# TrackDoD Novice Group Orientation

## Version 2001.a



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# Goals

## Go Fast... Safely

### Increase Margin on the Street

The faster you're capable of going, the more margin you have when you do it slowly. A rider taking a corner at 40mph when they could take it at 60mph has less margin than a rider taking a corner at 50mph who can take it at 90mph. A rider who is calm and comfortable at 150mph will have much better concentration and ability to react to situations at 65mph than someone who starts getting a speed rush at 80mph.

So just because you *can* go fast, doesn't mean you have to go fast to use those skills. You'll get benefits from riding on the track whatever speed you ride on the street.

### Learn to Ride Faster

Most of us, as a primary motivation, want to ride on the track to ride fast.

But what is "fast?"

"Fast" is the feeling you get when all the information you're getting from your senses -- your view of the road, the rush of the air, the engine tone, the feel at the bars, your sense of balance -- is too much for you to process. This is a bad thing -- you start overlooking things around you that are important, or the things you do see overwhelm your attention and you lose concentration. Either way, you open yourself up to serious mistakes and a bad crash.

The way to get over this "speed rush" is to practice. Riding at higher speeds around a track, where you're going around familiar corners and down familiar straights, lets you pick out the actual important cues from your senses. You start processing that information faster by learning -- mostly unconsciously -- what is and is not important. You end up filtering out all the "noise" in the input from your senses, leaving just what actually requires your attention.

When you've "trained" yourself this way -- I use quotation marks because it really is mostly an unconscious process -- you'll find that when you leave the constant repetition of the track, you'll automatically apply the same filtering to all your riding.

You probably won't notice this happening today unless you think about it. At the beginning of the day, you'll start out going relatively slowly and it will feel *very* fast. By the end of the day, you'll be going pretty fast, but it'll actually feel much slower because you'll have learned to handle it.

So we won't be practicing "fast." We'll be leaving the rush of "fast" behind us as we push onto a whole other level

of riding.

## Expand Your Tiltmeter

Each of us has a built-in mental limit to how far we can lean a bike without feeling like we're going to crash. Unfortunately this usually comes to light in avoidance situations, or when encountering a tighter curve than expected. What usually happens is the brain says "I can't lean any further" regardless of how far the bike can actually lean, and this leads to riders running off the outside of curves that the bike is fully capable of taking.

The only effective way to reset that internal tiltmeter is to ride at higher lean angles. Riding on the track, taking the same corners again and again, will lead to you doing that without even realizing it. By the end of the day you'll be leaning further and -- importantly -- more consistently than you started. The next time you hit a decreasing radius corner on the street, or a truck over the centerline in a curve, you'll be equipped to handle the situation with ease.

## Recover from Mistakes

Every rider makes mistakes -- the difference between the top GP riders and the fresh out of MSF novice is that the GP guys catch them almost before they're made.

Riding on the track, by its nature as a consistent environment, helps you practice how to catch those mistakes. Learning how to pick out your own correct lines, braking points, and so on, leads to an awareness of the wrong line, the wrong braking points, and other mistakes. The more you learn how to find your own way around a track, the more you pick up on cues that you've got it wrong, and the more intuitive it is to correct those mistakes before you get yourself in trouble.

# Focus

The controlled environment of a track session frees you of the need to "waste" attention on the mundane tasks of looking for errant minivans, loose gravel, horse manure, and all those other distractions you encounter on the street. That lets you focus on your technique on the actual *riding*. When you get back in the rough world of street riding, you'll find that since your limits have expanded, the actual riding part will take less of your attention, leaving you with more left over for avoiding those ever-present hazards.

# Learn to Race?

## Sort of...

Riding on the track necessarily uses racing skills. Every skill you use in a track session is applicable directly to racing. In fact you can develop your racing skills better in track sessions than you can by actually racing. In the same way that the absence of SUVs lets the street rider concentrate on technique, the absence of competition lets the race rider concentrate.

## ...but not exactly

Racing is not just about riding fast. It's very important, of course, but there's a lot more to racing than just going fast. Oddly enough, passing is a very small part of racing. The time spent passing is dwarfed by the time spent riding alone or in a constant order. Now riding fast in a race does involve dealing with slower traffic -- getting through backmarkers can make an enormous difference in lap times -- and the ability to adapt your lines on the fly is something that's difficult to practice in a regular track session. There are also factors such as the very critical

start procedure, race strategy and tactics, and end-race strategy and tactics.

But racing also involves dealing with the sanctioning body, licensing procedures, bike preparation, at-track modifications and repairs, entries, protests, medical requirements, and staying friendly to more officials than you'd meet in the Pentagon. It's not just dealing with all that, but being able to stay focussed and leave it all behind once you hit the track.

So while track sessions do give you the techniques and skills you need for racing, there's a whole other mental and theoretical field that you need to master to be a consistent winner. You can race and win the occasional race by just being fast; you can't win a championship that way.

## Exploding Joe Racer's Myths

The vast majority of riders have no idea how to ride a track. Worse, most riders think they do know how to ride a track, and fast too. Often they'll be all too willing to share their tips and techniques. Usually they get their rush from going "fast," and rely on having a sportbike to be fairly quick in the twisties. Invariably they apex their corners way early, and call almost any long corner "double apex" or even "triple apex." They use much more lean than they need to because their lines are bad and they're turning in the wrong place, and rely on stiff suspension to mask their choppy technique. Often they'll have picked their current bike because their last one had "soft suspension" or because "these roads need a sportbike."

So when you talk about riding on the track -- or even perhaps talk to some of the other riders today -- you'll hear a vast variety of opinions about what is the right way to take a corner. Generally the best thing to do is to nod sagely, let it in one ear and out the other. It's a religious and ego matter, and as the saying goes, if you're arguing with a fool he's doing the same thing.

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# Track Etiquette

Riding on the track can be as simple as just getting out there and doing it. That's what a lot of riders do, and something you'll have to watch out for, because it increases the danger. Once you get outside the TrackDoD, you'll find there's a bunch of riders who have no idea how to behave in a track session. Most of them have a vague idea what the flags mean, but as for the more general unwritten rules of being on the track, they are clueless.

You can increase your safety -- and look after your bike -- by following some simple procedures. Taken down to basics, it can be expressed as "be patient." Don't dash out and tear around like the world will end before the track session. Take time to plan what you do and be in control throughout.

## Before You Start

Before you even line up to get on the track, make sure you and the bike are ready for the session. That means performing a simple check. Walk around your bike and look at it. Check your own personal gear, too. Make sure your boots are done up properly. Make sure your visor is clean. Make sure you have the right gloves. Drink some water. Use the bathroom.

The simple pre-flight checks help you get out of relaxed mode, and into taking things seriously. You're about to ride your bike hard, and that's a serious matter that requires concentration. By the time you open it up coming out of the last turn, you and the bike will have to be 100% ready, and that process starts right now before you even start

the motor.

Put on all your gear. Once you get lined up on the grid, you can take some of it off again if you want, but dressing up now means you know you'll have everything you need -- no running back for a set of gloves, or to change to your tinted visor.

Start the bike. You want the motor to be warming up by the time you hit the track, so if this is the first session of the day give it a little while to get some heat into it. Get to the grid in plenty of time, switch off and relax.

# Warm Up

We all know about the classic mistake of crashing on cold tires. Less talked about, perhaps because it's more embarrassing, is crashing with cold brakes, or with cold brain. Neither of these should ever happen.

The whole bike needs to warm up before you get up to speed. Tires stick better when they're warm, brakes stop more effectively and consistently, the chain needs to warm up for efficiency, wheel bearings need to come up to temperature, the gearbox as well as the engine should be warm before hard riding. Also you yourself need to warm up. You need to get back into the habit of looking for your line, looking far ahead, getting the feel of the bike, modulating the brakes, and so on.

Fortunately all this is very simply achieved. All you need to do is take the first lap easy and work your way up to speed. Accelerate away from the pit lane gently. Take the first turn slowly, using the brakes gently. Accelerate out of the first corner firmly but not rapidly. As you corner progressively harder, as you brake more forcefully, as you roll on the throttle increasingly rapidly, it will heat up all the bike components that need it. As you warm up the bike progressively through that lap, you're also giving yourself time to come up to speed yourself -- early on you have lots of time to pick your line, and as the lap goes on you get into the rhythm of riding the track.

That's how to take the first lap. Start slowly and work up to speed. Don't flick the bike from side to side on the straight -- that does nothing but present an opportunity to throw the bike away. Just warm the bike and yourself up naturally by riding progressively harder through that first lap.

# Cool Down

Just like you come up to speed when you get on the track, you should also come down from speed before you come in. You want to let the brakes and engine cool down before stopping. You want to bring yourself down from the high state of riding fast to where you won't misjudge your speed in the paddock and crash there.

As soon as you pass the checker flag, slow things down. Raise your hand, pause, back off the throttle and change up to top gear. Sit up in a comfortable position. Start using a lower rpm range and less throttle. Brake earlier and less hard. Use less cornering forces and less lean angle. By the time you reach the last corner, you should be down to a slow street speed, hardly using the brakes at all, and rolling on gently using slow street rpms.

So when you come into the pits, you should feel like you're crawling along. Ride straight back to your paddock area, shut the bike down, park it and get your gear off. Drink more water before you feel thirsty.

# Between Sessions

Your job isn't done when you've parked the bike and pulled off your gear. Before you go out again, make a visual inspection of the entire bike. Any sign of fluid leaks? Do you need to lube the chain? How's the oil level? How about the fuel? You'd be amazed how many experienced track riders run out of fuel in the afternoon.

Look at your tires. Some tracks are very hard on tires, some tires wear rapidly. Even if you started with brand new tread, always check at the end of each session to see how they're doing. See how the surface of the rubber looks -- a tire that's working hard at optimum temperature looks rippled, and balls up the rubber at the edges. If it's coming off the edge of the tread blocks in chunks, or is looking shiny and blue at the edge of a smooth scuffed area, it could be getting too hot. If you can see signs of riding *over* the edge of the tire, you might be using too much lean angle -- compensate for it by using less lean of the bike, either by going slower or by leaning your body more. You can tell a lot about how you were riding the last session by examining your tires.

# Signal when Slowing

Any time you reduce your speed, or roll off the throttle on a straight, you need to warn the riders behind you first. Remember, there might be someone drafting you down the straight, and backing off suddenly could cause a collision. Or perhaps someone is judging a pass on you and are relying on you to keep up to speed.

So *before* you slow, raise your left hand high up in the air. Raise your hand, count one-thousand-one, and only *then* begin to slow down.

# Ride Your Own Ride

The biggest danger on the track is colliding with other riders. That not only means don't run into anyone, but also make sure that other riders have a chance to avoid you. The basis of this is usually expressed as "Hold your line," but it's really just an extension of the street principle of "Ride your own ride."

Most important is don't adjust your line just because you think someone faster is behind you. It's up to them to find a safe way around, but it's up to you to let them do that. That means don't change your line in the corner to let someone through, don't brake early to let someone by -- let them plan their pass around you. What if they are planning a drafting pass at the end of the straight, and are on your tail when you brake early? What if you cut your corner entry inside to give them room on the outside, and they're planning a late apex pass and are already there? The safest way to let someone by is to do nothing different -- ride how you would ride if you were the only bike on the track.

# Leave Some Space

If you're riding close behind another bike, allow some space between you. They should be riding their own ride, but that doesn't mean they're going to ride exactly the same every lap. They may be experimenting with braking points, trying out new lines, or maybe they're just riding inconsistently.

Whatever the situation, it's your responsibility to keep clear. Three feet is usually enough to give a margin between experienced riders, and that should be considered the minimum. If the rider you're passing is an unknown quantity, or a bit erratic -- or you tend to be a bit erratic-- -- allow more space. If in doubt, just stay clear. Remember, if you're getting caught up in traffic you can always pull into the pits and wait for clear track.

# Plan Your Passes

Even racing is not about stuffing your bike into every little hole you can find just to get by -- and we're *not* racing. Passing is something to be planned, and something to do carefully and with forethought.

Even if you're much faster than another rider, you'll still have some time when you can see them up ahead of you. Over the course of the day -- and over the course of more track events -- you'll get to know how the other guys

ride. Some corner slow and pass on the straights, some corner fast but go slowly on the straights, some are very similar to your own speed. Take into account the other rider's style. Plan whether you'll go around the outside in the corner, pass them on corner exit, or wait until you can blow by on the straight. By planning your pass you'll do it safely and cleanly, and be able to stay ahead of the bike you just passed.

# Be Friendly, Be Polite

A TrackDoD event is not a race. It's a track riding event. You're sharing the track with other people who also hold safety in mind, and many of whom are probably personal friends. But no matter who is on the track with you, being polite and friendly is how to keep things safe.

Polite and friendly means leave space between you. If you're passing an inexperienced rider, wait until you can do it where and when it won't surprise them, and leave enough space not to scare them. Ride around other bikes how you'd like them to ride around you. Don't push in front of other bikes in the grid -- or, if you want to get on the track towards the end of the line, pull up well back and wave others by. If you go off the track and need to re-enter, make sure you have plenty of space. Don't get frustrated at other riders -- if someone frustrates you, make a pit stop, and re-enter the course when they're a long way away from you.

You all have a gut feeling for what friendly and polite means. All you have to do is ride like it.

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# Techniques

# Smooth, but sometimes so quickly it isn't

Everyone says that the fast riders look really smooth. They do all sorts of things with the bike and it's always a smooth transition from one position to the next. What they don't say is that even when you don't *look* smooth -- like in the depths of some twisties, or diving into the tight corner, you still have to *be* smooth.

What *smooth* means is that as the bike transitions from one state to another -- accelerating to braking, or braking to turning, or turning to acceleration -- there's no sudden break from one to the other. Each blends with the other to make a progressive motion, with no jerks or sudden changes. That progression is what smooth is.

What many riders don't understand is that you can be smooth so quickly that it doesn't look it. When you move from braking to turning to acceleration rapidly enough, you can't see the smooth transition. All you can see is that bike is going on one direction *now*, and in another direction *now*. When you turn in to some corners today, you'll want to move the bike around that quickly, but you still need to be smooth when you do it.

## Give the bike a chance

As we'll see when we talk about dynamics later, bikes don't go from one state to another instantly. It takes time for a bike to go from upright to a lean, it takes time for the forks to compress under braking, it takes time for the bike to react. Being smooth means giving the bike a chance to get settled in one state before throwing the next one at it.

That's one reason why we *blend* braking into turning, rather than finish braking and then turn. It lets the bike come smoothly out of braking, and smoothly into turning, while doing both at once so we don't waste time.

## Squeeze the brake -- Turn the throttle

Part of giving the bike a chance is that we don't do anything suddenly. We *squeeze* the brake, not grab it. We *turn* the throttle, not whack it. That goes for the other direction too -- we don't let go the brake, we *ease* it out.

Sure, we do these things very rapidly, so that if you weren't thinking about it you might assume that you let go the brake and whack the throttle, but we must be smooth with all the controls -- in all directions -- if we want the bike to be smooth.

# Slow, Look, Lean, Roll

## The MSF is right... sort of

The MSF teaches every rider how to go around a corner. Slow, look, lean, roll. They're right. That's exactly what we do on the track.

What they don't tell you is you can do a bunch of these at once. We'll lean as we slow, and roll as we lean, and we never -- *ever* -- stop looking.

## Look where you want to go

Like the MSF says, you'll go where you look. So look where you want to go. That is never more true than on the racetrack, where you don't have to do much SIPDE and can concentrate on where you're going.

The MSF also tells you to keep your eyes up, look ahead, look through the turn -- but they don't emphasize it enough for the track.

The faster you go, the further ahead you need to look. When you exit Oak Tree, you should be looking for your turn-in at Courage, over half a mile away. When you've identified your braking point for Courage, you're looking for the turn-in. When you have identified your turn-in, *before you even get there!* -- you're looking for the apex. And as soon as you're on the gas, well before the apex, you're looking at your track-out point.

That's hard to do. It's much easier and oh so tempting to look at the next thing you have to do. You want to look at the braking point until you start braking. You want to look at the apex until you hit it. But by then you're not looking where you want to go -- *because you're already there!*

To start with today, you'll quite possibly not be able to force yourself to look that far ahead. Things will be happening rapidly enough that you'll have your attention full with just what you're doing now. But one of your goals during the day should be to move that attention point further and further away from you.

## DON'T look where you DON'T want to go!

Almost more important than looking where you want to go, is *not* looking where you *don't* want to go. It's actually quite hard. When you're in Courage, you'll be tempted to see just how far that grass runoff area goes before it hits the woods. Don't look there unless you want to ride on it. Here's a clue -- it's a long way, but it's all downhill and grass; don't ride on it.

It's easier to look where you want to go if you aren't always worrying what's around you. Here's another clue -- if you aren't going to ride on it (and you won't if you don't look there) you don't need to worry about it.

Let me give an example:

A big key to riding the Charlotte Motor Speedway road course fast is to get through the famous Turn One. It's a

fairly straightforward turn, except for one thing -- for most of the corner, you're aimed directly at a concrete wall. If you get the corner right, you'll exit the corner maybe three to six inches from that wall. If you can do that, you'll carry much more speed into the infield and can maybe even make a pass going into Turn Three, somewhere "everybody" knows you can't pass. The reason so many people get Turn One wrong is they get intimidated by the wall -- what if they make a mistake, they'll hit it hard! It doesn't worry me -- because I know I'm not supposed to drive into that wall, I don't look there. I'm looking at the exit of the corner, or the turn-in for the next, and so I hardly even see that wall.

The drop-offs in Deals Gap are Charlotte Walls. Don't want to ride off the edge of a cliff? Don't look there. And there's no reason why you should be intimidated by a big drop-off on the outside of a corner unless you're going to ride off the edge. A lot of Sleazeballs (a technical term we'll define later) take their bad line just because they're intimidated by the drop-off, and so they increase the chances of becoming Junior Birdman just by their mental attitude.

So don't bother to look at the runoff areas today. Sure, enjoy the scenery, but you should be spending all your attention on where you want to go, not where you don't.

## Reference Points

Keith Code makes a big deal about Reference Points. They're points around the track that help you anchor where you are visually. This rock by the side of the road, that patch in the asphalt, this clump of grass, that piece of kerbing... if you want to do that, that's fine. I think that people can see more things at once, and don't actually need to mark something mentally to use it as a visual anchor.

I also find that if you pick a marker near your braking point, for example, not only is it a visual anchor, but it locks you into braking there. Once you have associated "this rock" with "brake near it," it's very hard to unlock the two. Sometimes you'll find yourself turning in where you have some sort of Reference Point, even though it's not ideal, just because there's something you can fix on there.

So if you're a Code advocate, go ahead and use Reference Points. Just make sure they're only visual anchors, not behavioral ones.

## Site Picture

I use a full visual picture of the scene. A Site Picture for the approach to a corner, for example, is built around what you see as you approach the corner. You're not looking at the edge of the track trying to pick out things, you're looking for your braking point, turn-in, apex, and so on. But you're actually taking in a lot more than just those points -- your peripheral vision is noticing things around you even if you aren't focussing on them, and your picture at your braking point will include unconscious cues that will help you say "I recognize this."

It'll take a little while to build this picture, but the more you go around the track -- on your bike, in a car, on a bicycle, walking, it doesn't matter how -- the more you'll build a visual model of the way around it.

Your eventual goal is to be able to play a lap of the track in your head. Not only that, but to do it in real time -- it should take exactly as long to do the visual replay as it takes you to ride around.

Once you've reached that point, you can run practice laps in your head. When you come back to this track next time you'll hit the pavement already having run a hundred laps or so in your head. That'll give you a big advantage when you get to do it in reality. Bringing a different bike? Get familiar with the bike on the street, then visualize the track on the new bike -- the reality probably won't mesh perfectly with your visual one, but you'll have an idea of what to expect. It'll save a lot of acclimatization time and help you be fast straight out of the box.

# NO SWERVING -- it's all corners

In one way, the MSF does riders a disservice in terms of track riding. When they teach you to swerve, they emphasize to move the bike under you rather than lean with it. *DON'T DO THAT HERE!*

On the racetrack you are not swerving. You are taking corners. Lean *with* the bike, don't lag behind it. On the street I see a lot of riders who lean their bikes over a lot in a turn, but are keeping their body quite upright. That uses up a lot of the bike's lean angle --they leave less reserve, and would touch down well before a good rider would.

When you start reaching your own personal tiltmeter, you'll find it very hard to lean your body more. The pavement gets closer as you lean, and it's intimidating to sense it nearer to you than you're accustomed. It's vital that you not start to lean the bike under you at that point, but keep your body leaning with the bike. That's an important basic technique I'll be watching for today.

Compare these two pictures, taken at TrackDoD 1...

First, a note about the corner: this is exiting Oak Tree at VIR. It's a very slow corner, and so at the point where these photos are taken the bike is accelerating onto the front straight. The bikes in both photos are travelling at roughly the same speed.

In this first picture, the rider is leaning the bike under him. He's looking through the corner well, and accelerating nicely through the corner, but by keeping his body more upright he's pushing the bike down into the ground. He's almost used up all the lean angle he has available -- he's cornering about as fast as he can, and has virtually no reserve of cornering clearance left.

*photo by Mike Ragsdale*

In this next picture, the two riders coming out of the corner are leaning more than the bike. Notice how much more ground clearance they have -- and compare the angle of the wheels to the ground in this picture and the previous one. Even though one of these bikes is a standard and the other a cruiser, when ridden this way they actually have *more* ground clearance than the sportbike shown above.

*photo by Mike Ragsdale*

This also shows how useless Joe Racer's guide to how fast a rider is by looking at the tires. The rider in the first picture has scrubbed his tires all the way to the edge, but he's going no faster than the riders in the second picture, who may still have unscuffed rubber at the outside of their tires.

# Countersteer

Today I expect you to use countersteering on the track. You're accustomed to using it on the street, and there's enough to get used to today without introducing other ways of steering. I'll just say there are other ways, and leave it at that; I'll may talk about it in more detail later today.

There are in fact two problems with countersteering when you're right at the limit: it uses up front traction, and it moves the front of the bike towards the outside of the corner when you're already near the edge of the surface. So today, I want you to keep a traction reserve under braking, and don't go to the absolute edge of the track on corner entry.

# No coasting

On the track you're braking, cornering, or on the gas. Period. There's no neutral throttle, no coasting along at a constant speed while you decide where to brake, you're always *working* the bike in one way or another. So no backing off halfway down the straight -- if it feels too fast, look up and further ahead.

Of course there are exceptions to being fully on the gas. Sometimes you'll need to ease off from full throttle to stay behind another rider if you can't pass before the next corner, or if you're riding in another bike's draft. But anytime on the straight you are not riding close behind another bike, you should be fully on the gas.

# Shifting up

It's more important to do an upshift right than to do it fast. Don't rush it, just do it like you would on the street: ease off the gas for a moment, pull in the clutch a little, shift, and let the clutch back out as you roll back on to full throttle. Nothing new there.

# Shifting down

One difference between shifting down on the racetrack and shifting down on the street is that on the track you *only* downshift when you're braking. You downshift to get into the right gear for a corner, and since you're accelerating all the way up to the moment you brake, you'll be braking when you downshift.

A downshift must be done properly to be smooth. This is a point where you really don't want to lock the rear, and so you must match the rpms properly.

In the MSF, they just teach you to roll the throttle on to match the rpms. That takes time and can be harder to judge. They don't teach the throttle blip method because it's harder to explain and teach to new riders. If you have no trouble doing it the MSF way, continue to do it, except remember that on the track this might be harder because you're always braking hard at the same time.

## Blipping the Throttle

What some people find much easier -- and I would like you to try out to see if it works for you -- is to blip the throttle as you downshift. The sequence is: pull in the clutch, and as you shift just blip the throttle *hard* with the ball of your hand (like you were trying to impress someone on the sidewalk), then let the clutch out. You'll find that if you blip the throttle hard enough, the revs will match themselves. Also, because the revs match so well, you'll need only a slight touch on the clutch to make the shift.

Try this first with the engine off -- squeeze the brake lever hard, and practice rolling the throttle with the ball of your hand. You should be able to maintain a constant pressure on the brake lever while you're doing this.

## Multiple Downshifts

To make things more complicated on the track, most of the time you'll be shifting down more than one gear. There's a number of ways to handle this.

What I normally do on a very familiar bike is to keep the clutch in and blip the throttle for each downshift. That does increase the chance of ending up in the wrong gear if you miss a shift, so if you're going to get away with this you need to know the bike well enough to detect a missed shift without having to let out the clutch.

Unless you have that level of confidence, you'll be more secure releasing the clutch for each downshift. If you're not blipping the throttle, in fact, you really need to do this to make sure you're matching the revs properly.

Multiple shifts take time, so it's best to start downshifting as soon as you can, when you start braking. Most modern bikes slow down rapidly enough to change down all the gears as quickly as you can, but to start out allow more distance for braking and shifting until you are sure you won't over-rev the motor doing this.

# Ride Your Own Ride

On the track this is even more important than on the street. Your braking points, your lines, your style -- all are probably different from the person in front of you, whether they're faster than you are or not. So all you achieve by following someone is to take what might not be a bad line, but probably isn't the right one. It's much better to block that other bike out of your site picture and take your own way through the corner.

Remember this too: even if their line was great for you, if you follow it the best you can do is to be *as fast* as they are. You'll never be faster than they are.

Some people like to talk about a guideline for where to brake -- "wait until the guy in front of you brakes, count to two, then brake" (or some variation on that). I don't think I need to point out that sounds much better in a bar than it does in reality.

The other danger in watching the bike ahead of you is target fixation. You can get your attention taken by this other bike to the extent that you lose your site picture, and blithely forget to brake (really, I've done it myself). So try not to let that other bike intrude on your site picture -- be aware of them, but don't focus on them.

# Be Aware of Your Body

No matter what you weigh, you're a significant part of the weight of your bike/rider unit. Also, particularly with high-spirited sportbikes, it's easy to make inadvertent control inputs that can upset the bike. So be aware at all times of what your body is doing, what position you're in, where you have your weight, and so on.

## Loose arms

Motorcycles steer themselves very well. All the rider needs to do is make it lean, roll on, and it'll happily complete the turn, unwinding the corner by itself. An ideal situation would be to ride around the track with no steering input at all, as anytime you steer you scrub off speed.

Motorcycles are also self-correcting systems. If some sort of wobble or glitch happens, the bike will tend to sort itself out. It might be unpleasant while it does it, but it generally will recover.

Your bike can't do any of that unless you, the rider, let it. To do that you must keep a light touch on the bars -- hard enough to steer, but light enough to let the bike even itself out. So your arms should be loose at all times. Try not to put any weight on your arms, even when braking. You should be able to flap your elbows -- do the chicken dance -- at *every* point on the track.

## Body position

You need to be aware of how you carry your weight on the bike. You need to be able to move that weight around. That is best done on most bikes (forward control cruisers excepted) by using the ball of your foot on the peg. Keep your feet back and in, move them forward to brake or shift, then right back with the ball of the foot on the peg.

I see a lot of riders with pigeon feet, splayed out on the bike. All that does is makes it hard to shift your weight around, and gives you a fright when your boot touches down. Keep your feet in.

Keep your weight balanced with the wind pressure, your back, your legs, your butt. Remember to distribute your weight evenly so you don't tire out one set of muscles. Leave your arms free and loose.

## Lean In

To balance the bike in the turn, and to increase your ground clearance, you need to lean into the corner. In this context I don't mean lean the bike in, I mean lean yourself relative to the bike. As you turn in --before, ideally -- move your inside shoulder forward and in, following with your upper body. That not only moves your weight where you need it, but it puts your arms in a better position to steer into the turn. Keep your body leaning in until the bike straightens up coming out of the turn, and then it's an easy movement from the lean in to a full tuck.

Go back to the two pictures of riders leaning in and out. Notice how the riders in the second picture are leading with their inside shoulder, and how much more comfortable and relaxed they look.

## Hanging off

You don't need to hang off unless you're dragging bike parts consistently. Hanging off moves you around on the bike, changes your physical position and view, and alters the way the bike responds -- exactly what we *don't* want when we're concentrating on line and smoothness.

So I don't want anyone hanging off -- not at first, anyway. If you're dragging parts, you've reached the maximum speed you can do on that line -- and there are things you can do to reduce the need for clearance in a turn by changing your line, without hanging off. If you're consistently dragging, talk to me and we'll work on it -- which may include hanging off if you want.

## Breathe

Or, to be more accurate, pay attention to how you breathe. Your breathing should be healthy deep breaths, no gulping of air, no short sharp breathing. The Buddhist concept of mindfulness begins with being aware of your breathing. The ideal is to keep the awareness of your breath while you are putting your focus onto the track and your ride.

The starting point is to be aware of your breathing and how it affects your riding technique. Are you breathing quickly, from fear or adrenaline? If so, the rest of your body is probably also tensing into a fight-or-flight reaction. This is the time to take a couple of healthy breaths and relax. Check yourself as you hit each straightaway, and try to have relaxed breathing as you enter the curves; it should help you to remain relaxed and responsive as you ride.

## Head Position

Keep your head vertical as much as you can. No matter how much the bike or your body is leaning, keep your eyes level with the horizon. This helps you keep your view of the track consistent, without your picture constantly swinging from one angle to another. If your sight is consistent, you'll find it easier to be aware of where you are, and keep a good flow of vision without being distracted by changing viewpoints. It'll also help you judge lean angles more consistently.

Notice how in this picture (taken at TrackDoD 1 at Oak Tree) the rider's eyes are level, looking through the turn. The rider is hanging off, leaning hard, but his attention is focussed exactly where it needs to be. Keeping your head level helps you do that.

*Photo by Mike Ragsdale*

### Be Smooth Yourself

The bike can't be smooth unless you are. When you lean in, when you sit up or crouch down, don't jerk around on the bike. Take the time to move smoothly so you don't upset the bike. That means leaning in before you brake and downshift for a corner -- you need to avoid bouncing the bike around with your body.

## Use the Bike as Designed

On the street, you can get away with all sorts of odd ways to use a bike. On the track, we use each part of the bike as it's designed. We slow down with the brakes, speed up with the engine, and keep the clutch out except when shifting.

### Brakes are for braking

Most modern bikes on good tires have enough traction to stoppie -- lift the rear wheel from the ground -- under braking. At that point there's no more rapid slowing to be achieved. So the brakes are more than enough to do the slowing down for you.

Not only are the brakes more efficient at slowing the bike, but they're the only method you can really modulate to manage your traction. It's hard to modulate engine braking with the throttle.

That means *no engine braking!* If you're slowing down, you should be on the brakes. Don't get off the throttle unless you're braking.

### Engine is for accelerating

The only thing the engine is intended to do is propel the bike. Forwards. Use it for that, not for a brake.

That doesn't mean pull in the clutch while you're braking. The natural engine braking you get by being off the throttle will help you slow down for the corner without locking the rear wheel. What I do mean is that you don't

use engine braking unless you're on the brakes as well.

## Clutch is for shifting (down?)

On the street, some riders tend to coast around really tight corners with the clutch in. On the track, that's asking for trouble. When you pull in the clutch, you give up some control over the bike, and that is a very bad thing.

So the only thing you use the clutch for is to shift. Even then, it's a very brief and light tug and release, not a full-blown haul it to the bars and back. Depending on your bike, you'll probably only need the lightest touch on the lever to perform an upshift, and may not need it at all. You will need it for downshifting, but by blipping the throttle to match the revs, you again won't need it all the way in.

Note that when we talk about clutchless shifting, we are *not* talking about speed shifting, jamming into a higher gear, or anything ham-fisted like that. You ease off the throttle a touch, snick the shifter lightly into gear, and back on the gas. If you need anything more than the lightest "snick" on the shifter, you're not doing it right -- or the bike design won't let you do it easily -- and go back to using the clutch. There really isn't that much to gain by clutchless shifting, so it's not worth spending a lot of effort on learning it.

## Pegs are for feet

The footpeg is exactly that, a peg for your foot. It is not supposed to be something to scrape across the ground all the time. While it's usually the first thing on a bike that will touch the ground when you reach the limits of lean angle, it's not supposed to be dragged along the road as a matter of course.

Yes, it looks and feels cool to drag pegs. Yes, Joe Racer uses it as a measure of how well he's cornering. But aside from coolness and street cred, scraping pegs doesn't really serve much purpose.

The reason pegs have feelers is to make sure they're the first thing to touch down. The reason most footpegs are on springs is so they don't lever the bike off the ground when they touch. That doesn't mean they're supposed to be used that way.

Treat scraping the peg as you would a warning light on the dash: it tells you that you leaned *too far* this time. Ideally you want to have the bike skim along with clear space of half an inch or so between the peg and the road. Any closer than that and you run the risk of a bump -- or imprecise throttle -- bouncing the bike off the road. The peg scraping says, "you got away with it this time." Next time, use less lean angle: take a later apex, so the bike's unwound more to vertical at that point in the road, or slow down so you don't scrape when you flick the bike into the corner.

If you find yourself consistently scraping pegs talk to me and we'll address ways of finding more clearance.

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# Aerodynamics

# Basic Principles

Unlike most racecars, a bike is a brick. Having the rider stick out in the airflow, and not being able to fair in the front wheel, leaves a lot to be desired for aerodynamic efficiency. The bike tries to make up for it with power and low weight, but that only goes so far. To push the top end of speed and acceleration, the bike needs some help from the rider.

Aerodynamic drag increases with the square of the speed. Double the speed, and you get four times the drag. What that means in practical terms is that around 120mph, bikes run into what feels like a brick wall of air, and increasing your speed only a little needs a phenomenal amount of power. It also means that any difference the rider can make to drag will be multiplied and give big benefits. Even faired bikes are designed around a rider. The bike itself needs the rider in the right place to smooth the airflow.

# Straight -- Reduce drag

On the straight, your goal is to offer the smallest drag you can. The two ways to do that -- which cooperate in terms of the rider position -- are to reduce the frontal area and to smooth the airflow.

Reducing the frontal area has been understood for at least a century. Crouch down on the bike, bury your head behind the gauges, lie down over the tank -- riders have been doing that forever. It's still what you need to do on an unfaired bike. Just remember you still have to have your arms loose, you still have to be able to see, and you still have to be able to control the bike.

With a faired bike, the method is slightly different. You want to be not only tucked down behind the screen, but you want to present a smooth profile for the air to flow off the screen, over your back, and on to the tailsection. So you don't want to be totally out of the airflow, you want to become part of the shape of the bike.

In this photograph from a WERA race at NCMS some years back, the rider is well tucked in behind the fairing. Her elbows and knees are out of the airflow while still retaining control of the bike, and the air flows smoothly over the screen, and with the rider low on the tank the airflow is smoothed from the rider's back across the tail section of the bike.


*Photo by Martyn Wheeler*

Again, bear in mind that the priority is to control the bike. All the speed in the world will do no good if you run into the starter's stand. Remember also that some steep front-end geometry can start to wobble if you put too much weight on the front, so don't overdo it. But every little bit you can do to reduce the drag is squared in effect.

# Braking

When you brake, on the other hand, you want to slow down. Heck, why *not* use yourself as an air-brake? Sit up, let the wind resistance help pull you down from top speed. Let that squared-velocity drag work in your favor. Not only does it help out the brakes, but it is braking that doesn't come out of your traction allowance.

Be careful when you do this. You don't want an unexpected slam of air to pull you off the bike, and you still need to keep a light touch on the bars. But sitting up helps slow you down, and puts you in a better position to see the corner.

# Cornering

Going round the corner is much more important than reducing drag. For one thing, you're going slower in the corner anyway, so drag doesn't count as much. For another, your exit speed depends more on taking the corner correctly than on reducing drag. Sure, as you exit onto a straight, move across further into a tuck as the bike straightens up, but it's not as important as getting the corner right.

Having said that, there are some very fast corners where it will help to stay in a tuck. If you can take a sweeper flat out without coming near touching down, for example, you'll be faster if you can stay in a tuck through it -- and remember you can still lean in some while maintaining an aerodynamic tuck. But again, get the corner right first before you worry about drag.

# Drafting

A consequence of the bike being an aerodynamic brick is that it leaves a big hole in the air behind it. A following rider can sit in that hole and let the bike in front punch through the air for him. In fact, if they get close enough, the bike behind starts to fill in that hole for the bike in front, smoothing the airflow off the back, and so not only does the drafter get a tow, the draftee gets a push.

When the speed of a bike running alone is mainly governed by drag -- as it is for all bikes -- you can go *much* faster running with someone else. In fact, especially in the lower-powered bike classes, you may not be able to run at the front in a race if you *can't* run with someone else. It's like NASCAR at Daytona -- you have to run with someone, preferably a large train of someones, or you get hung out to dry in the airstream.

But drafting has many dangers. Tucked in behind another bike, you get a restricted view of the track. You can lose your site picture and orientation. If the rider in front slows unexpectedly, wheels can touch which will launch you both into something that would be a shoe-in for "greatest .mpg crash videos." You tend to fixate on the bike ahead of you, and not notice when the braking point is coming up. If you're catching up the bike in front, your bike will start to accelerate rapidly when it gets into the slipstream, and you can be sucked right into a collision.

So for today, while you can use drafting to a limited extent, please leave plenty of room and drop out of the draft well before the next corner. Collisions between bikes on the track are very bad news.

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# Dynamics

# Traction, Tire, Weight Transfer, and Geometry

## Introduction

You've heard it all before:

- "My suspension is too soft."
- "I need a sportbike."
- "This bike doesn't handle."
- "It doesn't turn in quick enough."
- "It's like a pogo stick in the corners."

All of these mean one thing: "I'm a lazy rider," which in turn means "I can't manage weight transfer."

Riding a bike properly is all about managing dynamics. We've talked about aerodynamics, now we'll cover the physical behavior of the bike.

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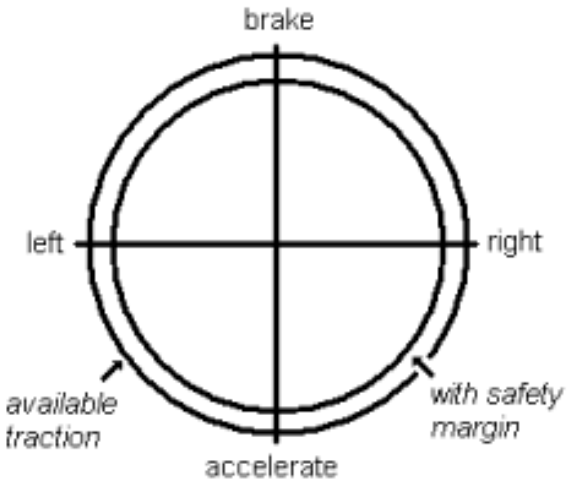
# Traction Dynamics

## The Traction Circle

### The Basics

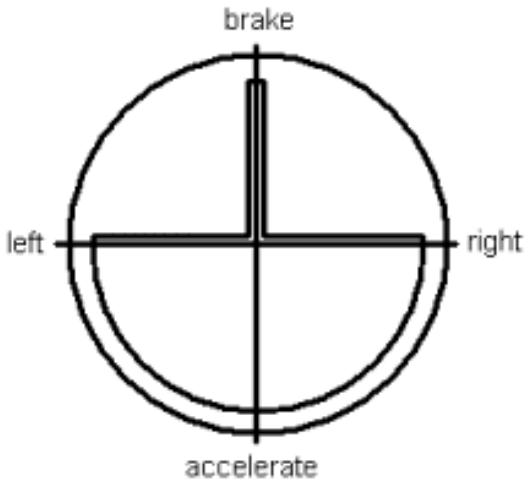
They talked about this in MSF. The more the weight is on one end of the bike, the more traction it has. There's only so much traction to go around -- you can use it for acceleration, braking, turning, or a combination of those. What is amazing is that many track riders -- and almost all street riders -- only use half the circle.

Today I want you to maintain a traction reserve -- leave a border around that circle so you can concentrate on technique rather than managing slides. So when I talk about the traction circle here, I'm really talking about one that's actually inside it, leaving a safety margin:




## Using the traction circle

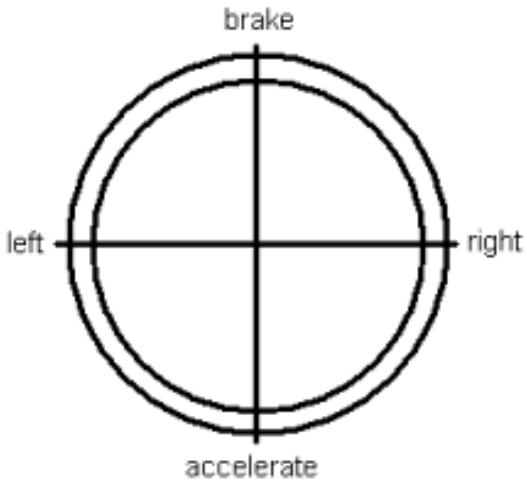
In the classic corner, you brake, then turn, and roll on the throttle as you come out of the turn -- slow, look, lean, roll. When you plot this on the traction circle, you'll see that uses only the bottom half of the circle:




## Trail braking

We're going to use the whole circle. By trailing off the brakes as we turn in -- *trail braking* -- we fill in the top half of the circle. That means we can save some of our braking for when we're in the corner, and so can brake later. (We also get other benefits we'll talk about later.)

Trail Braking is an often misused term by those who don't understand it. Note that it has *nothing* to do with what brake you're using. It just means that you keep braking as you go into the corner, trailing off the brake as you go deeper into the corner.




### Using the weight transfer

Remember that traction on a given end of the bike depends on the weight on that end. By trail braking, we put weight on the front when it needs it most, when it's turning into the corner. Then as we ease off the brake we distribute it more evenly between front and rear. As we accelerate out of the corner we put the weight on the rear -- at that point the rear of the bike is doing almost everything, and the front is just along for the ride.

This is managing weight transfer. It's using the weight transfer to help out the tires and get the most out of the bike.

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# Tire Dynamics

## Basics

Modern sport tires are sticky enough to stoppie, wheelie, and drag parts while hanging off. That's all the traction you can use, and usually they have some reserve beyond that too. On a dry surface, you have to work to exceed the limits of a modern sport tire.

Touring tires may not have the traction to do all that. They may slide if you put too much force into them without having enough weight on that end. It's even possible that you could exceed the tire compound's ability to hold the track, and the tire itself would start to slide because the rubber just can't grip any harder. This is roughly what happens to any tire that overheats.

So your choice of tire may limit you in how hard you can brake, turn, and accelerate. Just be aware of that, and approach the limits from the safe side.

## The Tire Itself

Even touring tires can almost always handle the demands of steady-state forces. What really breaks a tire loose is not the amount of force, but sudden loads -- like suddenly getting on the brakes harder, or the engine suddenly coming into a peaky power band, or countersteering too quickly.

So be aware of not only how hard you're doing things to the tire, but how suddenly. Remember the tire is flexible, and when you steer it takes a moment for those forces to transmit down to the contact patch with the road.

Give the tire a chance to catch up.

## Differences -- the rate of building forces

The biggest practical difference -- in terms of technique -- between sport tires and touring tires is the time they need to catch up. You can slam a sport tire around any old way, and it'll keep up pretty well. With a touring tire you need to build the forces progressively, and not overload it with peak transitions. Either way, though, the tire benefits from smoothness, from a smooth progression from one state to another.

Give the tire a chance to catch up.

Sport tires don't need much of a chance. In fact, with modern sport tires on dry pavement you won't break the front end free just by countersteering -- not if you trail-brake properly, anyway. But that does all change if it's raining, or you're running on cold race tires.

## Rain

Riding in the rain is a different matter. On a wet track you can exceed the limits of the tires much more easily. Although the principles of riding in the rain are the same as riding in the dry, there are enough other considerations that we'll cover this later.

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# Weight Transfer Dynamics

Remember what I said about giving the tire a chance? Exactly the same thing applies to the suspension. Like sport tires don't need much chance to catch up, it's the same with sport suspension. That's why sportbikes tolerate bad riding, and why lazy riders say "I need a sportbike."

Today, though, we're going to concentrate on getting it right. And quite possibly the single most important factor in being able to ride any bike fast -- as in, just get on any bike and ride it fast -- is managing weight transfer.

## Managing Weight Transfer

When you brake, the weight transfers to the front. The front of the bike goes down as the suspension compresses, and the rear comes up as the weight transfers off it.

When you're cornering, you're feeding the g-forces into both ends equally, and both ends of the bike compress from the cornering force.

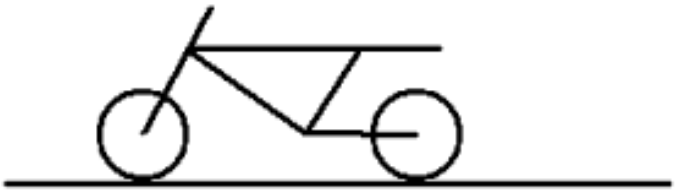
When you roll on the throttle, you transfer weight to the back of the bike and away from the front. The front suspension extends as the weight comes off it, and the rear compresses as it starts to carry most of the weight of the bike.

## Conventional Cornering

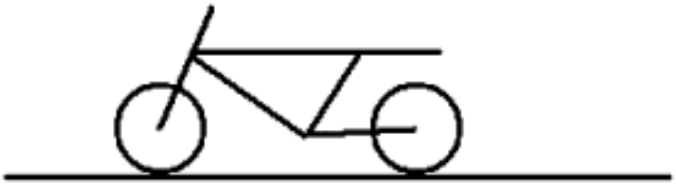
Let's first of all look at the conventional way of cornering. Not only does it waste half the traction circle, but it has even worse drawbacks:

Accelerating

Braking



Let Off



Cornering

Accelerating

So what's wrong with this?

Look at the front end -- it bounces up -- down -- up -- down -- up. At that back it's doing the same thing in reverse. All that bouncing up and down plays havoc with your traction and stability, as you're forever trying to keep the bike under control rather than going through the corner.

So when Mr. Hotshot-Squid says "I need more damping" or "I need better springs," what he usually means is "I bounce my bike." To make it worse, he's probably jabbing the brakes and whacking the throttle.

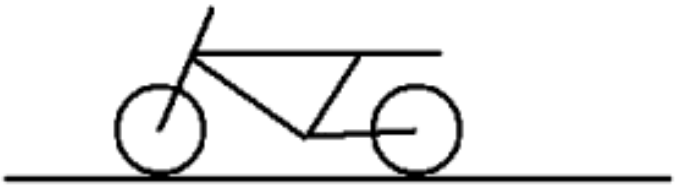
If you ride like this, no bike will handle to its potential. Sure, a sportbike will cope better because it has more damping, and that helps absorb the pogo-like motion the rider's putting into it, and that takes us back to "I need a sportbike." But even sportbikes handle better when ridden properly...

## Doing It Right

Doing it right is really very simple. All we have to do is leave out the "let off", and smooth the transition from one state to the next. We go from full throttle, squeeze the brakes to braking, ease off the brake to cornering, roll on the throttle to accelerating, and unwind the corner at the same time.

Accelerating

Braking



Cornering

Accelerating

Looking at what the bike does now, you can see a smooth flow: the front comes down smoothly and rises smoothly, with no big movements to absorb. Not only is the bike under control, but the suspension is free to soak up real bumps in the road, and so the bike doesn't skitter or bounce across the road.

This way, you can make *any* bike handle. I've passed a CBR600F2 in the depths of Deals Gap on a stock Suzuki Intruder, and there just isn't any bigger handling difference than that.

Does a sportbike handle better? Sure it does. A sport suspension "absorbs" changes quicker, so you can transition from braking to cornering to acceleration more quickly. You can be smooth much more rapidly -- the bike doesn't need as long to catch up -- so you don't waste any time making transitions.

## Bounce-back

There's an added difficulty when you're sport-riding a bike with a non-sport suspension and long fork travel, like a cruiser, DP bike, or relaxed standard. The damping and suspension design of a sportbike eliminates this effect almost completely. It complicates things a bit, but to manage your weight transfer fully, you have to take it into consideration.

As you brake, the front "rushes" down -- it gets momentum, so after you let off the brakes it still keeps going for a bit. So *ease* off the brakes slowly to give it a chance to slow down at the end. This is where "I need more damping" is true, but doesn't have to be because the rider can allow for it.

As a point of interest, it's usually on the "rush" that bikes with soft suspension bottom the front end. A rider who regularly bottoms the front end probably hasn't taken this into account.

Again -- always give the bike a chance to catch up, and some bikes need more chance than others.

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# Geometry Dynamics

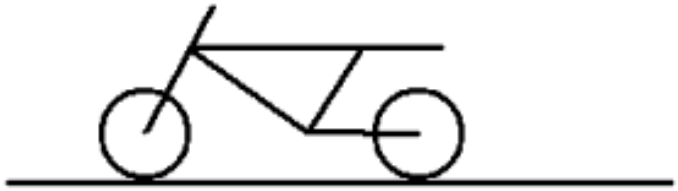
There's another effect to trail-braking that helps you get a non-sportbike to turn almost as quickly as a sportbike (again, a sportbike will do it better, but you can make a non-sportbike be pretty good). That's the geometry effect of the forks compressing (swingarm front ends don't do this).

The basic principle at work is that the steeper the front end, the quicker the bike turns in. Sportbikes come that way, cruisers and standards don't. Conversely, the more raked, the more stable it is.

You hear Joe Racer moaning a lot about "My front end dives."

"WELL DUH, JOE!" Of course it dives. Weight transfers to the front end, and the front end goes down. It's physics, it's vehicle dynamics. All fork front ends dive. What Joe Racer doesn't understand is that front end dive can be an advantage, not a problem.

By trail-braking into the corner, the weight transfer on the front causes the forks to compress. When they compress, they shorten. This not only reduces the length of the bike some, so it can turn quicker, but as the front end goes down, it steepens the angle of the forks. So what was a lazy cruiser turns into a much more agile machine when it's under braking.



Steady State

Braking

Accelerating

Now as you accelerate, you get more desirable effects. The front extends as you roll on the throttle, and it goes back to a lazy front end again, so you gain stability and it's less twitchy on exit.

(One thing to be aware of here is that if your bike already has a steep geometry at the front, it can get steeper under braking, which *can* cause it to get twitchy. Fortunately most steep front ends are on sportbikes, which have suspensions calibrated not to dive as much, and you can also be sure that the designers has this in mind too.)

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# Braking Point

## No-one Can Tell You Where to Brake

You are the only person who knows where you need to brake. Other people can suggest decent starting points to brake, but even someone else riding your own bike can't tell *you* where *your* braking point will be.

Your ideal braking point depends on many factors. It depends not only on the bike, but the tires, the track conditions, your own braking technique, and even such transient conditions as the temperature and humidity.

In fact, your perfect braking point will probably not even be the same from one lap to the next -- as the session goes on, you'll need to be constantly re-evaluating your braking point for each corner.

So showing you "braking points" is totally useless. So is asking someone else where they brake. Only you can determine where to brake.

## So How Do You Know Where to Brake?

Your initial braking point is a guess. Based on what you know of your bike, and your technique, you can make a pretty good guess. Always guess further back than you think you need to brake -- it's much safer to start further away and move your braking closer to the turn than it is to run off the track the first time you go into the corner at speed.

Once you have that initial guess, you use two basic principles to find your rough braking point.

### Basic Principles

If you come off the brakes before you turn, you braked too soon.

If you are going too fast to turn in where you want, or you turn and run wide of the apex, you braked too late.

### Refining Your Braking Point

The more you practice the more the basic principles become second nature. You'll then have attention left over for more subtle cues. You will start to pick up on how the bike feels under braking, you'll integrate that with your site picture, and you'll know very quickly whether you've braked too early or late. That'll let you adjust by either applying the brakes less hard, or preparing to adjust your line for a deeper turn-in.

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# Gear Selection

# No-one can tell you what gear to use

Just like braking, picking the right gear for a corner, and deciding where to shift up, depends on so many factors that only you can determine which gear to use. Also like braking, the right gear might change during a track session, so you have to be constantly re-evaluating which gear to use as well as re-evaluating your braking points.

# So how do you know where to shift?

## Shifting up

Deciding where to shift up is pretty straightforward. It takes very little thought, just following a routine that becomes automatic.

The basic principle is to shift up as you hit redline. If you have an engine that runs out of power before redline, shift just as the power starts to drop off.

The exception is if you'd have to shift up and then back down immediately. In that case it's often more efficient just to back off the throttle and hold it near redline rather than spend the time and effort shifting twice.

## Shift up on the straights

Shifting up involves backing off the throttle for an instant while shifting. However slight that is, it's still a break in the acceleration. That means that shifting up causes the weight to transfer from the back while you're shifting. If you're in a corner, that messes up your weight transfer management. So you only want to shift when you're on a straight, where a slight bounce won't hurt your stability.

## Shifting down = choosing a gear for a corner

Since you only downshift when you're braking, and you only brake for a corner, you only downshift when you're approaching a corner. Since you don't want to shift up while you're still in the corner, you want to pick a gear you can use all the way through your acceleration through the track-out point.

Bikes accelerate hardest in lower gears. Since you want to accelerate hard out of a corner, you want to use the lowest gear you can.

Ideally, therefore, the perfect gear has you shifting up exactly as you hit the track-out point. If you were racing, and the rules allowed, you'd want to customize your gearbox so you had the perfect gear for every corner.

In the real world, you rarely have the perfect gear available. That means you often have to choose between a gear that is too high and one that is too low. In that case, managing weight transfer takes priority, so you have to pick the higher gear so you don't have to shift in the corner.

If you're in a sequence of corners, that might mean you have to shift up before coming into a faster corner, so you don't have to shift before the exit. In this case, you'll probably be shifting before your ideal -- often substantially before the redline. That's called *short-shifting*, and it's a technique that's well worth mastering.

## Shifting in the corner

Sometimes a corner is just so long that you have no choice but to shift while still leaned over. VIR does in fact have one turn where you may well have to shift while still cornering. The Fishhook is such a long uphill turn that without a very broad power band it's likely you'll have to change gear.

You can shift up in a corner without really hurting much, provided it's when you've already unwound your line most of the way. At that stage you're not loading the suspension much with cornering, so it doesn't really hurt to bounce it slightly. Ideally, though, you wouldn't be shifting until at least the track-out point, once you're heading in a straight line.

You need to remember that shifting in the corner upsets the suspension. It's vital to shift quickly, and if the bike is not upright, then straighten it slightly before shifting to reduce the cornering forces; once you've shifted, you can pull it back down some to finish the corner.

For the Fishhook, it might well be worth choosing a higher gear than is ideal for the tightest part of the corner in order to avoid a shift further up the hill. That's something you can experiment with over the course of the day.

### Knowing you have the right gear

Like every other track skill, you need to be able to tell when you've picked the right gear, and when you've picked the wrong one. That's pretty easy -- if you have to shift up before the track-out point, the gear's too low. If you don't shift until after your track-out point, the gear's too high.

Like everything else, the technique of finding the right one is to play it safe and work from that direction. Start with a higher gear than you think you need, and work downwards until you reach the right one.

Being familiar with your bike helps in that you probably will know when you can't use a lower gear without running out of revs in a corner, so it's rare that you'll find yourself in too low a gear. If you do, though, remember that safety comes from not bouncing the bike in the corner, and just roll on more gently until you're going straight enough to shift without upsetting the bike.

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# The Track

## Corners and Straights

### Everybody talks about corners, but they're only part of the track

In fact, despite what you hear, races are won on the straights, not the corners. You spend so much more time on a straight than in a corner that the straights are actually more important.

The catch is that your speed on the straight depends on how you come out of the corner before it. The faster you exit that corner, and the sooner you get on the gas, the faster you'll start the straight -- so the faster you'll be all the way down it.

### What is a straight?

That's an important question, but actually it's asked backwards. So we'll address it from the other end.

What do you do on a straight? You stay wide open throttle, changing up when you need to do so. You accelerate all the way down it. (We consider the braking at the end to be part of the next corner, not the straight.)

So in effect, a *straight* in terms of a racetrack is anywhere you can stay at wide open throttle, without turning significantly. In other words, anywhere that acceleration is the only significant part of the traction circle that you're using.

### What is a corner?

Corners connect straights. Sometimes it's not one corner that connects straights, but a sequence of corners. So a corner is anywhere you can't stay full on the gas, or where you have to turn significantly. That means that anywhere you come off the part of the traction circle that's full acceleration, you're doing a corner.

### How to fit them together

Look at the track, pick out the straights, and connect them with the corners. Then see how to classify each corner, and the correct line follows naturally from that.

## Types of Corner

There are three types of corner, depending on how they relate to the straights they connect.

### Type I

Type I corners are the ones that start a straight. They're the most important because the faster you come out of a Type I corner, the faster you'll be all the way down the straight.

### Type II

Type II corners are the ones that end a straight. The goal here is to keep your speed up as long as possible, preferably deep into the corner. Because they end a straight, and don't lead on to one, the exit speed is not as important as maintaining speed into the corner.

### Type III

Type III corners are everything else. That means they don't start or end a straight, but just connect other corners. They're the rarest type of corner -- some tracks don't have any of these at all.

Strictly speaking, since they don't start or end a straight, they're also the least important. While that is true, the line you take through a Type III is very important indeed, as we'll see later.

## Analyzing the Track

The key to finding the proper way around a track is to analyze it before you ever take a fast lap. The first step in that is to pick out the straights -- since they're where you get your lap speed -- and then identify the corners.

Identifying the corners is not quite as straightforward as it sounds. Remember our definition of what a straight really is, and you'll see that not everywhere the track makes a bend is actually a corner.

For example, at VIR, the kink in the dip between Courage and the Spiral is not a corner -- you just take it in almost a straight line at full throttle. Likewise the kink between the Fishhook and South Bend tends to become part of the former rather than a corner in its own right.

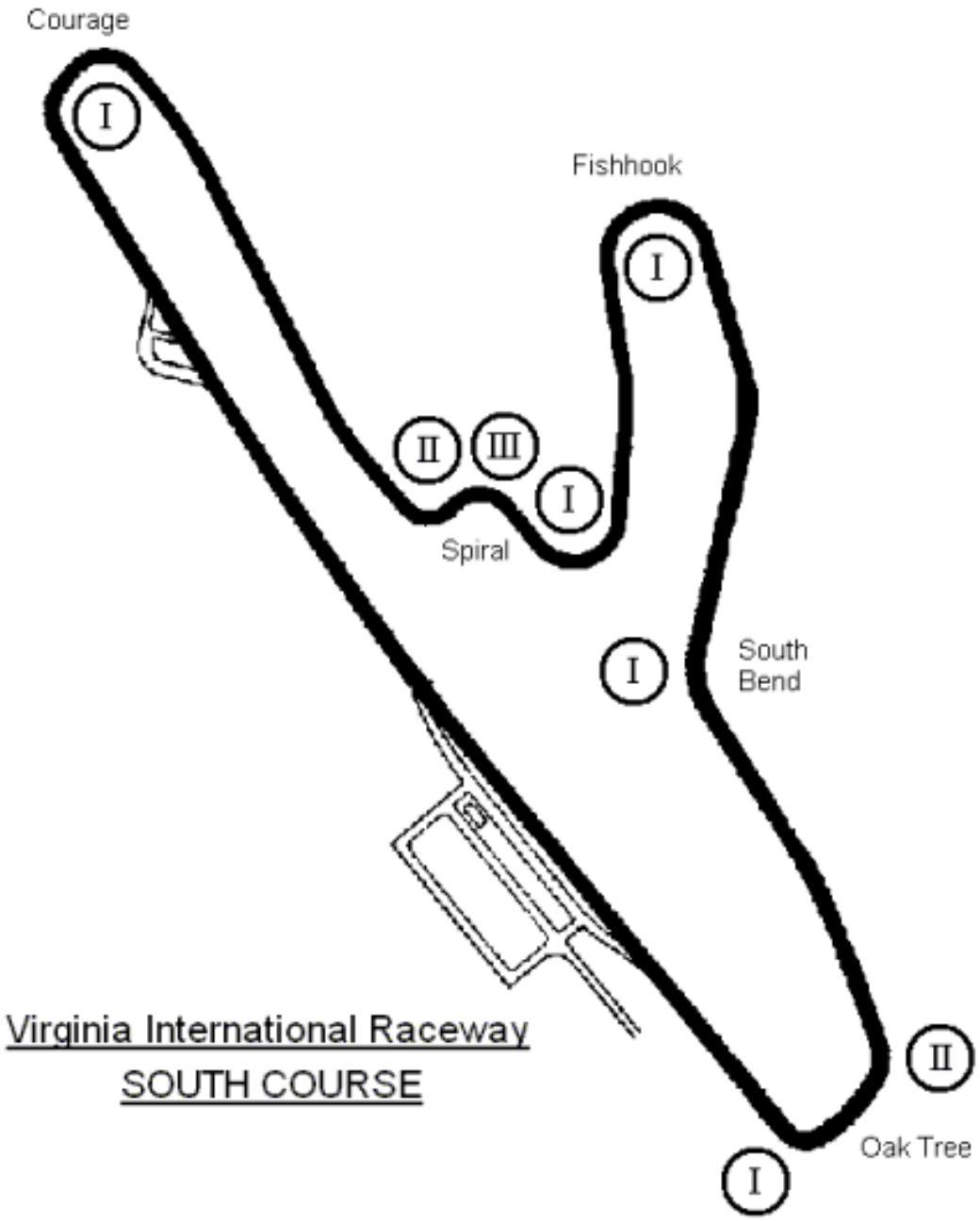
The next step is to classify the corners into one of the three types.

Since Type I corners are the most important, we pick those first. This is easy -- they're the ones at the beginning of every straight.

Next most important are the Type II corners. There's one at the end of every straight, *unless* it's already been picked out as a Type I. Type I over-rides Type II.

Finally, if we have any corners left over (some tracks don't), they must be Type III.

So, using the VIR South Course as an example:




This gives us a starting point to pick the best line around the track.

# Picking the Line

## Classic Corner

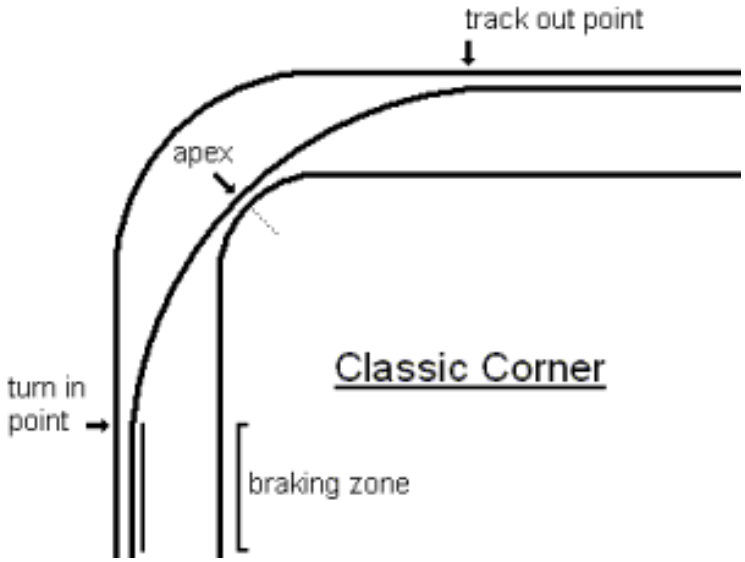
Back before the development of racing as a science, a corner was a corner. The object was to take the smoothest line around the corner. Since the larger the radius, the faster you can go, you plan a circular line that turns in from the outside of the corner, comes close to the inside of the corner in the middle, and reaches the outside of the track again at the exit.

Those three points are the turn-in point, the apex, and the track-out point.

This line has a neutral apex and a constant radius.

Also, classically, all the braking is done before the turn, and then all the acceleration is done after the turn. As we've already seen, we can do better by trail-braking and accelerating out of the corner.

Early texts that treated racing as a science, such as Piero Taruffi's classic book, spend a lot of attention and detail in describing -- in words and with mathematical analysis -- how to take this line around as much of the racetrack as possible. We will in fact not take any corner in the classic manner.

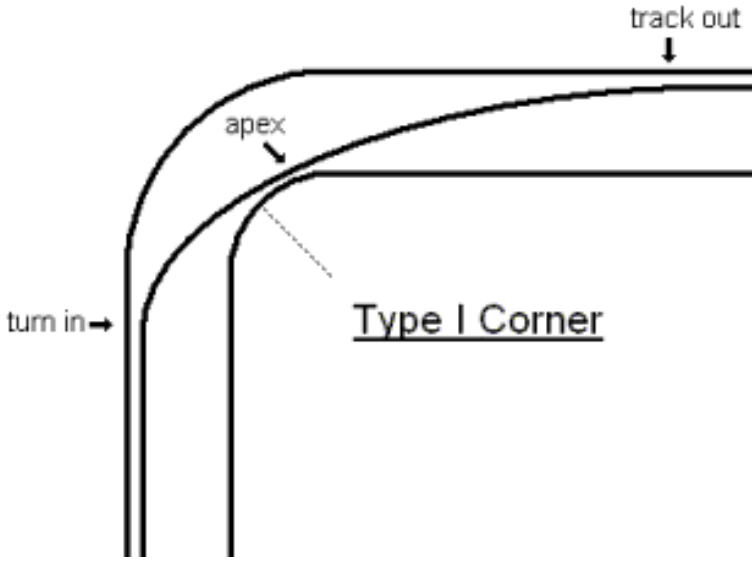



## Type I Corner

Our object in a Type I corner is to maximize exit speed. To do that we must take a line which lets us roll on the throttle early and keep rolling on.

Remember the traction circle? To accelerate hard, you can't be turning hard. So we do most of the turning right away in the corner so we can concentrate on accelerating out. We turn in late, trail braking into the first part of the turn, and switching to acceleration well before we get to the apex.

This is a Late Apex line, as the apex is further around the corner than the classic line. We also brake later than the classic line, since we turn much later. And since we unwind our corner as we come out of it, we can accelerate much sooner than the classic line, and so come out of the corner much faster.




### Other benefits of the late apex

The late apex line is also the safest to use on the street, in that most of the turning is already done well before you reach the apex. That means if there's a hazard around the corner, or the corner tightens up unexpectedly, or there's gravel on the exit, or any other of the things that can go wrong on the street, you can take avoiding action just by not rolling on the throttle so hard. That puts you back nearer the center of the traction circle, and from there you have traction reserve in every direction.

The late turn-in on the street also gives you a better view through the corner before you turn in, and so you have a better sight line and can adjust for unexpected hazards. This is another reason why the late apex line is in practice faster on the street -- you can see further around the corner, and so can ride harder while still remaining within your sight lines.

### The Sleazeball line

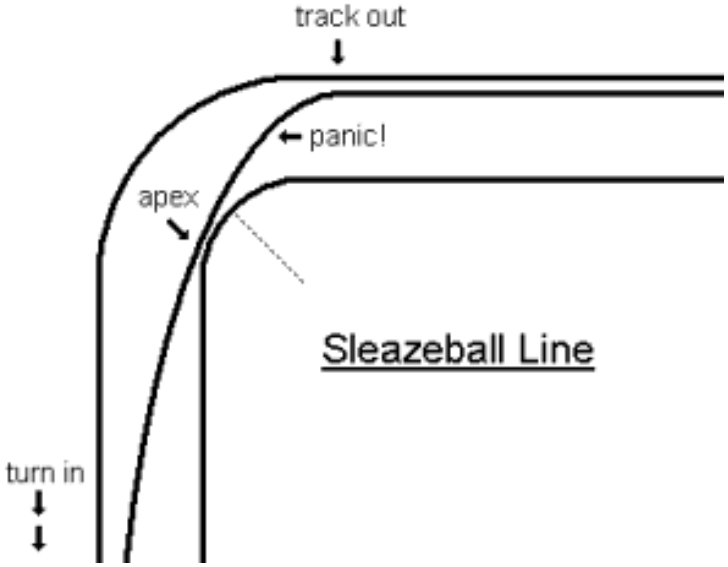
But a late apex line is not what most riders do. In their eagerness to get into the corner, they turn in way too early and too little, also braking too little, taking a very early apex and carrying way too much speed into the middle of the corner.

Even in a predictable turn, this is a disaster. The rider ends up aimed for the edge of the road, heading into the woods. If the rider is going fast enough, this is where they'll panic, fixate on a tree or something, and slide into the woods, probably with the rear brake locked. Even if the rider looks in the right place, since they've left all the turning until the end, there are zero avoidance options left. There's no room to brake and no traction reserve for extra turning.

Most single-vehicle motorcycle accidents are the result of an early apex. The mistake that leads to this is so far back -- way back when the rider started the turn-in -- that the rider doesn't associate it with the wreck. They blame it on the bike -- it wouldn't handle, or it didn't have enough brakes, or it stood up under braking. They blame it on the road situation, and say there was nothing they could do.

A frightening number of riders, including most of those who ride sportbikes, take corners like this. Many of them bought a sportbike just so they could take this line better and have more reserve at the panic spot.

We have a word for the early apexers. They are Early Apex Sleazeballs, and what they do is called sleazeballing the corners. As you'll see, it's a term I'm fond of, and one I'll all too happily apply to you if you take a corner like this.



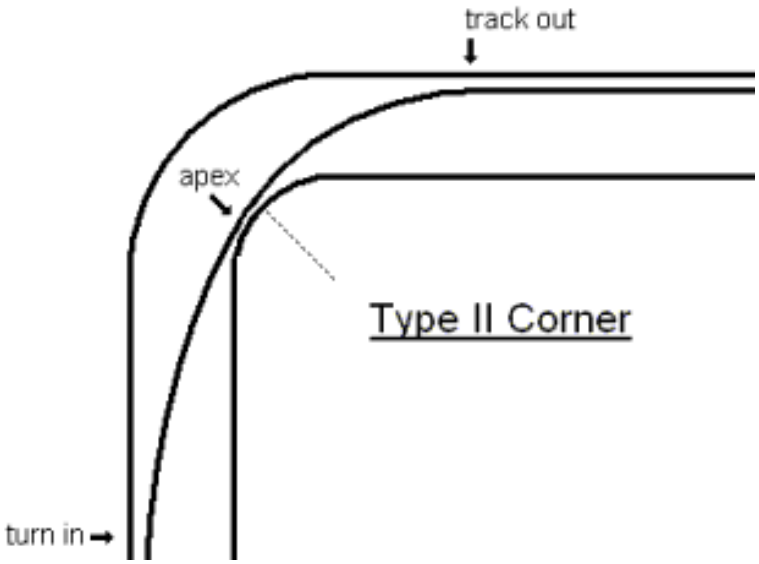

## Type II Corner

OK, back to corner types. We spent a lot of time on Type I corners because they're the most important on the track. Not only that, but perhaps even more significantly: if you take every corner on the street as if it were a Type I, you will probably never crash in a corner or even get close to a dangerous situation. And you'll exit every corner quickly, and blow away every single average street rider in the twisties, no matter what bikes you all are riding.

The next most important corner on the track is the Type II, a corner that ends a straight. The object is to stay on the gas as long as possible and carry as much speed into the corner as you can.

This means we turn in gently and relatively early, braking right before the turn-in, and brake almost all the way through to the apex. The apex is slightly early.

From the apex, we then act as a normal corner exit, unwinding the radius, straightening the bike up, and rolling on the gas. The exit speed of a Type II corner line is lower than that of a Type I, but since we aren't entering a straight, that doesn't matter.




### So what makes this different from a Sleazeball?

The difference is that the Sleazeball is still braking and tightening up the corner after the apex, and has the majority

of the turning still to go.

A Type II line starts unwinding the corner at the apex, accelerating and straightening up as the bike approaches the track-out point. Since you're accelerating and unwinding the corner, all the avoidance and mistake correction capabilities are still there.

## Type III Corner

The Type III corner is -- taken in isolation -- the least important. Speed into or out of it is of very little significance.

That does not mean, however, that the *line* through a Type III is not important -- far from it. Any sequence of Type III corners must end with a Type I before the next straight, and so it's vital to take a line through the Type III that sets you up correctly for the all-important Type I. You might in fact put together a whole sequence of Type III's, all of which have the sole purpose of setting you up for the single Type I at the end.

A Type III (or sequence of Type III's) will always start with a Type II, which connects it to the previous straight. Again, the line through the Type III should be chosen to allow the goals of the Type II corner to be achieved as well.

Working out the line through a Type III corner can't be considered in isolation. It depends completely on the corners around it. So to find the line through the Type III, we do the following sequence:

1. Fill in the line through the Type I corner.
2. Fill in the line through the Type II corner.
3. Connect them smoothly with a line through the Type III (or multiple Type III's).

The South Course at VIR is unusual in that there is a textbook Type III corner, part of the complex called the Spiral. We'll use that as our example.

Remember that the line through the Type I is *much* more important than anything else. So we start by filling in the line through the Type I, extending it back through the Type III to give us the best approach. Then we fill in the ideal line through the Type II. The chances are that those two lines won't join up:

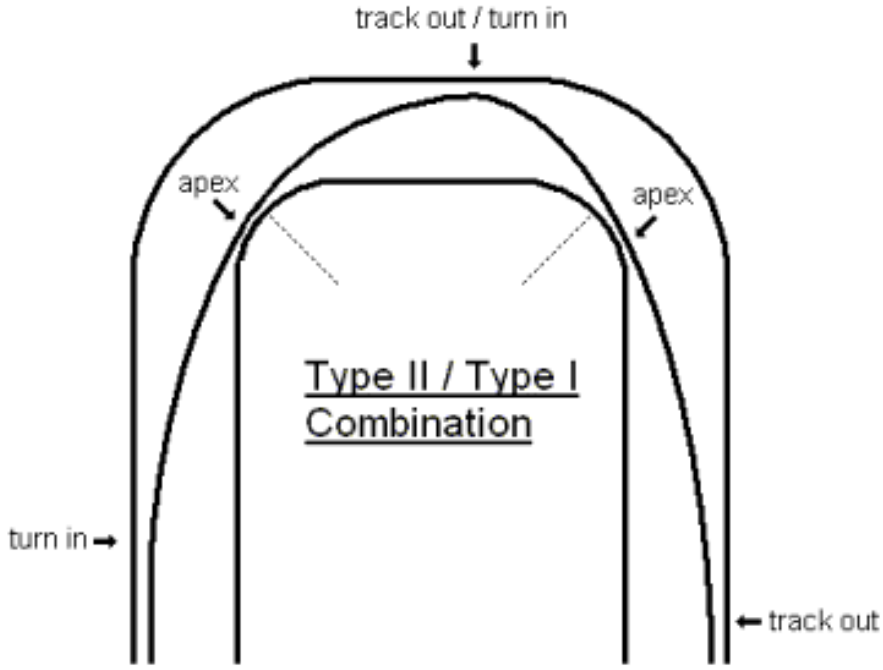
At this point we go back to the rule that a Type I takes priority over everything else. That includes the Type II corner that starts this sequence. So we modify the line of the Type II to link it up to our best line for that Type I. We still want to go deep into that turn, but it's much more important that we come out of it on the left to set up for the Type I.


But don't fix this line in your head yet... the actual Spiral at VIR has an added complication of dropping about thirty feet down, and we have to take that into account too.

## Type II + Type I Combination

At many tracks, there'll be a corner or sequence of two corners that leads from one straight to another. Again, we have a textbook example on the VIR South Course, at Oak Tree. Although it has one name, you can see clearly that it's two corners, connected by a straight so short you can't even call it one. (Another example would be Turn One and Turn Two at Roebling Road, or 3A and 3B on the infield road course at Charlotte.)

Again, when we determine the line, the Type I takes priority. At Oak Tree, it's particularly important because it leads onto the very long front straight -- it's the most important corner on the track. So we first mark out the line we want to take through the Type I, and then draw a Type II line that ends where we want to start the Type I turn-in.

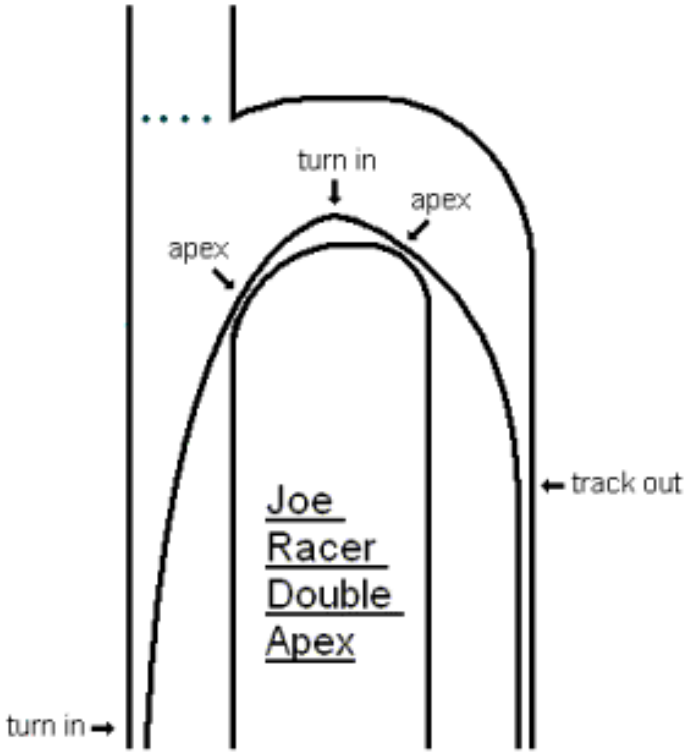


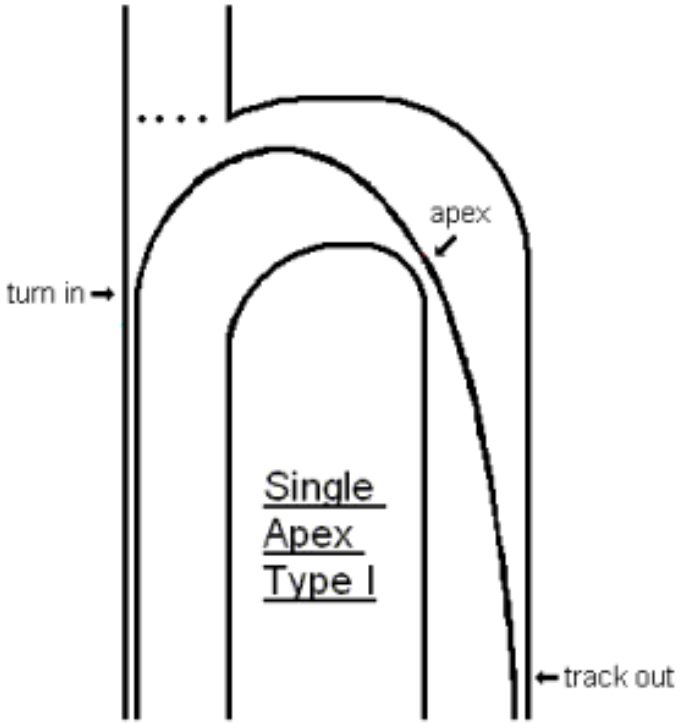

## The Mythical Double Apex

A Type I/Type II Combo is *not* a double apex turn, no matter what Joe Racer tells you. *One* turn has *one* turn-in point; *two* turn-in points means it's *two* corners. Many riders -- the majority, in fact -- lock themselves into a slow line by thinking of this Type I/II Combo as a single turn, and end up taking bad lines as a result. Knowing it's two corners -- remember: *ONE* CORNER, *ONE* TURN-IN! -- lets you analyze each part properly and get a good line through both of them.

Calling a turn a double apex is also Joe Racer's way of rationalizing an excessively early apex. He's an incurable Sleazeball, and turns in so early that he can't take a corner this long in one line. So he hooks together two very bad lines by turning in twice and hugging the inside. Sometimes he'll even call it a triple apex, if his line is bad enough he has to turn in yet again. You'll probably hear someone describe VIR's first turn, Courage, this way.

In reality, Courage leads onto a straight and is a classic 180-degree Type I:



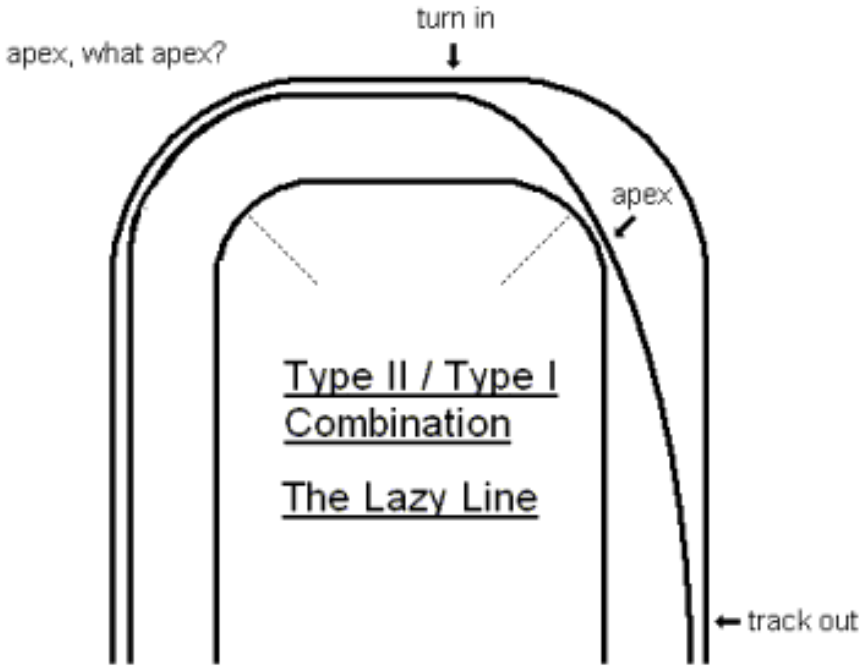




So anytime someone tells you such-and-such a corner is a double apex, take it with a large grain of salt. Nod sagely and accept their words, and promptly ignore them and work out your own line. Anyone who calls a corner a double apex just because it's long probably has too much ego and too closed a mind for it to be worth arguing the point.

## The Lazy Line

Many riders take a halfway approach to a II/I Combination. While they'll take the second part correctly, turning in at the right place, a nice late apex accelerating hard out onto the straight, they'll throw away the first part.

I'm sure you'll hear a lot of this today. "It feels much better to take the first part of Oak Tree wide, then turn in for the second part." The line looks like this:




Well, the statement is correct. It does feel better. That doesn't make it the right line. It feels smoother. That doesn't make it the right line either.

What this line does is ignore the fact that there are two corners here. It makes it easier, sure, because you don't have to work as hard if you only bother with half the corners. It makes no difference to the exit speed from Oak Tree, but wastes a lot of time in the first part by not taking it properly.

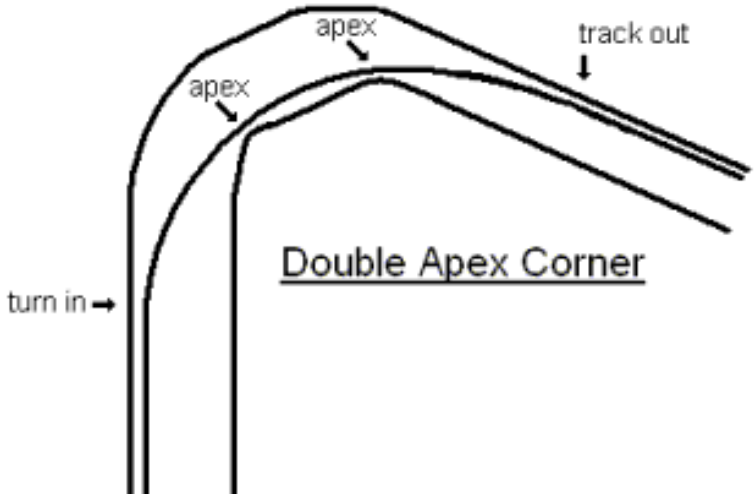
Think about what happens in the first part. While the lazy rider is just cruising around the first part, we've carried more speed into the corner, and are actually back on the gas again before braking for the second part. We have to turn in sharper for the second part, but motorcycles are maneuverable and quite capable of a quick flick into the corner.

Now if you were taking the corner in a minivan, you might want to take the Lazy Line just to scrub off less speed on the turn-in for the second part, but none of you are going to be riding a minivan today. Remember riding around a track isn't supposed to be a gentle cruise in the countryside, you're here to work, and you need to be working all the way around the track.

## The Real Double Apex

So is there such a thing as a double apex turn? Sure there is, but they're rare. To be a double apex turn, it first has to be *one* corner, which means *one* turn-in point. If with that *one* turn-in, your line takes you to the inside, back out a bit, and back in to another apex, it's a double apex.

There are no double apex turns on the VIR South Course.

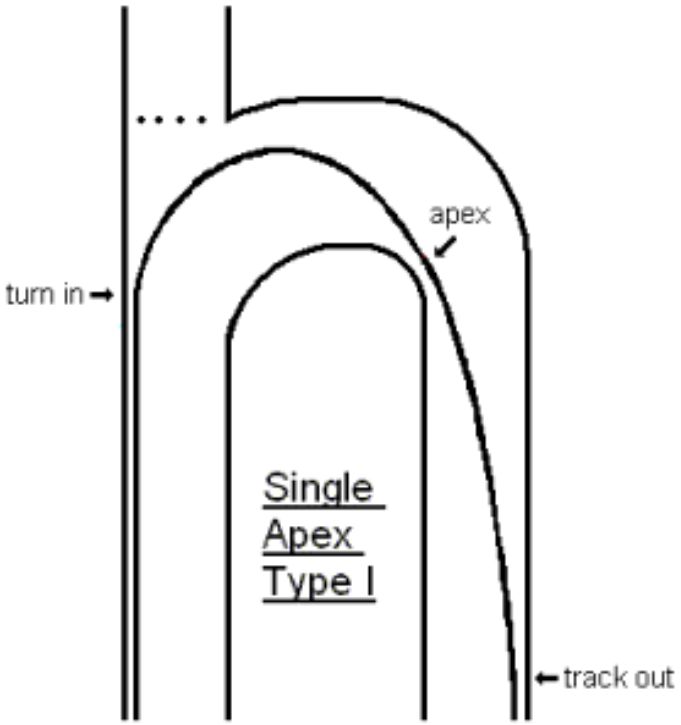


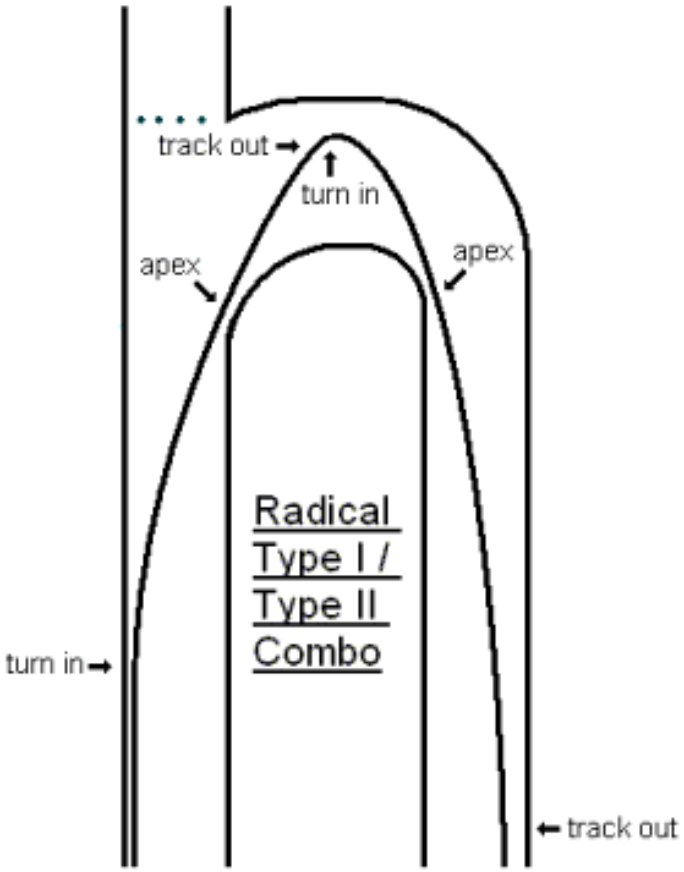

## Is This One Corner or Two?

Some long turns -- generally 180 degrees or more -- give you a choice of lines. A good example is Courage on the VIR South Course, which connects the front straight and the infield straight leading to the Spiral.

With these corners, you *can* take it as a single Type I. You can turn in once, take a late apex, and exit it onto the next straight just like a textbook Type I.

You could also divide it into *two* corners, a Type II coming off the front straight and a Type I exiting onto the infield straight.



### Which one do you use?

Which one works best for you depends on a lot of factors. Does your bike accelerate, brake, and turn rapidly, or do you have to take longer braking, have low power for acceleration, and take longer to turn? In the former case, you can dive into the Type II, snap it over, and launch out of the Type I. In the latter case, the tight turn in the middle takes too long and loses too much speed to be worth it, so a single long Type I will give you better exit speed.

As a general rule of thumb, if you *can* take it as a single corner, try that way first. It's not easy, because you have to turn very late and turn your head way around to look for the apex. In some ways it's more difficult that way, because hitting the apex so far around the corner is mentally hard to do -- it's easy to be a Sleazeball -- but it is the better initial line.

Are there exceptions? Sure there are. No matter what type of bike you have, if the corner is tight enough, you will *have* to slow down to a crawl in the middle of the corner. In that case, you'd just as well slow enough to take it as a Type II/I Combo, since you have to brake a lot and accelerate from a minimal speed.

### Skills you have to master first

Taking a corner as a double II/I requires some technical bike-handling skills that are not easy to put together.

Look at the line above, and you'll see that there's a lot happening very quickly. You get on the brakes, turn in, get back on the gas, back on the brakes, flick the bike over *very* rapidly, and get back hard on the gas again. Mess up any one of those, and if you're not accustomed to how rapidly things are happening, you can be in trouble very quickly indeed. Also, in the case of Courage at VIR, you no longer have the option of the "escape road" if you miss your braking.

Like everything else on the track, slow down when you're working on this. Get the line and technique right, and as you get comfortable with it you can attack the transitions harder.

### Using this on the street

Any of you who've seen me ride twisties in the mountains will immediate recognize one of the ways I go fast in the *very* tight stuff -- for me, every switchback is a II/I combo. It's very hard work, gets some very funny looks, but it is *fast*.

You have to be careful, however, not to over-ride your sight lines. If you can't clearly see the point where you'd transition between the Type II and the Type I, you can't safely take it that way. It works best in switchbacks, where you can see not only the whole corner but the straight following it too.

## Did I Get It Right?

Exit speed is the only real measure of how good you are at a corner. If you want an objective measure of how well you did a corner, get yourself a site picture of the exit and pick a spot just after your track-out point. Your rpms, or speed, there is the measure of your corner. If it's a corner where you have to shift after it, see where you have to shift up -- the sooner you have to shift, the better the exit speed.

Another measure is that you should be *riding* the whole track. There should not be one point on the track where you're not working hard at it. If you find yourself cruising a section of the track, then you're not applying enough attention to it and need to think harder about that area.

Complete lap times mean nothing unless grid position is at stake. I'm not going to address the special needs of a qualifying session, except to say that they don't apply for any other type of session

So we don't need no steenkin' lap times. They mean nothing today. With the techniques I've outlined, you will

*know* whether you got it right or not, for *you* and *your bike* on *this day*. Don't waste attention on worrying about lap times. Take each corner right, exit fast, and the lap time will come.

# Elevation and Camber

There is an added complication that has to be taken into account in the line -- changes in the slope of the track, whether uphill or downhill (elevation), or banked or sloped outwards (camber). This affects how much total traction you have available, and in some corners can change the line quite radically.

## Traction

Simply put, whenever the bike is being pushed *up* by the road -- uphill, or a banked turn -- it's like you have extra weight on the tires, so you have more traction available. That lets you brake harder, turn harder, accelerate harder, and mix those more radically.

Whenever the road is dropping away from the bike, you have the opposite effect -- less traction. That means you can't brake as hard, turn as hard, accelerate as hard, or mix those as readily.

So you want to take advantage of uphill and banked sections to do most of your turning there, and try to keep fairly straight in downhill or off-camber sections.

## Ground Clearance

Camber also affects how much ground clearance you have while cornering. You can use much more lean angle in a banked turn, and that emphasizes the need to make use of the banking to do most of your turning. On the other hand, in an off-camber turn, you can't use as much lean angle, and so you need to be more careful.

## Affecting the Line

Since an off-camber turn leaves you less lean angle, you need to either turn less or turn at a slower speed. Since the traction is reduced too, the slower speed makes a great deal of sense. For an off-camber turn, therefore, slow more and take an even later apex so you can get good drive out of the corner.

# The VIR Spiral Revisited -- the ***REAL*** line!

The VIR South Course has one corner where almost every line modification reason has to be taken into account. It is of course the complex called the Spiral. I'm sure you all thought it looked interesting enough when we considered a flat racetrack back when we looked at Type III corners, but that doesn't even begin to describe it.

The first turn of the Spiral is right at the crest of a hill -- you'll be going over a crest in the turn, and it's off-camber as soon as you get over the crest. It then drops thirty feet into the Type III at the bottom, and from there rises uphill again, with the Type I slightly banked.

So first we have to take into account the Type II being *on* the crest of a hill. Since the traction will drop dramatically as the bike goes over the crest, and we'll have less ground clearance in the off-camber turn, we have to slow more than we would for a flat corner of this type. We also can't trail-brake as much into the corner because of the crest of the hill. Fortunately, the entry to the turn is quite steeply uphill, and we can use the extra traction there to brake later and harder before we turn in. Then we have a moment to get back on the gas, which will help plant the rear in the downhill off-camber section, then back on the brakes and trail-brake into the right-hander at the bottom of the hill.

Now let's look at the exit from the complex, the Type I. Since it's slightly uphill and banked, we can take advantage of the extra traction to brake more rapidly, turn in more rapidly, and get on the gas hard while we're still turning. We can go deeper, turn harder, and be full on the gas well before we reach the apex.

Now back to the right-hand Type III in the center of the complex... This corner is initially off-camber and downhill, so we have to trail-brake smoothly and gently, and turn in smoothly. We end up taking this turn as a sweeping curve, under power, exiting to the right side of the track into the braking zone for the final left-hander.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# Signs of an Early Apex

The worst thing you can do, street or track, is apex too early. You'll end up running out of road, ideas, and options very rapidly at the exit. Since we want no-one crashing today, I want you all to learn to recognize when your apex is early. The sooner you recognize it, the sooner you can fix it.

So the single most important thing you can do to be safe on a racetrack -- or the street, for that matter -- is to be able to recognize an early apex and convert it to a safe line.

## Partial List of Things to Look For

### Site Picture

Your first clue that you're headed for an early apex is your site picture. You can often tell you're turning in early -- to an early apex -- when you do it, based just on realizing that you're not in the right place. If you can catch your mistake now, it never becomes a problem -- you just delay your turn-in until the right place. No-one will even realize you made a mistake at all. This is how the top racers never seem to make a mistake.

## Angle at the turn-in

Most of your turning should be done at the start of the corner. If your angle when you turn in is too shallow, you've turned in too soon. Widen your line by straightening up the bike until you can turn back in again on the right line. You'll lose very little by correcting your mistake this early.

## Can't get on the gas before the apex

If you find you can't start rolling on hard by the time you reach your apex, then you've left too much turning for the end of the corner. That means you've come in too early. You need to straighten the bike up a little to expand your traction reserve, use that reserve to slow down, and turn in again for the right apex. You'll lose some speed, but you'll recover early enough in the corner to make a decent exit.

## Angle at the apex

By the time you get to the apex, the bike should be pointing pretty much down the following straight. If you're pointing towards the edge of the track, you've apexed early. If you have enough traction reserve, you can hold the bike in to the inside of the turn until you reach the right apex; otherwise you'll have to straighten up, slow down, and turn back in for the correct apex.

## Can't unwind through the apex

Before you reach the apex, you should already begin to come back upright as you unwind the turn. If you're still trying to hold it down into the turn, your apex is too early.

## Can't roll on through the turn

Once you start rolling on, before the apex, you should be able to keep rolling on hard through the turn. If you're still holding back on the throttle, you're still doing too much turning towards the end of the turn.

## Angle at the track-out

On the proper line, you should reach the edge of the track as the bike comes upright and parallel to the edge. If you're still turning when you get the to edge of the track, that's a sure sign you've been a Sleazeball.

# How to Fix It

Your priority is to get back on the correct line as soon as you can. The longer you leave it, the harder it is to correct. If you correct it early enough, the impact on your exit speed can be small; leave it to the end, and it'll affect your speed much more -- for example, your speed in a drainage ditch is pretty low.

## Go wider, slow down, turn back in

You can widen your line, which reduces cornering force and gives you back traction reserve. Then slow down. That reduces your speed so you can turn tighter, so you can then hit the right apex.

## Don't roll on the gas... as much

If you're beyond at the apex when you notice you're early, don't roll on the gas as hard. That gives you back a traction reserve, which you can use to tighten your line before rolling back on the gas.

## Hold the bike down to the apex

*If* you have traction reserve, and *if* you have cornering clearance, you can recover from an early apex by holding the bike down along the inner edge of the curve until you approach the real apex, when you can get back onto the proper path. Remember that you still need to be rolling on the throttle to keep the bike settled -- don't make the mistake of backing off mid-corner.

This photo from TrackDoD 1 shows me at Courage, correcting an early apex by holding the bike down into the corner. The clue that I'm being a Sleazeball is the angle of the front wheel -- it's turned to the outside of the corner, countersteering hard to keep lean angle on the bike. By this point in the turn, the bike should be unwinding the curve and coming back to vertical, and shouldn't be scrubbing off acceleration by so much steering input.

*Photo by Mike Ragsdale*

## Get it right next time

If you notice it at the track-out, you've already gone too far to fix it this time. Make a note of it and use a later turn-in and later apex next lap. Use your mistake to revise your site picture of the entry to the turn.

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# Other Mistakes

# Shifting

## Missing an upshift

No problem. Just pull in the clutch, roll off the gas, and shift up again. Maybe you'll be in the right gear, maybe you'll be in one higher, but it'll work.

## Missing a downshift

Now if you miss a downshift, you have other worries. It will distract you, and probably mess up the braking you're doing at the same time. Keep braking deeper into the corner as you shift *up* into the next gear (going down an extra one would be very bad!), and turn in for a very late apex as if you missed the braking marker. You'll be very slow around and out of the corner, but it'll keep you on the road.

# Braking

## Braking Too Late

Keep braking. Go deeper into the corner and brake more until you slow way down, then turn in for a very late apex. If you're approaching the edge of the track, don't look at it, but look in towards a late apex and turn in anyway. The chances are the bike is capable of doing it (since you left a traction reserve today) and you will scare yourself but not crash.

## Braking Too Early

While braking too late is more spectacular, braking too early is also a problem. It's easy to brake too early, and then come off the brakes before turning into the corner. That of course messes up your weight transfer -- your front end is now bouncing back up while you're trying to turn in.

So if you find yourself braking too early, don't come off the brakes completely. Ease off the brakes earlier than you would, but keep some braking so that you keep the front end under control.

# Cornering

## Scraping the pegs

Like I said earlier, scraping the pegs is a sign you leaned too far; I also talked about what to do to stop doing it next time. But what about *this* time? You're in the corner, rolling on the throttle, and the peg starts scraping. What do you do?

The simplest answer of course is "nothing." Lean your upper body in more, roll on the gas, and ride the bike through the corner. That's not easy to do, of course -- the natural reaction is to get off the gas, and that's just asking to crash. You *don't* want to upset the suspension. Keep in mind that when you're in the corner, you want the bike to be smooth. Even when you're dragging the pegs -- or hard parts for that matter -- you must avoid doing anything sudden.

If you have a shaft-drive bike, rolling on the gas very hard can lift the rear end of the bike up and pull the peg clear of the ground. (To a certain extent this works on chain-drive bikes, but it is a lesser effect and depends on swingarm geometry.)

You can straighten the bike up some too, but avoid doing sudden corrections -- don't upset the bike. It doesn't take much to lift the peg off the ground, and a sudden jerk on the bars is likely to cause more problems than you have already. All you need is a small correction.

# Passing

## On Corner Exit

Every successful pass on a straight comes out of the corner before. To pass someone on a straight, you have to exit a Type I faster than they do. That means you need to have enough space between you mid-corner to roll on properly on the exit. You want to reach your own track-out point as if you had the corner to yourself, and *then* use your extra speed to pass. So don't go into the corner right on their tail, give yourself enough room to allow for catching them up at the track-out point. When you reach your track-out point, you should be going faster than they are, and in their slipstream. With them punching the hole in the air for you, you can just power on by.

## On the Straight -- Drafting Pass

Here you back off from the bike in front, and use their slipstream to build up momentum which you then use to slingshot by. Not only will you have momentum to pass, but as you move out of their slipstream they lose the benefits of you drafting behind them, so they'll slow down right as you are going by them.

Today, make sure you leave plenty of space between you. Like drafting in general, this puts bikes close together and therefore at increased risk.

## Into the Corner -- Late Braking

This is a very effective pass, but because of the intersecting paths of the bikes we won't be using it on the track today. During a race, this is probably the most common and effective pass -- and it's also the one that's most often done badly. The possible consequences of doing this badly is why we don't allow passes on the inside in corners today.

## In the Corner?

To pass someone *in* a corner, as opposed to *into* the corner, you must be much faster than the bike you're passing. Here it's mainly a matter of remembering that the rider you're passing will be following their own line -- which might be one you don't expect -- and it's your responsibility to get by safely.

If you can, it's generally better to hang back in the corner, and execute a pass on corner exit as described above. That will give you good exit speed, and good speed on the next straight, whereas passing *in* the corner wrecks your line and slows you down all the way along the straight.

## The Outside Pass

The "outside pass" is an oval racing technique. You can't really use it on a road course except on really long corners, or unless you have a serious speed advantage over the bike you're passing.

The technique is to take the Lazy Line, mostly following the outside of the turn, to get in front of the other rider *before* you approach the track-out point. That means you won't take as good a line as normal, and won't get as much drive out of the corner, and that's why you have to have a big speed difference to make it work. If you don't, it's trivial for you to get passed back by a simple corner exit pass.

You have to remember that until you have passed the other bike, they have right of way. They can take their line to the outside at the track-out, and might not even be aware that you are there. So to do this pass, you must be sure you complete it while still in the corner. Part of the usefulness of this pass with car racing is that you can put your car in a position where they can't track out all the way, and so lose exit speed -- all that achieves on a bike is being run off the track.

## Passing the Coordinator

I am expecting you to take the opportunity to pass me when you can. I will be disappointed if you don't. Through the day I will from time to time set up situations where you can practice your passing technique. Sometimes I'll signal for you to pass, sometimes I won't, but nevertheless if you see the opportunity to get by, don't be afraid to take it.

Unless I've signaled "follow me," of course... in that case I'll probably be slower than necessary just to make sure you get the right line or whatever. Passing then would be counter-productive. But that's the exception, not the rule.

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# Rain

There's nothing magical about riding fast in the rain. Moisture doesn't change vehicle dynamics. All the principles you use in the dry also apply in the wet. Modern tires -- the latest generation in particular -- provide excellent traction in the wet. There are factors you need to take into account to go fast, though...

## Give the Tires a Chance

In the wet tires take longer to adapt to new demands. A tire can break free easily if forces are fed into it too quickly. Braking hard before weight transfer has developed will lock up the stickiest sport tire. Countersteering suddenly can break the front loose. Accelerating too hard can throw the rear into a vicious slide. Nevertheless, all this is easily controllable. All you have to do is remember how vehicle and tire dynamics work, and always give the tire a chance to catch up with the bike.

### Don't Forget How to Ride

The same techniques you use in the dry are the ones you use in the wet. Tires still have most traction when they have most weight one them. Smooth transitions between braking and turning, and turning and accelerating, still give you the most traction. In fact, it's more important in the wet to do it right, because it's easier to break the tires free with sudden changes. Build the forces smoothly -- braking, cornering, accelerating -- and your tires will reward you with good traction.

### Remember Dynamics

Let's look at approaching a slow corner at high speed, like Courage at VIR. As you approach the end of the straight, you need to allow more space for braking -- not just because you can do less braking before locking up, but because you have to build your braking force more slowly.

You come out of your tuck and start squeezing the brakes. As you brake, weight transfers to the front. As weight transfers, the front has more traction. Continue to squeeze the brakes on harder -- as weight transfer builds, you'll

be able to brake harder. The more you brake, the harder you *can* brake! You'll find that provided you *squeeze* the brakes, and let the weight transfer forward, you'll be able to brake almost as hard in the wet as in the dry.

So now you're approaching the corner under hard braking. There was never a better time to take advantage of trail-braking! With the extra traction you get from the weight transfer, you can turn in quite rapidly under braking. Still, it is a wet track, so give the front tire a chance to build the cornering force -- don't snap into a countersteer, keep your inputs smooth and progressive.

Now we've turned into the corner. We're still braking. As the cornering force builds, that's giving your extra force on the tires -- trail off the brakes as they're no longer needed, and start to roll on smoothly before the apex.

Once again, the tires need longer to build forces. Don't roll on as hard as you would in the dry, because the sudden torque can break the rear loose. But *do* roll on, because like braking, the more you roll on and transfer weight to the rear, the more the tire can handle the acceleration.

So the very same techniques you use in the dry are exactly what you need to do in the wet. You'd be surprised how fast you can actually go in the rain, provided you remember how dynamics work, and ride properly.

# Find the Most Traction

When it's really wet, as opposed to damp, going fast means finding the most traction. If some parts of the track are wetter than others, you want to ride on the drier part.

As you ride around, be aware of the track and how the water gathers. Most corners on a track are banked to the inside, so the water will run from the outside in. That means that in the case of a wide banked track, the water will be significantly deeper on the inside than the outside -- on an oval in a Southern cloudburst, you could easily be talking about ¼ inch difference. That's a lot of traction difference. Likewise on the street, the road tends to be crowned, so the center of the pavement will have less water than the edges. Ride where the water's shallow.

Coming out of -- or into -- a corner, you may find that years of racing have left a small depression where heavy cars have worn and compressed the asphalt. That will be deeper than the surface either side of it. Ride where the water's shallow.

It's not only depth of water to consider, but the traction of the surface. For many years, Summit Point had long concrete strips through many corners where cars had worn the surface. That concrete was treacherous in the wet. So pick your line to avoid the concrete. Also, a well-used track in a dry spell will build up rubber on the line. That rubber will be slippery until it washes off -- pick your line to avoid those streaks.

# Rimshots

When it's really wet, riding a "correct" line can take second rank to finding traction. If the track's well-used, or there was a sports-car race right before the bike event, the rubber will be on the line -- it will lay down in the braking zone, go across to the inside, and track back out at the exit. So taking the line will put you on slippery pavement.

Under these conditions, you'll find the most traction following the radius of the corner -- a Lazy Line. You have a choice of following the outside of the corner, or the inside -- both take about the same time to get around the corner, but on the outside you'll be going faster and therefore have better exit speed from the corner.

So that's what a Rimshot is: a Lazy Line deliberately taken around the outside of a corner in the wet to find more traction.

Approach the corner on a line offset from the normal tire track. Brake in a straight line, trail off and into cornering

as you cross the dry line, and roll on slowly through the corner as you follow the outside. You should have the bike mostly straightened up as you re-cross the rubber on the dry line, and accelerate on a line offset from the normal tire track on the exit.

# Drag Strips

If it's that wet, you won't be able to roll on much in the corner as you take a Rimshot. You'll be exiting the corner straight upright, without a whole lot of speed, a couple of feet inside the outside of the track to avoid the exit rubber. Now you have a drag strip straight to the braking zone for the next corner.

So in flood conditions, the course is a series of Rimshots and Drag Strips.

# Vision

You can't ride if you can't see. This applies whether you're doing 10mph in city traffic, or 180mph on the racetrack. So prepare for rain to give you the best visibility.

There are two keys to seeing in the rain -- clearing the rain from your visor, and preventing fog on the inside.

Clearing the rain from your visor is easy: Rain-X. Apply it using the directions on the bottle, and it'll work as advertised. The faster you go, the clearer will be your visor.

Eliminating fog is harder. A Fog City Fog Shield, applied correctly, will do a fine job. (I find it works best to polish the inside of the visor with a very fine plastic polish before applying.) Some people don't like them, and in that case there are a number of alternatives. Various commercial anti-fog treatments are available of widely varying effectiveness. There's also the scuba diver's standard of rubbing saliva over the faceshield and rinsing with water -- it works just about as well as the commercial products, and is free; and you'll always have saliva at the track. Some people have had success with Rain-X on the inside of the visor, which does reduce fogging, and also beads it up and helps it roll off. In all those cases, a breath guard inside the helmet will help.

If it's really bad, there's always the car racers' standby: Attach a lump of duct tape to the bottom of the visor, so that you can jam it down and still have a ¼ inch or so of gap between it and the helmet. If it's flood conditions, rain will get in, but at least it won't fog up the visor.

# Rain is FUN!

But the real secret to riding fast in the rain is simple: enjoy it!

Riding fast in the rain gives you a unique opportunity to examine the dynamics of riding the bike. The tires' response time is slower, you have to take more time over your actions, and the overall effect is of riding in slow motion. You have more time to think about what you're doing, observe how the bike reacts, feel what's happening. You can learn more by riding on a wet track about bike-handling skills than you can in the dry.

If that doesn't thrill you, find something else to enjoy. I used to love watching the way the front tire on my Intruder threw up a line of spray, especially when it was illuminated by the headlamp at night. I love the sound of rain on the helmet. I love the way I can so easily see through my Rain-X'd visor when the cars around me are peering through ineffective high-speed wipers. I love watching the spray thrown up from the bike ahead of me. All these are things that adjust my attitude to riding in the rain, give me something to enjoy so I can relax and concentrate on riding.

But heck, I also love watching snowflakes in the airflow around the front of the bike, so maybe I'm just crazy...

# Conclusion

## Am I Going Fast Enough?

A track day is the New Math of motorcycling. It really doesn't matter how fast you are, as long as you use the right method. Working on lines, working on weight transfer, working on braking points -- all these are things best practiced while riding below 10/10ths.

To start with, you may even get slower as you unlearn bad habits and slow down to get things right. A squid charging at the corners might well be faster than a rider learning the right techniques -- at first. After a while, the rider practicing proper skills will be faster than the squid -- and by then the squid may well be off in the weeds staring at a wrecked bike.

Remember also that part of the process is letting go of "feeling fast." The object is to go fast without it feeling fast, being in control of everything that's going on.

So come out of today with your measure of success being your own personal improvement. It doesn't matter who's faster or who's slower, just that you yourself have worked on your technique and improved.