http://www.sportrider.com/tech/146_0006_susp/

Suspension Tuning Guide
Introduction

Ahh, today's sportbikes...aren't they great? Acceleration and power that make the best motorcycles of a decade ago pale in comparison, all rolled up into increasingly compact, yet hospitable packages that don't require Mick Doohan-type skill to access. There's a nice feeling of satisfaction that comes from blowing the doors off of a $120,000 Porsche with a simple twist-of-the-wrist on your $10,000-or-less (insert your brand here) sportbike. In pursuit of that speed, however, the level of sophistication and technology present in the latest two-wheeled machinery has reached unbelievable heights.

That level of sophistication has brought along a few complications. Today's sportbikes not only have incredible straight-line speed, but also their handling capabilities are on par with (if not surpassing) the best racing superbikes of a decade ago. This has required chassis technology to keep pace with the rapid engine development, leading to suspension components bristling with multiple adjustments that can easily confuse the average rider. Sure, spring preload is easy enough to understand; but what the heck is rebound damping? And what does it do with regards to a motorcycle's handling? Should I go toward the stiff end of the spectrum, or the other way? Where do I begin?

Tuning suspension isn't as complicated as it looks; it requires a basic understanding of suspension theory, and how the various components affect suspension action. Once you've got that handled, establishing a basic plan of attack in solving a particular handling problem won't appear so daunting.

What we're going to do in the following pages is make that task of dialing in your sportbike's suspension easier. We'll start by giving you a basic overview of the principles behind spring rates, and rebound and compression damping (no major theoretical essays here; just the basics). We'll also show diagrams that dissect various fork and shock components, and describe how they work so you can see which adjuster does what task.

The next section will include a variety of typical handling problem scenarios encountered by sportbike riders, broken down into two parts: the problem and then possible solutions to start a careful, organized plan of attack. Also included is a detailed chart that specifies handling characteristics that fall on each side of every suspension adjustment (for example, too much compression damping results in this, too little results in that).

There's a section that gives chassis and suspension setup tips for aggressive canyon/street riding, racetrack/riding school days and/or racing; and dragracing, too. And finally, we've included a listing of aftermarket suspension tuning and component companies, so that you can get the pieces and final advice quickly.

This guide will help you gain a better grasp of your sportbike's suspension and how to dial it in to get the most out of your motorcycle. After all, having horsepower is one thing, but if you can't get it to the ground, you'd just as soon be better off on a 50cc moped. Read, learn and enjoy.

--Kent Kunitsugu

Suspension Tuning Guide-Learing The Lingo
To ride like a pro you've got to talk like one

Every activity has its own language. Learning a new skill sometimes feels as if it requires scaling a linguistic learning curve that makes surmounting Mt. Everest seem like a day hike. To the uninitiated--not that any Sport Rider reader could be accused of this--the language of motorcyclists can seem just as daunting. So, to make sure we're all standing on top of the same hill, peruse the terminology below to help speed yourself along to suspension enlightenment.

Bottoming (also called bottoming out)--when a suspension component reaches the end of its travel under compression. Bottoming is the opposite of topping out. Cartridge Fork--a sophisticated type of fork that forces oil through bending shims mounted to the face of damping pistons contained within the fork body. The primary advantage of cartridge forks is they are less progressive than damping rod forks. The shims allow damping control at very low suspension speeds while high speeds deflect the shims more--causing less high-speed damping than fixed orifice damping rods. The resulting ride is firmer with less dive under braking while simultaneously lessening the amount of force square-edged bumps transfer to the chassis.

Compression Damping--controls the initial "bump stroke" of the suspension. As the wheel is forced upward by the bump, the compression circuit controls the speed at which the suspension compresses, helping to keep the spring from allowing an excessive amount of travel or bottoming of the suspension. Damping--viscous friction caused by forcing a fluid through some type of restriction. Damping force is determined by the speed of the fluid movement, not the distance of suspension travel.

Damping Rod Fork--a simple type of fork that utilizes a tube with holes in it to create compression and rebound damping, delivering an extremely progressive damping curve. The faster the wheel moves vertically, the more oil that is shoved through the holes. Typically, damping rod forks have very little low-speed damping and a great deal of high-speed damping. The ride is characterized by excessive fork dive under braking and hydraulic lock when encountering square-edged bumps. Any change to the damping rod system, such as changing the size of the holes or altering the oil viscosity, affects the entire speed range.

Fork Oil Level--the level of oil within the fork as measured when fully compressed without the spring installed. It is used in tuning the amount of air contained inside the fork. Since compressing air makes it act as a spring, raising the oil level leaves less room for air, resulting in a rising rate throughout the fork's travel. Reducing the oil level reduces the force at the bottom, giving a more linear rate.

Free Sag--the amount the bike settles under its own weight. Both streetbikes and race bikes require 0 to 5mm of free sag on the rear. The bike should not top out hard.

High-Speed Damping--damping to control fast vertical movements of suspension components caused by road characteristics such as square-edged bumps. High-Speed damping is independent of motorcycle speed.

Low-Speed Damping--damping to control slow vertical suspension movements such as those caused by ripples in pavement. (This is also independent of motorcycle speed.)

Packing--a phenomenon caused by excessive rebound damping. When a series of bumps, such as ripples, are encountered the suspension does not rebound completely between bumps and

compresses (packs) further down on each successive bump. This can drastically change steering geometry if packing occurs on only one end of the motorcycle.

Preload--the distance a spring is compressed from its free length as it's installed with the suspension fully extended. Preload Adjuster--a method of adjusting suspension components' preload externally. These can be ramped or threaded.

Preload Spacer--material used to adjust a fork's preload internally. Typically, thin-walled aluminum or PVC tubing is used.

Rake--the steering neck angle (not the fork angle) relative to vertical, which varies with changes in ride height. For example, the rake angle decreases when the front end compresses or is lowered. Changes in tire diameter can also influence rake by altering the ride height.

Rebound Damping--controls the extension of the fork or shock after it compresses over a bump--hence the term "rebound."

Ride Height--suspension adjustments (raising or lowering the fork or lengthening or shortening the shock) to alter the chassis attitude of the motorcycle.

Sag--the amount the front or rear of the bike compresses between fully topped out and fully loaded with a rider (and all of his riding gear) on board in the riding position. Sag can also affect steering geometry. Extra sag on the front end will decrease the effective steering head angle, quickening steering, while too little front sag will slow steering. However, too much front sag combined with too little rear sag could make the bike unstable.

Spring--a mechanical device, usually in the form of a coil, that stores energy. When compressed, more energy is stored. Springs are position sensitive, caring only how much they have been compressed, not how quickly (as with damping).

Suspension Fluid--used inside a shock absorber to create damping when forced through orifices or valving. The fluid is also used for lubrication and should be incompressible.

Topping Out--occurs when the suspension extends to its limit. A shock with a spring of the proper rate mounted should have just enough force to top out without a rider on board.

Trail--the horizontal distance between the front end's point of rotation (i.e. where a line drawn through the steering head would intersect the ground) and the contact patch of the tire. Since trail is dependent on rake, it is a variable dimension that changes proportionally with the variation of rake during suspension action. For example, trail drops off dramatically when the bike reaches full dive under braking, giving a rider more leverage to initiate steering inputs.

Triple Clamp Offset--the distance from the center of the fork tubes to the steering stem center. The greater the offset, the smaller the trail dimension.

Unsprung Weight--the weight of every part of the motorcycle that is between the road and suspension (i.e. wheels, brakes, suspension components below the springs, etc.).

Valving--the mechanical hardware that creates damping. Valving is a combination of check valves, holes, ports, shims, springs, etc.

Suspension Tuning Guide-Handling
How To Get It

Trying to figure out a handling problem can be tricky. It's hard enough dealing with the intricacies of spring preload, rebound damping, etc., but when a definite problem forces you to back off the throttle and take notice, trying to determine the root cause of a handling difficulty can be downright baffling. Is it the front or rear causing it? And how do I know if rebound or compression damping adjustments will help?

In this section, we've come up with some of the most common handling complaints that afflict the average rider. Some of these problems occur entering the corner, some of them happen in midcorner, and others can even cause difficulty exiting a corner. Take a close look at the various problem scenarios we've listed and see if one of them sounds similar to a dilemma you've been struggling with. Then try our suggested solutions to see if they make an improvement. Remember take it one step at a time, take a test ride after each change, and take notes on whether that change made a difference.

TERRY TANKSLAPPER

Problem: Terry's bike feels unstable, especially when entering turns. The bars seem to "twitch" excessively whenever a midcorner bump is encountered. The bars often whip back and forth violently several times (or more) when Terry is accelerating aggressively over bumps while coming out of a turn--in other words, a "tankslapper." The bike steers very easily, although a lack of traction is sometimes noticeable in the rear whenever he tries to accelerate at moderate lean angles. The bike also seems to have a dropped-down, "nose low, rear-end-high" attitude while riding.

Solution: The biggest distinguishing factor in this case is the "nose-low/rear-end-high" chassis attitude feeling. If Terry's bike definitely feels this way, then probably he has too much front end weight bias. This not only hinders traction at the rear, but also affects the steering geometry (steeper rake/less trail) and can cause the instability problems. As long as Terry has his suspension static sag levels set correctly, the first step is to try less rear spring preload and/or more front preload, to the point just before they begin to affect handling negatively; Terry should remember to adjust his rebound damping if necessary (in fact, he should check to see if decreasing the front rebound damping in small increments helps; the forks may be too stiff, hindering traction). If only partially successful, a more drastic step would be changing chassis ride height; this would involve raising the front end by dropping the fork tubes in the triple clamps (if there's enough material protruding above the top clamp, to ensure front fork structural integrity), and/or dropping the rear by shortening the rear shock (if possible).

Note: We've also seen a tankslapping tendency produced by too much rearward weight bias. Terry might try working the opposite of the preceding paragraph solution, or check out the understeer/no front traction problem scenario for more suggestions.

MARSHMALLOW RIDE MIKE

Problem: Although Mike's bike has a very smooth ride while riding over potholes and such in the city, once he's out in the canyons, his bike seems to "float" over the pavement like a luxury car, with little or no pavement feedback. When he starts to ride aggressively, the bike rocks back and forth excessively, especially during brake/throttle transitions, and the "floating" feeling becomes even more pronounced. Hard cornering makes the bike feel loose, almost as if it has a hinge in the middle. Mike's tires might begin to chatter midcorner when encountering bumps and accelerating over those bumps causes his bike to wallow or weave.

Solution: The problem here is generally not enough rebound damping. The ride is smooth and supple at low speeds, but higher speeds generate greater amounts of energy that can't be

dissipated with the little damping available. As a general rule of thumb, if either end is pushed down firmly and quickly by hand, the suspension should return in a smooth, controlled manner without "rebounding" once or twice before settling down. Mike should try stiffening up the rebound damping in small steps, and remember to do the front and rear separately, not simultaneously; that way he can readily see if one or the other makes a difference. If Mike has the rebound damping cranked up to the maximum and his bike still feels soft and wallowy, he may need to rebuild the suspension components.

REAR-SWAPPING RICHARD

Problem: When Richard gets on the brakes aggressively while approaching a corner, the bike's rear end begins to swap side-to-side, and feels as if it wants to pivot around the front.

Solution: The cause here is way too much front end weight transfer under braking. The front end is compressing so low that the bike's weight tries to pivot around the steering head, causing the side-to-side movement. The quickest solutions here are to increase the front fork spring preload and/or raise the front ride height by dropping the fork tubes in the triple clamps, or decrease the rear ride height by shortening the shock (if possible). Richard should try increasing the fork spring preload first, and progressing in small increments until the handling begins to be negatively affected (remember to watch the rebound damping when increasing the spring preload). If that doesn't work, Richard should try the ride height modifications; watch for adverse handling reactions in other areas when doing this as ride height changes drastically affect how the bike corners. Other solutions to try--although less effective--are to increase the compression damping in the forks (if possible), or to decrease rebound damping in the rear (to allow the rear tire to follow the pavement quicker). Again, Richard should watch for adverse handling reactions in other riding situations when test riding.

ROUGH RIDING RICKY

Problem: Ricky complains that his bike is uncomfortable and he feels every little bump in the road. He doesn't have any confidence because his bike feels nervous and twitchy, especially over bumpy sections where it doesn't absorb the bumps, and his tires lose grip easily. Diving into corners during track days, Ricky's bike is unstable and jumps around over every little bump and crack in the tarmac.

Solution: The rough ride Ricky is experiencing is most likely due to a generally too-stiff setup--with too much compression and rebound damping. First off, Ricky should set his rebound adjusters as outlined in the setup section, and back the compression adjusters out to no more than the middle of their range. This will give a starting point to work from, and get rebound damping in the ballpark. Dialing in the rebound more accurately can be accomplished by riding the bike over a rough section of pavement; the suspension should not pack down (too stiff), nor should the bike be wallowy like a Cadillac (too soft). Riding the bike repeatedly over the same road after making small changes to the damping adjusters is a good way to distinguish between the characteristics and determine a good setting. Once the rebound is set properly, the compression damping can be fine-tuned according to the setup section. Once again, Ricky should make small changes between test sessions over the same road to help him feel and compare the different settings.

BOTTOMING BARRY

Problem: When Barry brakes hard approaching a corner, the front fork bottoms out severely, especially over bumps. However, the fork action and overall bike handling is fine everywhere else.

Solution: The problem here is Barry's ride height is set up correctly for his riding style, but the fork action is obviously too soft whenever weight is transferred to the front (as when hard braking). Barry has stiffened up the fork spring preload before, and while it helped with the bottoming problem, it unfortunately made his bike's chassis attitude too front-end-high, adversely affecting handling. The cure here would be to raise the fork tubes in the triple clamps (starting in increments of 4mm), which lowers the front end; Barry could then increase fork spring preload without causing the ride height problems mentioned previously. Care should be taken to ensure that the front wheel/fender isn't getting too close to bottoming out on the lower triple clamp or radiator when lowering the front or raising the fork tubes. If the preload adjuster becomes maxed out during testing and dial-in, a set of heavier rate springs or a larger preload spacer (inside the fork) may be necessary.

HEAVY HANDED HANK

Problem: Hank says his bike's steering feels super heavy at low speeds, and once he gets his bike turning by using lots of muscle, it practically falls into corners.

Solution: These characteristics could be the result of a squared-off rear tire (too much straight-line riding) or notchy or too-tight steering head bearings; if Hank has a steering damper mounted, it may be adjusted too tight. Suspension-wise, heavy steering is a typical result of having rear ride height set too low, raking out the chassis like a chopper.

If Hank notices the same troubles after trying his bike with the steering damper backed off, checking his tire and adjusting his steering head bearings, the problem is most likely in his bike's chassis attitude. Front and rear sag should be checked and set correctly, followed by another ride to check for any changes in handling. If there is little or no change, Hank will have to gradually change his geometry by either raising the fork tubes in the triple clamps or--if he's lucky and has a rear ride-height adjuster--raising the rear of his bike. When dropping the front end of a bike by adjusting fork height, it's a good idea to keep an eye on clearance between the front tire and radiator, and also--on a conventional fork--to ensure the sliders don't bottom out on the lower triple clamp.

UNDERSTEERING ERNIE

Problem: Ernie is having a lot of trouble with his bike's front end, especially while exiting turns. His front tire loses traction and pushes to the point where it's washed out on him a couple of times. He notes that steering is a bit heavy, and on uneven sections of pavement the front tire skips over bumps and threatens to fold if pushed too hard.

Solution: The trouble Ernie is experiencing is probably due to a combination of sag and ride height settings that leaves his bike riding high up front. Having a front tire skip over bumps on the exit of a turn is a sign that the fork is topping out--without enough sack to allow the suspension to sink into depressions in the road.

Ernie should check his bike's front and rear sag settings to ensure correct spring preload. With the preload set, he should take his bike for a spin to determine if there's any change in its behavior. If the problems persist, backing off the front preload will drop the front of the bike a bit, quickening the steering and letting the wheel track over bumps more effectively. If, however, the fork starts to bottom under braking with the preload backed off, the fork tubes can be raised in the triple clamps to sharpen the steering while keeping the original preload setting.

Suspension Tuning Guide-Dialing It In
Dial in your suspension for maximum effect

STREET

One of the major keys to a successful suspension setup is the condition of the components. Before attempting any setting changes, check to make sure your bike's fork and shock are in good working order. This includes replacing leaky seals, lubricating sticky linkage bushings, and changing old fork or shock oil. If your current components have more than 15,000 hard miles on them, you can bet it's time for a rebuild. Check your steering head bearings for notchiness or tightness and replace them if needed. And most importantly, squared-off or worn out tires will mask almost any suspension change you make.

The first step to a good setup is setting static sag (see sidebar page 50). For street purposes, front sag should generally be between 30 and 35mm, and rear sag between 25 and 30mm. Don't vary from these numbers if you're heavier or lighter--that's the whole idea of measuring sag while you are on the bike. An easy way to check if your shock spring rate is in the ballpark is to measure the rear "free" sag, that is, the sag without your weight on the bike. This number should be between 0 and 5mm--with the bike off its stand and on its own, you should be able to lift the rear end just slightly and top out the suspension. If your bike is topped out at rest, you need a stiffer spring, because you have got a lot of preload dialed in to achieve the correct static sag. Alternately, if your bike has a lot of free sag (you can lift the rear a bunch before it tops out), you need a softer spring. One notable exception to the sag numbers is Yamaha's R1, which has substantially more front sag to keep the front end on the ground under power. Use the capsules (page 42) and subjective chart (page 48) to determine if you should mess with your R1's front preload.

Rebound damping can be initially set as follows: With the sag properly set and the bike at rest and off its stand, firmly push on the triple clamp (don't hold on the brake or push the handlebar) or seat. When you let go, the suspension should rebound quickly to its original position--but not beyond. If it takes more than approximately one second for the suspension to return to position, less rebound damping is needed. If the fork or shock over-extends past its free sag, and then compresses again, more rebound damping is required. Street riding entails many different pavement characteristics, and the road is generally bumpy compared to a racetrack, so it's better to err on the soft side if you are unsure. This will also give you the added benefit of a smooth ride for daily use; you can always dial in a tad more rebound when you get to your favorite road where the surface is more of a known quantity.

It is difficult to set compression damping without riding your motorcycle and feeling how its suspension works. What feels nice and plush at a standstill may turn out to be too harsh at speed, and compression damping is sometimes set by personal preference as opposed to a definite optimum. Start with the compression adjusters in the middle of their adjustment range, and take your bike for a spin. Working with the front and rear individually, soften the damping adjuster, and try your bike again over the same road. Is your handling better? Worse? The same? Try again, this time with the damping stiffer than what you started with. Continue experimenting, making adjustments accordingly. As with rebound damping, it's always best to err on the light side with compression, and for the same reasons.

One final check--with your bike off its stands, place your hands near the rear of the tank, and push down. A well-balanced setup will have both ends of your bike compressing and returning at approximately the same rate with this push. If the front compresses or rebounds different than the rear, attempt to match them, keeping within the parameters established individually.

TRACK

As with the street setup, first ensure that your bike's suspension components are in good working order, and you have relatively new tires installed. One word of caution regarding setup and tires: Don't get dragged into adjusting your suspension to account for tire wear over the course of a track day without taking notes. You'll be amazed at how poorly your bike handles when you put new tires back on and keep the shagged-tire suspension settings.

In general, a bike set for track use is stiffer than a streetbike, due to the increased acceleration, braking and cornering forces involved. Static sag for track bikes should be in the range of 25 to 30mm--somewhat tighter on the fork than a street setup. Similarly, compression and rebound damping should be somewhat stiffer. Avoid tightening your rebound arbitrarily; you still want the suspension to rebound within one second to its static position after pressing on the bike, but not overshoot.

If you have a ride height adjuster on your aftermarket shock, set it to the same length as the stock unit for a start. Similarly, begin with your fork at the stock height in the triple clamps. Use the handling scenarios (page 42) and the chart (page 48) to determine if you need to change your bike's attitude. Generally, for a track bike with a steering damper, you'll want to quicken the steering as much as possible by lowering the front end or raising the rear, while still retaining stability and without sacrificing rear end traction.

For track riding, it's important to take good notes--and lots of them. Along with your initial settings, you should also write down some baseline figures for things such as fork oil weight and amount, ride height, spring rates, and so on. Record any changes you make so that you can refer to them later. Also, keep notes for different tracks--as your setup will change depending where you are and the conditions. Once you find that "magic" setup, don't be afraid to deviate from it and experiment; you may be able to improve on what you have, and you can always go back to what you wrote down in your notes.

SETTING STATIC SAG

One of the most important suspension settings is static sag--the amount your bike's suspension compresses when you sit on it. To set static sag, we use Race Tech mastermind Paul Thede's method, which takes into account any stiction in the components. It's best to have two friends to help--one to hold the bike while the other one measures--while you (fully dressed in your riding gear) do the compressing.

First, extend the front suspension completely. Measure from the seal wiper to the triple clamp for a conventional fork, or to the axle clamp for an inverted fork. Call this number L1.

Sit on your bike in a normal riding position (or racing crouch if you're track-bound), and have one helper steady the bike. Your second helper should push down on the fork, let it extend slowly and then re-measure as before. This number is L2.

Finally, the fork should be extended by hand, settled slowly, and re-measured. This figure is L3. Halfway between L2 and L3 is where your suspension would settle if there were no friction in the system. Static sag can be calculated as follows: sag=L1-(L3+L2)/2. Repeat this process to determine the rear sag--measuring from the axle to a point directly above on the frame for each of the numbers. If you have too much or too little sag, dial in more or less (respectively) preload as needed.

STRIP

While roadracers set up their suspensions to allow their tires to follow the contours of the pavement, dragracers have an entirely different set of goals. First and foremost, the center of

gravity (CG) needs to be kept as low as possible. Second, suspension travel should be kept to a minimum. For dragracers, keeping the front wheel down and the rear tire hooked up leaving the line is all that matters.

At first glance, trying to keep the front suspension as stiff as possible might seem strange, but once the theory is explained, the logic comes through. Dropping the front end three inches to keep the CG low is a no brainer: Running a low CG minimizes the rearward weight shift as a bike starts to launch. The lower stance is achieved by disassembling the fork and inserting three inch spacers between the stanchions and sliders--effectively reducing the fork's ability to extend by three inches.

Ironically, the same desire to keep the CG low is behind the stiff front suspension. Once the fork is lowered, the preload gets cranked all the way up. Both the compression and rebound damping get dialed in to their firmest settings. Finally, 15 to 20 weight oil is used to further minimize fork movement. By keeping the front suspension immobile, the entire forward end of the motorcycle acts as a single unit and is much harder to lift off the ground. If the front suspension has sag and is allowed to rebound at the launch, the chassis can gain enough momentum to lift the front wheel off the ground when the suspension tops out. Instead, a rigid suspension acts as a dead weight helping to keep the tire planted.

The goal of keeping the front tire earthbound does not mean that dragracers want the additional drag the wheel can put on the bike, though. Many racers run the tire pressure at 35 psi or higher for less rolling resistance. Also, making sure that the bearings are nice and loose will lessen drag.

The back of the bike needs to be firm, too--but not overly stiff. The lower ride height in the rear can be achieved by lengthening the rear linkage's dog bone so that the rear of the bike drops approximately four inches. Although some people think that running a strut instead of a shock will help their bike launch, Rickey Gadson, Kawasaki Factory dragracer, says that being able to tune the rear suspension's firmness is critical to maintaining good rear wheel traction. On smooth tracks, the shock can be run stiff, but on a rough track, the rear needs to be softened until the tire stays hooked up. Bikes with struts will be hurt on poor tracks. Rear tire pressure should be dialed in to suit conditions, too. Surprisingly, Gadson says he starts with approximately 30 pounds and adjusts the pressure based on how much traction he's able to maintain. His theory about tire pressure is that running the most pressure possible--while still keeping the rear tire hooked up--lessens the rolling resistance of the tire.

Suspension Tuning Guide-Suspension Troubleshooting Symptoms

Here are some basic symptoms of suspension damping problems that you might find affecting your bike. Remember these are extreme examples; your symptoms may be more subtle. You may also have to find an acceptable compromise on either end of the adjustment spectrum. It all depends on how the bike's handling "feels" to you.

LACK OF REBOUND DAMPING (FORK)

The fork offers a supremely plush ride, especially when riding straight up. When the pace picks up, however, the feeling of control is lost. The fork feels mushy, and traction "feel" is poor.
After hitting bumps at speed, the front tire tends to chatter or bounce.
When flicking the bike into a corner at speed, the front tire begins to chatter and lose traction. This translates into an unstable feel at the clip-ons.
As speed increases and steering inputs become more aggressive, a lack of control begins to

appear. Chassis attitude and pitch become a real problem, with the front end refusing to stabilize after the bike is countersteered hard into a turn.

TOO MUCH REBOUND DAMPING (FORK)

The ride is quite harsh--just the opposite of the plush feel of too little rebound. Rough pavement makes the fork feel as if it's locking up with stiction and harshness.
Under hard acceleration exiting bumpy corners, the front end feels like it wants to "wiggle" or "tankslap." The tire feels as if it isn't staying in contact with the pavement when on the gas.
The harsh, unforgiving ride makes the bike hard to control when riding through dips and rolling bumps at speed. The suspension's reluctance to maintain tire traction through these sections erodes rider confidence.

LACK OF COMPRESSION DAMPING (FORK)

Front end dive while on the brakes becomes excessive.
The rear end of the motorcycle wants to "come around" when using the front brakes aggressively.
The front suspension "bottoms out" with a solid hit under heavy braking and after hitting bumps.
The front end has a mushy and semi-vague feeling--similar to lack of rebound damping.

TOO MUCH COMPRESSION DAMPING (FORK)

The ride is overly harsh, especially at the point when bumps and ripples are contacted by the front wheel.
Bumps and ripples are felt directly; the initial "hit" is routed through the chassis instantly, with big bumps bouncing the tire off the pavement.
The bike's ride height is effected negatively--the front end winds up riding too high in the corners.
Brake dive is reduced drastically, though the chassis is upset significantly by bumps encountered during braking.

LACK OF REBOUND DAMPING (REAR SHOCK)

The ride is plush at cruising speeds, but as the pace increases, the chassis begins to wallow and weave through bumpy corners.
This causes poor traction over bumps under hard acceleration; the rear tire starts to chatter due to a lack of wheel control.
There is excessive chassis pitch through large bumps and dips at speed and the rear end rebounds too quickly, upsetting the chassis with a pogo-stick action.

TOO MUCH REBOUND DAMPING (REAR SHOCK)

This creates an uneven ride. The rear suspension compliance is poor and the "feel" is vague.
Traction is poor over bumps during hard acceleration (due to lack of suspension compliance).
The bike wants to run wide in corners since the rear end is "packing down"; this forces a nose-high chassis attitude, which slows down steering.
The rear end wants to hop and skip when the throttle is chopped during aggressive corner entries.

LACK OF COMPRESSION DAMPING (REAR SHOCK)

There is too much rear end "squat" under acceleration; the bike wants to steer wide exiting corners (since the chassis is riding rear low/nose high).
Hitting bumps at speed causes the rear to bottom out, which upsets the chassis.
The chassis attitude is affected too much by large dips and G-outs.
Steering and control become difficult due to excessive suspension movement.

TOO MUCH COMPRESSION DAMPING (REAR SHOCK)

The ride is harsh, though not quite as bad as too much rebound; the faster you go, the worse it gets, however.
Harshness hurts rear tire traction over bumps, especially during deceleration. There's little rear end "squat" under acceleration.
Medium to large bumps are felt directly through the chassis; when hit at speed, the rear end kicks up.

Suspension Tuning Guide-Resources

RESOURCES-Where to go when you need help with your suspension.

FMF Racing, Inc.
18033 South Santa Fe Avenue
Rancho Dominguez, CA 90221
(310) 631-4363
(310) 900-5699 fax
www.fmfracing.com

Fox Racing Shox
3641 Charter Park Court
San Jose, CA 95136
(408) 269-9201
(408) 269-9217 fax
www.foxracingshox.com

Koni North America
1961 A International Way
Hebron, KY 41048
(606) 586-4100
(606) 334-3340 fax
www.koni-na.com

Lindemann
520 McGlincey Lane, Unit #3
Campbell, CA 95008
(408) 371-6151
(408) 371-4915 fax
www.le-suspension.com

Oehlins/Parts Unlimited
3501 Kennedy Road
Janesville, WI 53545
(608) 758-1111
(608) 758-1144 fax
www.parts-unlimited.com

Penske Racing Shocks
P.O. Box 1056
Reading, PA 19602
(610) 375-6180
(610) 375-6190 fax
www.penskeshocks.com

Progressive Suspension
11129 G Avenue
Hesperia, CA 92345
(760) 948-4012
(760) 948-4307 fax
www.progressivesuspension.com

Race Tech
3227 Producer Way, Suite #127
Pomona, CA 91768
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