racing, training *must* reflect this. An athlete trained to maintain 30mph at 90rpms will find it surprisingly difficult to maintain the same speed at 130rpms. It's a different type of motion requiring different preparation. And the most intense efforts on the track by definition take place at the highest cadences. But the most intense efforts in most roadies' training rides take place at very *low* cadences.

Think about it: if you are like most road riders, your most intense efforts take place on hills. So the moments when you are putting out the most wattage at the highest heart rate are likely well below 90rpms - which is the *opposite* of what you're looking to do. Generating 300 watts at 90rpms really is a different matter than generating 300 watts at 140rpms, and you need to train with that in mind. It actually suggests that your big efforts should be on slight downhills, with a tailwind, or at least on a flat section. This isn't natural for roadies - it takes some focus to do this consistently, to stop training yourself to go hard up hills and easy down them, and frankly to find sections of road where you can safely hit 50-60kph without interruptions.

- (b) **Shorter distances:** A nice aspect of track racing is that, because races are shorter, training sessions can be shorter too. They of course need to be more intense, focusing on the explosiveness and speed needed for the track, but a good amateur trackie can succeed entirely on training sessions of 90 minutes or less. Some track racers will say that longer rides will actually *hurt* for purposes of developing speed on the track - I won't opine on that, but it is certainly the case that a high percentage of your training time needs to be at *very* high levels of effort, so the comfortable long road rides typical of club riding won't get you there on their own. (And - club rides tend to have major efforts around climbs, contra the point above about doing intense efforts at high cadences.)
- (c) **Time in the weight room:** Road racers often lift weights in the winter as a part of general conditioning, often on the theory that it

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balances out the body (particularly the core) and prevents injury in the long run. Studies seem to have shown that extensive use of weightlifting, however, doesn't really help road performance much - if you want to get better at racing a road bike, the best thing to do is to ride a road bike.

On the track, lifting weights seems to return more benefit, to the point where it's not uncommon for track racers (particularly, but not exclusively, sprinters) to lift not only in the off-season, but during the racing season too. Much could be said about different techniques - but I will only note that the typical training regimen includes both upper- and lower-body lifts, and many of the most productive lifts are variations on the dead-lift. Dead lifts and variants have the merit of increasing not only leg strength, but strengthening the upper and lower back, arms, and hands (for grip) as well. All valuable for track racing.

Injury is the thing to look out for. Cyclists, unlike runners and other athletes, are not accustomed the idea of training injuries. They are pretty rare. But weightlifting, particularly with heavy weights at low repetitions, is *very* likely to result in injury. You have to watch out for it, and there's a steep learning curve. Given the major muscle groups involved (quads, hamstrings, lower back), a muscle pull or tear in the weight room can set you back weeks or months - so read about it, consult someone with experience, and proceed conservatively. But having said that, weightlifting can really increase your strength and speed on the track.

For many riders, weight training is a great help to their performance, and has the added benefit of being an indoor activity for winter training. So - bring weight training into your regimen if you can, but take it slow and try not to learn "the hard way" by testing your limits too early. That's how injuries happen.

A CLOSING NOTE

There's no substitute for riding the track with experienced riders that you can learn from. But I do find it very helpful to watch track racing online,

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and in recent years there has been an explosion of high-quality coverage on the internet. In particular, Universal Sports has a great deal of archived track racing from the World Championships and Olympics available for free to view. It's extremely helpful, especially for the more unusual events (Keirin, Madison, Match Sprint) to watch these events online in order to get a better feel for them.