

Riding a Standard Revolving Paceline

On some of the Wednesday evening rides from Y Lot this last summer, the riding was almost fast. (Good sign! - - - getting enough people together with the horsepower to get it cranking for more than a few hundred yards.) The riding was also spectacularly sloppy. (Bad sign.) In particular, trying to get a fast, smooth revolving paceline going was impossible for more than a few seconds.

Of course, no one wants to admit they don't know how to do it, so we don't stand the proverbial snowball in Hades' chance of getting anyone to attend a teaching session. But where did past generations learn this stuff? These, and other basic bike handling skills, were taught at the club level. It just doesn't seem to happen today. So what's the result today? We end up with club rides, race training rides, and races being much more dangerous than they need to be.

While bike handling is something you can't learn to do by reading, I hope what follows about revolving pacelines may at least help a little bit in making our rides a little safer and more enjoyable when we start picking up the pace. This is not going to be "complete," and in chaos of racing situations there are exceptions to every rule.

In past decades, the basic tool for teaching a variety of bike handling and timing skills was the revolving paceline. It's not a very social way of riding, like our standard two-by-two touring "paceline," but even for those who will never race, it will pay big skill/safety benefits. It is the standard way of getting a group of 5 or more riders down the road quickly and smoothly, with a minimum of group total energy. (For this reason, you most often see this used in breakaways - - more on this below.) While the non-racers can pick up basic handling skills from doing it, for the racers it is an essential tool.

The standard revolving paceline is made up of two parallel lines of riders, with the riders in one line (the "advance" line) going slightly faster than the riders in the other line (the "relief" line.) (We don't have pictures yet; we'll try to add them later.) As soon as the rider at the front of the advance line is clear of the front wheel of the rider at the head of the relief line, he moves over into the relief line and slows down a little bit. This lets the next rider on the front of the advance line pull by him. At the rear, the last rider on the relief line will accelerate a little bit and get onto the rear wheel of the last rider on the advance line.

Not being able to get a smooth revolving paceline going means that the "fast" parts of training rides go much slower than they should. When is the last time you saw the final sprint in a big Pro-1-2 criterium start from 27 mph? Good riders are time trialing for 40K faster than that! The real question is, when is the last time in such a race that you've seen the speed in the last 5,000 meters drop below 30!! (Local races, of course, are another matter.)

Here are the basics. **If you don't do it in training, you're not going to be able to do it in the races.** If you are a mediocre bike handler on training rides, the adrenaline coursing through your veins and the nervousness making your stomach do somersaults is not going to miraculously turn you into a great bike handler in a race. If your timing is bad at 27 mph in training, it's going to be downright lousy when the race is going over 30 mph.

"Timing" is the ability to be where you need to be, when you need to be there, while using a minimum amount of energy. In terms of revolving pacelines, for example, you need to have good timing skills to move from the end of the slower line onto the back of the faster line - - - more about that below. When the back end of the advance line has big gaps and is actually going faster than the front end of the line, you know one or more people have "bad" timing. (Sounds familiar, doesn't it?)

Since our pacelines are going relatively slow, many of the riders with poor timing can make up for their mistakes. If they miss the correct move from the slower to the faster line, they can pick the speed up to close the gap. That works OK when the front of the advance line is going 26 or 27 - - - you just sprint up to 29 or 30 to close the gap. That'll work for a little while, but what a waste of energy! The problem comes when the front of the line is going 30 or 31. You might be able close that gap at the back once, maybe twice . . . and then you are off-the-back. Better luck next time - - - or maybe you'll need the luck this time, since if you took anyone else off the back, they're going to be extremely perturbed!

First a little "theory" – but really practical theory. Why is a revolving paceline so efficient? A basic rule of bicycle racing is: **Unless you have a very good reason to be in open air, BE ON A WHEEL.** (That is, draft another rider.) The benefits of drafting are common knowledge, although the actual benefit gained is a function of your drafting skill. (Those 15% or 20% figures you see in the popular literature are about as accurate as the myth about maximum heart rate being 220 minus your age. If you're really good at drafting, you can gain even more.)

Being "on a wheel" should be your normal state of affairs in a race except under exceptional circumstances. You should never have to think about it; you should just "be there" without any conscious thought. So what are the exceptional circumstances? (1) When you are attacking, and (2) when you are contributing your "fair share" of the work for a group or for your team. ("Fair share" is a difficult and murky concept, but also very important when you race against many of the same people week after week and year after year. I just want to be clear that my emphasis on "always" being on a wheel doesn't mean you can sit in and let everybody else do the work.)

It is this "theory" of always being on a wheel except when doing your "fair share" that makes a revolving pace line look the way it does. The only time you should

be in open air is when you reach the front of the advance line. You stay in open air only long enough to pull past the front wheel of the person at the front of the relief line, and move into the relief line. You then slow just a little bit and wait for the next person in the advance line to pull in front of you. After that, you should never be more than a few inches off a wheel until you are again at the front of the advance line. If a gap ever appears in front of you, someone in the paceline is doing something wrong. (It might even be you!)

What makes this kind of paceline potentially so fast? Think about interval workouts. The shorter the "on" part of the interval, the faster you can go. (The speed you can hold for 15 seconds is certainly higher than what you can hold for two minutes.) The "better" the rest between the "on" parts, the faster you can go. Think of the revolving paceline like an interval workout: (1) first you are at the front fighting open air at high speed for only a few seconds; then (2) you are back on a wheel, getting the full benefit of drafting, recovering/resting until (3) you come back to the front for another hard effort for a few seconds.

Notice I used the phrase "potentially so fast." A group of 7 or 8 high-horsepower riders off the front of a pack can really fly! They are all strong enough to do their "interval" at very high speed and they are all fit enough to get good recovery between their hard efforts. The riders that can get such a breakaway going also tend to be fairly close in their physical abilities. For our club rides, no such luck; the speed of such pacelines is limited to the weakest rider's abilities.

For riders with widely differing physical abilities, there are faster ways of getting a group down the road - - - but they don't allow practicing all the bike handling skills that the revolving paceline does. For the stronger riders, riding a revolving paceline at less than your capacity allows perfecting your timing skills. If you can't do it virtually perfectly at slower speeds, there's no way you're going to be able to do it at 30 mph. In other words, everybody can benefit if we use revolving pacelines for some parts of our club rides even if we aren't hammering down the road at race pace.

Another key piece of the "theory" of revolving pacelines is that each rider should only do one short interval for each revolution of the paceline. This "theory" determines the speed difference between the advance (faster) line and the relief (slower) line of riders. What if the difference is five miles per hour? If the advance line is going 30 and the relief line is going 25, that's quite an acceleration each rider has to do to move from the relief to the advance line. A few revolutions and the riders are going to feel like they are doing two intervals each time through.

(A basic axiom of bicycle racing is that it is not pure speed that breaks riders' legs; it is changes in speed that turn legs to soggy pasta. Does it strike any of you as strange that we spend the majority of training rides going at a steady speed when races involve constant changes in speed? (But that's another story.)

So perhaps a five-mile per hour difference is too large. If we don't want to accelerate much going from the relief line to the advance line, perhaps we want a very small speed difference. How about half-a-mile per hour? The problem then is that the "on" part of the interval at the front of the advance line becomes very long. It can seem to take forever to get over into the relief line. The longer the interval, the slower the speed that can be maintained. Too small a speed difference defeats the purpose of the revolving paceline.

So we need a speed difference that (1) won't leave the rider at the front of the advance line hanging out in the open air too long, and (2) won't result in having to do a second interval each time at the back of the paceline. In actual practice, this works out to about 1.5 mph. Anything slower or faster than this creates problems.

So that's the background. (1) The only time you are not "on a wheel" is for a short "interval" at the front, (2) there should never be any gaps opening between riders in either line, and (3) the difference in speed between the two lines should be about 1.5 miles per hour. There are, however, a few more things you need to know.

1. Clockwise or counter-clockwise? The relief line should always shelter the advance line from the wind. With a true straight-on headwind, it doesn't matter. But if we are heading south and there is a southwest wind, the advance line is on the left and the group is rotating clockwise. This also means that if we make a right turn (now heading west), the relief line should now be on the left, with the group rotating counter-clockwise. This means that (a) everyone must be aware of the wind direction, and (b) everyone must know what to do when the direction of rotation must change.

In some crosswind conditions, the paceline must echelon to be most efficient. Yes, it does work, but most people have enough trouble doing a revolving paceline well without having to echelon on top of it.

2. Harder, not faster! As a rider, you want to avoid doing anything that causes an abrupt change in the speed of either line. Here are some typical beginner's mistakes.
 - a. You are the second rider in the advance line. The leader pulls over in the front of the relief line and suddenly you are in open, unprotected air. It's time for your "interval," you feel the extra pressure of the open air, and you turn up the power output. But you turn it up too much, and you speed up! A gap opens up between you and the rider behind you in the advance line, since he was expecting you to hold a steady speed. You screwed up - - - because you are out in the open air, you do have to pedal harder, **but don't pedal faster!**

If you are having problems with this, when you are back farther in the advance line, start counting out pedal strokes to yourself. By the time you get to the lead position, you will have a counting rhythm in your head, which you can continue in order to ride a steady speed at the front.

- b. You are the first rider in the advance line. You have managed to correctly pedal harder, but not faster. You pull over into the relief line - - - but you don't slow down. Bad move. First the rider behind you in the relief line is mad because he wants to be on a wheel to get some rest while you are riding away from him. So he either continues without protection or he speeds up to get on your wheel. If he does the latter, then everyone behind him also has to speed up, so they're all mad at you, too. You've also made the person now at the front of the advance line mad because he either has to speed up a lot to get around you into the front of the relief line or he's stuck beside you in the open air. If he does the former, then everyone behind him has to speed up, so they're not very happy. And the rider at the end of the relief line is really mad because he's going to have to accelerate much more than then 1.5 mph he was expecting. Short of slamming on your brakes and locking up your wheels when you are at the front of the advance line, it's hard to imagine another move that could make so many people so angry so fast!
- c. You are again the first rider in the advance line, and you have managed to correctly pedal harder, but not faster. But as you move into the relief line, you slow down three miles per hour. This makes everyone behind you either put the brakes on hard, overlap wheels, or both. The effects get worse the farther back in the relief line. The last person in the relief line, because of Murphy's Law, always gets caught overlapping the wrong side of the wheel in front of him, has to brake even harder and then sprint to get onto the advance line. He will not be a happy camper.

The point is that virtually everything you do will affect everyone else in the paceline! When you are learning, you will make such mistakes, and you may not even be aware that you are making them, so you must rely on what others are telling you. For example, when you are moving from the advance line to the front of the relief line, you may either be going too far past the rider in the relief line or you may be cutting too early and almost taking his front wheel out. Since it's happening "behind" you, you may not have the best view and must change what you are doing based on what others are telling you.

After you do it a few thousand times, it will feel a little more natural. Think about the delicate timing involved. You can't slow down while still in the advance line because that will interfere with the riders behind you. You have to move to the side and slow down in such a precise way that you end up 3-5 inches in front of the wheel behind you, going exactly 1.5 mph slower than

you were going in the advance line! Timing, timing, timing! You can't learn it reading, you can't learn it by riding a two-by-two touring paceline; you can only learn it by doing it over and over and over.

3. But what about at the back of the paceline? The stuff going on at the front of the paceline is the easy stuff. The move from the back of the relief line onto the advance line can make or break a paceline.

First, when you are in the relief line, all the "important stuff" is happening behind you. You have to know what is happening back there because moving over into the advance line too soon can be disastrous. Move over too late and you're spending extra energy trying to close a gap, and possibly screwing it up for the next few people trying to get into the advance line.

You cannot assume that the order of riders in the revolving paceline will stay the same. It can change for all sorts of good and bad reasons. **You have to look each time.** This doesn't mean turning all the way around - - - very few people seem to be able to do that and hold any kind of a straight line, particularly when they are tired. It just means turning your head to the side far enough that you can pick up what you need to know in your peripheral vision.

Looking is the easy part. You then face a much more complex problem. First, you have to speed up 1.5 mph. But you are supposed to be directly on the wheel in front of you all the time, so you can't do your acceleration while you are in the relief line. You can't slow down in the relief line without (a) possibly interfering with the rider behind you, or (b) having to accelerate more than the 1.5 mph. Neither is a good alternative.

So it looks like you have to do your acceleration over in the advance line. This means you have to wait until the last person in the advance line completely clears your front wheel before you move over - - - and since you're going 1.5 mph slower than that rider, a gap opens up. Yes, you can do your acceleration in that gap - - - but because there is a gap to close, you have to accelerate more than 1.5 mph in order to go faster than the rider in front of you, and then you have to slow down! Not very smooth or efficient. And it violates the principal of always being directly on a wheel except when you are at the front of the advance line.

So if you can't do your acceleration in the relief line and you can't do it in the advance line, where are you supposed to do it??? As crazy as it might sound at first, you accelerate between the two lines. That is, you purposely shove your wheel in between the two lines so as to overlap them - - - and you time this acceleration "perfectly" so that your speed matches the advance line just as the last person in that line clears your front wheel. (See what I mean about the need to practice until your timing is perfect?)

Now it sounds a little scary to be purposely overlapping wheels, but you are going to be doing it right about the time the riders' shoulders are even. In other words, right about the point where they can't have their rear wheels any closer together (and thus chop your front wheel) because their shoulders/handlebars are too wide! It's a lot safer than it sounds - - - IF your timing is right.

4. Hills? There are no hard-and-fast rules about what happens, but everyone should expect speed changes. If the group was already operating at its capacity on the level, it must slow down for an uphill. It takes a lot more energy to maintain a given speed on a grade than it does to maintain that speed on the level. Under these conditions, even as the speed drops, power output is fairly constant. If, on the other hand, the group is operating under its capacity on the level, power output on a short uphill may actually increase to keep the group speed from dropping too much.

The real danger on the uphills is when the rider in front of you stands up. Most riders "throw" their bike backwards when they do this, sometimes six or more inches. (It is possible to stand up without doing this, but it takes a little practice.) So it is often best to leave a few extra inches between you and the rider in front when heading up steeper grades.

For downhills, the basic rule is that the person at the front of the advance must always pedal. So the group is almost always going to speed up, sometimes more than just a little. Downhills, unfortunately, always end. With larger pacelines, the front rider hitting the "level" will slow down before the riders at the back. So on the downhills, you may also want to let the gap between you and the rider in front of you open up just a little bit.

5. Filling in Gaps: When a paceline is cranking and gaps open up in the advance line, there is the temptation (if you are a stronger rider) to jump from the relief line to fill a gap. This is not for beginners, for again, timing is critical. (For example, if a rider in the advance line is rushing to fill the gap and you suddenly pull in front of them, the ripple effects are unpleasant. If we are in the midst of a "friendly" paceline, it's probably best not to bother making the move – just let the paceline re-form. If, however, we are in a rush/finish simulation, the gap may have opened because someone was "dying" - - - if you don't get over into the advance line, you may miss the "break." The key here is using good judgement, making sure not to endanger anyone on a training ride. In a race, of course, things are not so black and white.
6. Going Off the Pavement: Even in training rides, when we are trying to take up as little of the traffic lane as possible, it is best not to ride right at the edge of the pavement. We need just a little maneuvering room if things get a little chaotic. (In addition, the edge area collects all the stuff most likely to

puncture tires.) Occasionally, however, we get squeezed or something forces you off the pavement. On training rides, NEVER pop back on the pavement trying to keep your position in the paceline. The edge of the pavement has a nasty way of grabbing wheels and dumping a rider on the pavement. It's one thing to cause a mass crash this way in a race – but don't you dare do it on a training ride; we know where you live. Instead, just let the paceline go on by, get back on the pavement safely, and then chase like crazy.

7. How Close are the Two Lines? Very close – like almost grazing elbows in training rides. The riders should not be spread out all over the road, particularly when rotating counterclockwise. Just remember that the worst thing that can happen is tangling up “hardware” (the bicycle parts). The only thing you have to protect your “hardware” is your “software” (your body).

Again, while “in theory” the standard revolving paceline is the fastest way to get a group down the road, in practice there may be better alternatives in specific circumstances. But the skills learned and practiced in doing revolving pacelines are also needed for all the other methods we use for getting a group to go fast.