

THE ROAD YOU RIDE

An Expert's Eye View of the Racetrack and Getting Around it With Speed and Efficiency

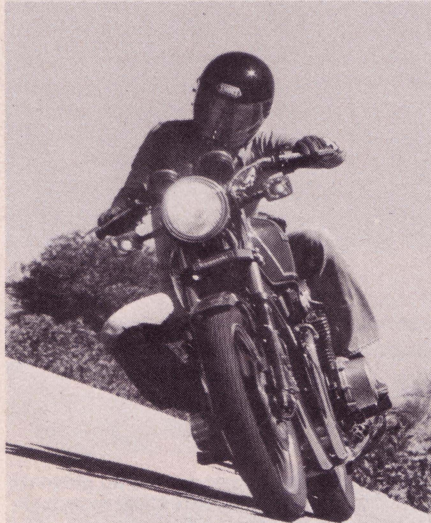
The following is excerpted from Keith Code's upcoming book, *A Twist Of The Wrist*, which details the technology of riding and racing.

How much should you know about the road you ride? Which aspects are important and which are not? Why are some pieces of road harder to ride than others? Riders invariably have their favorite sections of road, the parts that flow together into a dance where everything happens just the way it's supposed to, no surprises. On the street or on the track, you know which ones they are, but why are they so comfortable?

First, some background. Highways are constructed so that people can travel from point A to B. The highway engineers are very thoughtful; they want to see you make it in one piece. The turns are often gently banked, decreasing-radius corners are rare; seldom is there a hairpin at the end of a straight stretch of road. Off-camber turns are avoided wherever possible. They strive to construct the corners in a predictable and straightforward way.

A racetrack is another sort of beast. Not much of anything is done for your convenience. The designers are out to construct a course that will continue to create a changing situation for the rider. It is intended to fool and challenge you. Hairpins are put at the most difficult sections of the track, usually after the fastest straight, and "S" turns, or chicanes, often have a slower exit than entry. Corners may baffle you with several camber and radius changes designed into the road to break your flow and force you into unusual situations. And always, the faster the turns are negotiated, the more difficult they become. There are, however, only five major changes that can be designed into an asphalt road. What are they?

1. Changes in camber. A piece of road can have positive camber (banking), off, or negative, camber (the inside of the road is higher than the outside) or it can be flat. A turn may be designed with any combination of these cambers.
2. Changes in radius. A single turn may be constant radius, as in a perfect half circle. It may decrease in radius, tightening up toward the end, or it may have an increasing radius, opening up at the end. It may be a combination of all three.
3. Series of turns. In a series of interdependent turns, you have to anticipate the next part of the turn when you make a line through the first part. A series of turns can have any or all of the camber and radius changes listed above.
4. Uphill, downhill and crested track changes. Elevation can be added at any point to any type of turn or change in a road or track.
5. Straight sections. The places where no turning or very little turning is required.



These are the major types of changes that can be engineered into a piece of asphalt. With the addition of bumpy sections, which are not planned by the designers, you have all of the situations that are possible. Figuring out which of these characteristics are present in a road or track is essential in order to understand and conquer it. Each of these changes has a direct influence on you and your bike's progress through the corner. In order to ride quickly and safely, you must understand how these changes affect you and how you can best handle them.

POSITIVE CAMBER OR BANKING. Most everyone is comfortable riding a section of road that has some banking or positive camber. The banking has the effect of holding you up by creating a "wall" to push against with the tires. The bank also has the property of slowing the bike down even more when you enter the turn because of the increased resistance created by this wall. When you are riding on a banked surface, it is very difficult to see the banking. If it is a slight bank you may not notice it at all, unless you look at the turn before you ride it. On the high banks at Daytona, after riding the outside tri-oval for several laps at a record attempt there, the banked sections actually appeared flat and the pit area looked tilted at a 20-degree angle. It is easy to be deceived by even a small amount of banking because you are leaned over and don't have a straight view of the road. Also, it seems that the banking becomes less noticeable as you increase speed. You should always design your approach so that you can use the banking to its best advantage. That means you should stay low in the bank for as long as possible. In other words, you should be as close to the inside of the track as possible when the banking begins to flatten out. By doing that you give your-

self and the bike the maximum holding advantage the banking offers before the bike begins its outward swing on the flatter section from the forces of acceleration.

Your bike and you in a turn are just like a weight on the end of a rubberband when you swing it around. The faster you swing it, the heavier the weight becomes and the more it tends to want to go to the outside. The banking holds you in until you move onto the flatter section of road that follows. You can go into banked turns faster than it looks like you can. When you size up a turn visually and estimate how fast you can negotiate it based on your previous experience with turns of that radius, you will be fooled by the banking. Initially, you will probably find yourself going in much too slowly. Again, the banking will hold you from going to the outside.

Additionally, when you are exiting a banked section of road to a flatter surface, you must straighten the bike since it will drag more easily when the banking is gone. Example: if you are in a banked section and you are leaned over to the pegs, you must lean the bike over even more in relation to the track surface to keep that degree of turning radius when the bank is gone. If the bank is ten degrees, you must lean the bike over ten more degrees to keep that turning radius. The banking gives you more ground clearance than does a flat section of track. I have known riders, who could run lap times on racetracks that were very close to record times and had raced on the course 30 or 40 times, who finally discovered that one section of track was banked—and *that* was why they could do what they were doing. If you don't discover things like this, you might be getting away with riding maneuvers you feel you shouldn't without ever knowing why. By discovering the explanations behind your abilities, you can begin to use the track to your advantage.

OFF CAMBER OR NEGATIVE CAMBER. I don't know any riders who regard an off-camber turn as their favorite. Riders generally dislike them. These turns seem to have less room for error; they definitely do not inspire confidence. A turn that begins banked and ends up off camber is the one that demands the most changes and adjustments in lean angle. In order to continue around the turn, the bike must be leaned over farther. The effect is much the same as going from a banked to a flat surface. You lose ground clearance. Therefore, the idea in off-camber turns is to set them up so that you are in the off-camber situation as little as possible (just the opposite of a banked turn). You must try to minimize the amount of time and distance that you are being influenced by in the negative camber. Use straight lines on the part of the track that is off-camber. In other words, you don't want to be committed to your maximum lean angle going into an off camber section. Ideally, you would only commit yourself to the maximum lean angle at the very end of the section.

There is an alternative to this that has been used with great effectiveness and actually sets up the situation so that you do the greatest leaning in the middle of the off-camber part. It has been called "squaring off" a turn; it has been called

"going slow in the slow parts." Whatever it is called, it refers to the type of turn handling that allows you to straighten out the negative camber as much as possible. Driving in as vertically as possible and then making the major steering change and driving out on a straightened line is basically the idea.

There is another, more basic way of looking at this situation. It is easier to see the basic turn than it is to see the changes in camber because the basic turn is more obvious than the camber change. This is one of the deceptive tactics of the race-track designer. The rider is sucked into the turn because he is basing his riding tactics on what the turn looks like from his preliminary investigation instead of taking into account the changes in camber that can so seriously affect him. He should realize that gravity is now pulling the bike in the opposite direction of his intended turn. The tendency of the bike to go toward the outside in an off-camber turn is dramatic.

FLAT TURNS. Turns with no negative or positive camber will not increase or decrease the lean angle necessary to negotiate a turn at a constant radius or constant line. Turn Two at Daytona is a great example of a basically flat turn with no radius changes, and most fast riders prefer to ride it on the inside. In a turn like that, the fastest way through is the straightest line and shortest distance around the turn. In a flat turn there is no attempt to fool the rider unless a radius change is put in for variation. These turns are the ones that commit the rider to his maximum lean angle and maximum speed for the longest period of time. There aren't a lot of tricks that apply to this turn; you are going to be riding around the inside at max speed and max lean sooner or later, so you might as well get down to it. Taking a wide entry into one of these will just give someone the chance to pass you.

CHANGES IN RADIUS. Changing the radius of a turn is a tool used by the designer of a track to put an additional twist into the action.

CONSTANT-RADIUS TURNS. A constant-radius turn is one that neither increases (widens) or decreases (tightens) as you go through it. As mentioned above, if it is a fairly long constant-radius turn with no camber changes, you will eventually wind up down on the inside of the turn for most of it. If it is a short, hairpin turn, you may have other options on how to set up the entry and exit. In a really tight hairpin, you have to make an abrupt turning change at some point; it should be done at the point at which you feel most confident. There is no rule on how it is supposed to be done. If a constant-radius turn has camber changes, it can act as a decreasing-radius or an increasing-radius turn. For example: if the turn is banked on the entry and flattens out on the exit it will have exactly the same effect on your bike as a decreasing radius. If it is flat on the entry and banked on the exit, it acts as an increasing radius. It is very common among amateurs (and professionals, as well) to ride the turns the way they appear to them at speed and not the way they really are. It is very easy to have your attention stuck on the radius of a turn and not see the camber changes. Thus, knowing

where the camber changes are will greatly help you plan a turn.

DECREASING-RADIUS TURNS. This is a turn that tightens up as you go through it. In a decreasing-radius (DR) turn the designer tries to trick you into treating it as a constant-radius, one-apex turn. If you fall for that, you will be forced to do one of three things: 1) Run wide at the exit, 2) Lean the bike over more at the end of the turn, or 3) Back off the gas, so that one and two don't happen. *A decreasing-radius turn has at least two apexes.* If you try to cheat the turn out of one of these apexes, it will get you back at the end. In a DR turn you must ride what is there; you must not try to make the turn something that it is not. There is some misleading information that has been circulating among riders for years about DR turns. It is said that you "late apex" DR turns. In a very tight DR turn this may be true, but in a larger turn the actual handling is to double-apex the turn. You should widen the entry in order to make the turn larger for yourself, spreading it out by making it longer with the wide entry line. This keeps your speed up and cuts down on the abruptness of the actual steering change. A DR turn that is flat on the entrance and banked at the exit will act as an IR turn or a CR turn, depending on the severity of the banking. If a turn is constructed so that it forces you to go slow at some point along the line, you must decide where to go slow instead of letting the designer decide for you. By figuring a turn for what it is, you ride the track, the track doesn't ride you. If you make a big mistake in line, you have probably just been sucked into riding the track the way it looks rather than the way it is.

INCREASING-RADIUS TURNS: This turn widens as you go through it. An IR turn is probably the safest feeling kind of turn because they have room at the end to make changes and corrections. As the turn increases it constantly gives you more room to do what is needed. You can recover easily from going into an IR turn too fast; you have plenty of room. An IR turn can be changed dramatically by the camber of the road, just as the DR turn can. If it is banked going in, and flat or off camber on the exit, it will act as a CR or a DR turn, depending on how much negative camber it has. *The radius of the turn is usually secondary in importance to the camber of it.*

SERIES OF TURNS: When two or more turns are linked together in such a way as to influence each other, it is a series of turns. Series of turns are usually designed to slow you down at the place where you should be able to go faster. For example: the entry into a two-turn "S" is faster than the exit. If the entry is taken as fast as possible, it will spoil the exit. If the entry is approached with the exit in mind and some of the speed is sacrificed there, the rider can begin a more constant drive out of the turn rather than having to back off and re-setting the turn for the exit. It is very distracting to make this kind of change at the second turn in a series. Kenny Roberts has often said that you must go slow in some places in order to go fast. His "slow," of course, would put most of us into cardiac arrest. Here again the designers attempt to lull you into taking action

either too soon or too late. In some high-speed chicanes, being temperate with the throttle on the way in and setting up a smooth exit is worth over a second in lap time. Chicanes such as those at Pocono, Daytona, Riverside and Sears Point are examples.

UPHILL, DOWNHILL AND CRESTED TURNS: When the track changes in elevation, it can create some exciting changes in how you ride a turn or section of a road. Uphill and downhill sections of a track don't pose any particular problems unless they are in conjunction with a tricky camber change, radius change, or both. Difficulties in up and down sections usually arise where there is a crest or sharp rise followed by a downhill. At that point the bike will feel light and will be light on the ground as well. Braking over a crested hill is tricky because the downward pressure of the bike is lessened at that point, resulting in less traction. It is very easy to lock up the wheels. Riding a turn with a crest in the middle of it has the same effect. The bike tends to stand up and go toward the outside. There is again a loss of traction. It has the same effect as a short patch of off-camber road. It is best to go over a crested road as vertically as possible. On uphill sections where braking is done you have an advantage. You can stop or slow the bike faster than you can on flat or downhill sections. If the hill that you are braking on has a 15-degree slope, you have a 27-percent better stopping factor. You can use the brakes 27-percent harder without locking them up. That's a lot. On a downhill section the situation is reversed; the brakes are easier to lock up. The other possible problem with up and downhill and crested roads is that bikes tend to wheelie over them. That isn't really a problem unless you have to make a turn while the front wheel is still in the air. Since that's the wheel you steer with, you have to have it in contact with the ground in order to make an accurate direction change.

STRAIGHT SECTIONS. These are the portions of the track or road where no turns or changes affect you. You are going in a straight line, more or less. Straightaways are a great place to relax for a second or two. Check and see if your breathing is regular while you are on the straights. Often riders tend to hold their breath during intense riding, which slows their efficiency. Lack of oxygen is certainly one of the causes of muscle cramps during riding.

The road you ride, whether it be public or racetrack, is made up of the five components: camber, radius, elevation, series of turns and straights. How these components are combined determines your approach to riding them, not only where speed is the consideration but for safety's sake as well. The purpose of a racetrack is to test and retest your skill; it is intended, by the designers, to be difficult. It is constructed to pose problems for you. Your task is to unravel the mystery of the construction, using your knowledge to your advantage. No amount of bravery will substitute for understanding, and no amount of suspension changes will entirely overcome the forces generated by the five components. —Keith Code