HOW TO ADJUST YOUR BIKE

HANDLING CHANGES

Turning and Tracking Modifications

By Rick Sieman

Handling, a very general word that covers a lot. So, for our needs, let's define it, just so we can get on some common ground.

For our purposes, handling means: How a bike turns in the corners. Does the front end wash out, or push to the outside? Or does it tuck under and let the bike flop over in slow turns? At the rear end, handling is how the bike tracks under acceleration and how the rear end behaves over bumps. Lastly, we'll define handling as just how the bike feels "overall." In other words, does the bike move around quickly, or is it very stable and slow reacting to rider input? While there may be minor points not covered here, this definition of handling should serve our needs adequately.

You see, the reason we needed to go into all of that "defining," is because we're going to explore some thoughts on how to change the handling characteristics of *your* bike to suit *your* riding style. Now, this doesn't mean that you'll have to get out the torches and the hacksaw. Nope. The changes we'll describe here are within the scope of that mythical "average" rider, wherever he may be.

Experiments at the Rear

To understand just how little changes on a bike will alter handling characteristics, let's take a "normal" bike and, by making small adjustments, *ruin* the good handling traits.

Assume that we have a Suzuki RM125T model in front of us. This particular bike has no serious flaws in handling, if all the suspension components are in reasonable shape and springs are not sacked out.

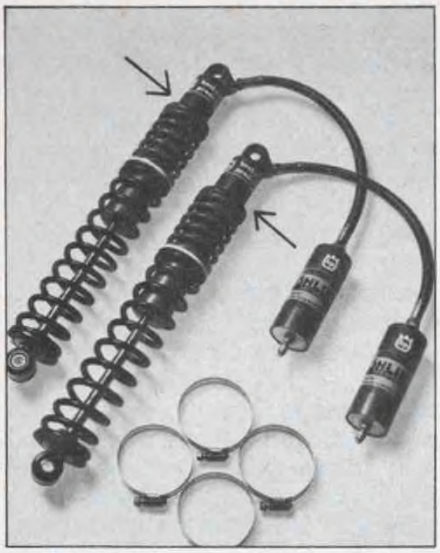
O.K., now let's take this RM125T through a more or less average motocross corner. For this demonstation, make it a hard-packed, flat, second gear, right hander. After you've taken a few passes through this turn, you find out that the RM works all right and the front end sticks reasonably well, as long as you scoot your body weight up on the tank a bit.

Back to the pits. Take the side panels off the bike and fiddle with the clips that determine the preload on the shock springs. Take them to the softest possible position. Slip your side panels back on, then head out to the track and that same turn once again. Chances are very good that your front end will wash out badly, no matter how far you slide up on the tank. And, if you happen to make it through that turn without falling down, you'll probably notice one other strange phenomenum: The rear end of the bike will not be hooking up under acceleration, but will be slithering from side to side like you have a flat tire.

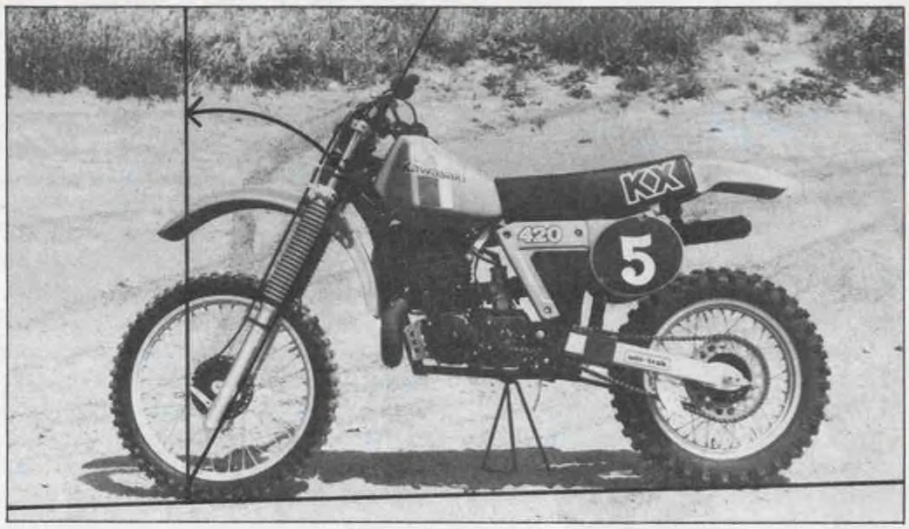
Two things should be obvious at this point: One; whatever you do to the rear end will affect the front end. And, two; whatever you do to the rear end will, quite naturally, affect the rear end. Item two, a chimp could figure out, but item one seems to escape many riders.

The one clear, inescapable fact that emerges from this experiment is the following: *If you do not have enough pre-load on your rear end, your front end will steer like a pig!* This is one of the reasons you hear so many riders snivel, "Hey, my bike worked just great when it was new, but now it handles like a pile." Perhaps this complaining rider should consider compensating for sagging springs and such to restore the good manners that were built into his bike?

Invariably, when we get a chance to ride the bike of a working pro rider, we find out that the rear end is set very firm and the forks are set soft. Of course, there are exceptions to this rule because of rider personal preferences, but, by and large, this seems to be a very consistent thing.



By increasing the preload on the shocks, you can make the front end of your bike bite better in the corners. This can be done without removing the shock from the bike, in many cases.



Rake is calculated through the steering head, not the forks.

And, we usually find out that their bikes turn very sharply on those flat, bermless corners. We could pull that same experiment on the pro's bike, reduce his preload at the rear shocks, and his bike would lose that steering accuracy instantly.

One thing that we almost forgot to mention was the tendancy of the rear end to slew around when too little preload is used. Interesting thing, that. Consider. When you punch the throttle to accelerate, the rear end of the bike will squat down and the front end of the bike will try to rise. If your springs are way too soft (or the preload is not sufficient), the bike will wallow under the load from the engine. If the bike is not pefectly straight up and down when you accelerate, the rear end can swing wildly off to one side or the other.

This should impart another fact to you: If your bike is doing this slithering act out of most corners, you need either more preload, or even maybe a heavier set of springs on your shocks.

Up Front, Now

Back to our flat corner again. This time, let's take the bike through the turn with way too much air in the forks. Normal pressure calls for around 11 psi, but since we want to experiment, we'll slip in 20 psi, just to see what'll happen. O.K., end of the straightway, get on the brakes and try to turn. Whoa! Chances are you'll have a very hard time getting the bike to lean over and complete the turn. The RM will want to "stand up straight" and continue in its original line.

Why? Simply because the excess pressure in the forks would not let the front end of the bike "dive" enough under braking to reduce the geometry to the numbers required for sharp cornering. Let's take a look at these numbers and get into the mysterious realm of . . .

Rake and Trail

Boy, you hear a lot of people tossing these words around, don't you? Wonder how many of them know what they actually mean and how they affect the handling of your bike?

Rake, at first, seems to be a very simple thing. Most folks think it's the angle of your forks with the bike sitting level. Wrong-O. Rake is calculated through the steering head, not the forks! Read that again. *Rake is calculated through the steering head, not the forks.* The angle of the steering stem itself, which is inside the steering head, is the determining factor. The only reason that we use the stem, rather than the head, is because of a few odd designs (Can-Am's adjustable cones, for example) where the steering head angle and the stem are slightly different.

As you can see from the simplified diagram, the fork angle on most bikes matches the steering head. So why, except for a few oddities, don't we just use that for a base angle?

The reason we use the steering head, rather than the forks, is because we have to determine "trail" from steering head, also.

Here's another diagram, this one showing both rake and trail. As you see, we draw a line from the steering head to the ground. Then, we draw another line right through the axle to the ground, as if it was hanging from a string. The distance between those two points is what we call trail.

Here you can see both rake and trail drawn in. In general, the less rake and trail, the sharper a bike can turn.

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Normally, here are some rules to follow. If you have a lot of trail, the bike will track well at high speeds in a straight line, but will steer slowly and tend to push in the turns.

If you have very little trail, chances are the bike will turn quickly, but not have much stability at higher speeds. This is why the forks on trails bikes are almost straight up and down and why those on drag racers are pushed out like choppers.

More general rules: If you have a fairly modest rake, say 28 degrees, chances are your bike will turn well, especially at slower speeds. If you have a bike with 30 degrees, for example, it'll probably track straight and true at higher speeds and be difficult to twist through any corner without the front end washing out.

Combinations Thereof

Right about this time, maybe an idea entered your head: What if you could figure out a way to get a minimal rake (28 degrees or so) combined with lots of trail? Wouldn't that give you the benefits of both, with no shortcoming to speak of?

Sure. That's why just about every dirt bike now made has a forward axle setup. And that's why the Maicos of the early and mid-seventies had such an advantage over every other bike in the corners. They were the first with a forward axle, among other things.

Of course, other manufacturers have caught on.

Enough of theory, however. Let's get on to the important stuff, like . . .

How You Can Change the Handling of Your Bike to Suit Your Style

We'll base our discussion of handling changes on motocross techniques. If you're an enduro rider, or a desert racer, the information applies directly to you. Use it as you need it.

First off, we can all agree that various bikes handle differently. Some are sharp turners, while others track well at high speed, but are sluggish in the corners. You will not be able to make one bike do all things, at all times, under all conditions. If you're a desert racer, then you should set the bike up to track straight at higher speeds and sacrifice some steering accuracy in the turns.

If you're a motocrosser, you'll want that bike to turn well, yet have some good stability at medium speeds for jumps and whoopers. Enduro riders, in general, will want a plusher ride, but still need a bike that snakes around trees, rocks and such. Of course, the conditions in your particular area will determine just how you'll want to set your bike up. Some western enduros are little more than desert races. Some MX tracks are so tight and twisty that riders barely get over 45 mph.

(1) Always start with the rear end when making handling changes. Try to accomplish what you want with the back before you tamper with the forks. If you want to make your bike turn sharper, our first suggestion is jacking up the preload, as we discussed earlier. Naturally, you'll make sure that your springs and shocks are in good working condition before you try anything. Trying to adjust a burnt-out set of shocks is like blowing you nose in your riding gloves. It can be done, but why bother?

The position of your axle can affect the front end. If you have your rear axle adjusted all the way to the back, it'll give you slightly more travel, slow the action of the rear end down and put an increased load on the shock. Generally speaking, if you move the axle all the way to the rear, your bike will get more stability at higher speeds and the rear end will respond slower. If your bike has a nasty habit of the rear end jumping out, or kicking to the side over choppy bumps under acceleration, this is one of the first things you ought to try. It's like getting a lengthened swingarm free.

Most bikes have about a two-inch range of adjustability in the axle slots and some have even more. The only inconvenience with this method of adjusting is that you'll have to remove links to take it forward.

One word on moving that axle forward. If you ride on a tight and twisty track with few bad bumps, the bike will turn sharper and respond quicker with the axle in the far forward position.

Moving the axle to the far rear position is also an easy way to soften your rear end up, if you happen to have a bike that comes with springs that are too stiff for your body weight and riding style. Some riders feel that the new YZs, for example, are sprung too stiffly for them, so they opt for the lighter mono spring. Now, they have a supple ride, but the bike loses a lot of steering accuracy in the process. By simply moving that axle back, they not only soften-up the feel of the stock spring, but actually gain a bit of travel.

(2) You don't want to get into conditions of extreme preload. If you can't get the front end to start biting and all of the available preload is used up, then consider going to heavier shock springs. When this is done, you can then back off the preload and start adjusting all over again. Most fast riders prefer to be slightly oversprung on the rear and run a light to moderate preload. You should be able to bottom your rear suspension out occasionally, but only on the most severe bumps, when you're genuinely charging. Your rear suspension should be able to take a surprise hard hit without bottoming out.

(3) One other way to change the steering is to change the length of the shocks. Let's assume you have a bike with 15.5-inch shocks on the rear, and, even after you've made all of the adjustments available, the bike still will not steer. By going to a 16-inch shock, you'll change the rake (and trail) on the front of the bike. A small half-inch change on the shock length means more than a degree of rake change up front. And one degree is a massive change to a bike's geometry.

Then, too, a half-inch longer on the shock means that the rear end of the bike will sit at least one inch higher . . . and probably more. Most modern bikes have a Suspension Lever Ratio of at least 2 to 1. This means that for every inch of shock travel, the rear axle will move two inches. Some bikes have SLRs of 2.3 to 1 and more. So, any changes you make to shock length will have a dramatic effect on how the bike handles.

Actually, it's best to leave a shock length change for very last. Wait until you've tried everything else available, including any and all possible front end adjustments that can affect steering and handling.

(4) Damping adjustments can add confusion to changes made at the rear. To set things straight, consider damping and what it is . . . and what it does. Damping (not dampening) is merely a method of slowing the action of the shock down. On compression

damping, oil is forced through orifices inside the shock as the shock is being compressed. For most riders, you'll want as little compression damping as possible.

Rebound damping is nothing more than the oil being forced through holes as the shock extends after being squashed flat. This is critical. If you have too little rebound damping, the shock can return to the fully extended position too quickly, causing the rear end of the bike to "pogo" wildly. When a shock fades, this is what happens. Insufficient rebound damping can destroy your steering in the turns and make the bike handle like a maniac over the bumps.

In general, we like to see very little compression damping and just enough rebound damping to slow the rear wheel down on the return stroke. Too much rebound damping can cause the rear end to "pack down." If your rear packs down, two things happen: Less travel is available, because the shock can hit a bump while still partially compressed; and a packed-down shock means that the geometry of the bike is now grossly off and the bike will not turn normally.

By raising the fork tubes in the triple clamps, the rake and trail can be reduced on any bike. Make sure that your tire won't hit the fender at full compression.

Forks and Fiddling

(5) We know that changing rake and trail dramatically affects how a bike handles. The simplest way to reduce both rake and trail is to raise the forks up a bit in the triple clamps. If the front end on your bike washes out, try sliding the fork tubes up about five millimeters at a time. Make sure both legs are even.

If the first move isn't enough, move it 5mms again. Refer to your manual to find out just how far you can raise the forks without the tire hitting the front fender. If your manual doesn't tell you, then you'll have to remove the fork springs, sack the front end out completely, and measure for yourself.

As you move the forks up, you'll feel the difference with each small change. Ride the bike after each adjustment, until you get the bike turning just like you want it.

(6) Often, you'll get the front end biting and sticking well, only to have the rear end start to get squirrely. Here's where you have to go back to the rear end and possibly make some compensating adjustments, like moving the axle back, etc. Experiment.

(7) This next point is so simple that we almost hate to mention it, but, many riders appear to be unaware. Tires, or lack of. If you have a bike with a worn out or poor front tire, that may be the sole cause of your bike's refusal to turn. One of the things that we always do with a test bike that is suspect in turning matters is slip a 3.00x21 Metzeler up front. It's one of the finest pieces of rubber available, and if your bike doesn't turn with a new Metzeler up front, then you are definitely ready for any and all adjustment at your disposal.

(8) If you want your bike to handle like a train on the tracks at high speeds, you can reverse the fork adjustment and extend the forks in the triple clamps. This will increase both rake and trail and make your bike very stable at speeds. Of course, you'll pay the price in the turns.

(9) Varying oil viscosity and levels can affect the way your forks compress and rebound. This can also affect the turning. When the brakes are applied, the front end dives. The quicker and easier it drops, the less the rake. The less rake, the sharper the bike will turn. Every modern owner's manual gives you basic starting oil levels and guides, for softening and firming the forks. Use as needed in conjunction with moving the forks up and down in the triple clamps, and you can drastically change the way your bike turns.

A word of caution. Too soft is not desireable, because if the forks dive too easily and quickly, the front end can tuck under while you're turning. You'll have to experiment to suit your needs and riding style.

(10) Air pressure in the forks also affects the turning of the bike. Air is nothing but a cheap infinitely adjustable spring that aids your standard springs. The more air pressure, the less your forks will settle under braking. The less pressure, the easier they settle.

(11) Other options are available to you for handling changes. Some of them are expensive and we'll merely mention them to arm you with knowledge.

Different length forks are available, as are trick swingarms. Both can make big changes to your geometry. Both cost lots of money.

Tires are not all the same height. Let's say that you want to add a half-inch in height to your rear end, but do not want to invest in a slightly longer set of shocks. Measure your rear tire, then go to your local bike shop and find a taller rear knobby. Zongo, instant geometry change!

A few years back, special uneven triple clamps were available for various bikes. These changed rake and trail by changing the relationship of the steering stem to that of the forks. You can still find these clamps around. Our advice is to avoid them as if they were touched by the plague. You can find your bike perilously close to negative trail with these bogus units.

Peg location and height can also affect handling, by allowing the rider a more pronounced weight shift than the stock setup.

A simple thing like bar shape can also make the bike easier to turn. Experiment to suit you needs.

One Last Factor

All of the adjustments and changes aside, one last important thing can also greatly affect how your bike handles . . . that's the rider, and where he is on the bike. Learn how to get your weight forward for the turns and back on for straights. Move around on the bike. After all, the most adjustable thing on that entire motorcycle is you.□