

# How I set up my motorbike



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I bought myself a **Yamaha YZF R1** bike which was supposed to be a top handling bike. It was not. The bike was reluctant to turn. I took the bike to a club racer mate of mine and he had a test ride and then suggested that I increase the rebound (???) I turned the rebound (???) screw and it seemed to improve the bike handling. I turned it a bit more and it went back worse. I felt that since I had already fiddled with one of the settings, I might as well try other suspension settings.

I tried suspension settings from motorcycle newspapers, sports bike magazine, top racing websites and forums and they were all crap. In fact two sources never recommended the same setting for my bike and no one adequately explained how they got those settings. I felt I had to find my own suspension settings for my bike. In order to do so, I had to understand how it worked and this article will attempt to explain how I set up my bike and how you can too.

Lets start at the very beginning.

## What is "suspension" all about?

Your bike suspension is designed primarily to **absorb** the imperfections in the roads, and ensure that tyres **keep contact** with the roads. Most bikes suspension are based on a **spring** like you would find in a pen, mattress or trampoline but much stronger. To stop the spring from bouncing the tyre like a yoyo; the rate the spring moves up and down is controlled by "dampers".

Dampers are "**like oil filled bicycle pumps**". The pump will move faster or slower depending on the size of the hole the oil is being pumped through and the thickness of the oil. All bikes have both a spring and dampers. My bike has the spring on the outside of the damper on the rear wheel (called rear shock) but the front wheel suspension has the springs within the dampers hence you cannot see them. They are called the front forks.

The suspension for your front wheel is independent from the back wheel and can react differently to road and riding conditions.

## Where did I start?

Before I touched the bike, I located the **handbook** for my bike as supplied by the manufacturer. The handbook contains details on what can be adjusted and where on the bike the knobs and screws are for setting up your bike front and rear suspension. Also it details the manufacturers recommended suspension settings for your bike. If you have aftermarket (third party) suspension, contact them.

Depending on your bike you may be able adjust some, all or none of the following

- **Preload** (Spring tension, based on your weight)
- **Damping** (speed the spring squashes and returns to normal )
  - **Compression** (advanced damping control, speed the spring squashes)
  - **Rebound** (advanced damping control, speed the spring returns to normal after been squashed)

Note that compression and rebound are part of damping.

After I had established what I can adjust on my bike and how to adjust it, I got a **pen and paper** and wrote down my bikes current settings so that I can return the bike to it if I make a mess of things. On my bike, this meant counting “**clicks**” as I turned the screws for the compression and rebound clockwise or anti-clockwise. Preload is easier to note and record as you can see what “notch” the rear spring is on and what “ring” the front is on.

The manufacturer has spent a lot of time and money on research and development and they have a financial incentive to ensure that my bike handles well, therefore the manufacturers recommended suspension settings for your bike will not be that bad. Compare what your current settings are for your bike against the manufacturers setting. If they are different, and you think your bike could handle better, have a go at setting your bike to **manufacturers recommended settings**.

You should be able to fiddle with your suspension and bring it back to the settings recommended by the manufacturer or your original setting before you go any further. Do not read any further unless you are competent with the above and acknowledge that this whole article is purely for information only. Please do not fiddle with your bike, then injure yourself and then blame me.

## Setting your bike up?

To set up your bike you will require the proper tools as recommended in your bikes handbook, usually a long screw driver, spanner for the front and a funny looking tool for the rear preload and tape measure!! You will need patience and time. It is best to set the bike up where you are most likely to use it i.e. on the roads or race track.. Ensure your bike is in good working condition, including replacing dodgy fork seals, lubricating linkage, and changing fork or shock oil and you have correct tyre pressure . If you are unsure of your tyre pressure and it is a track bike use **32psi front, 30psi rear**.

Twiddling with setting randomly will not get you far. You suspension can be broken down to the following

- Front wheel
  - Preload
  - Damping Compression
  - Damping Rebound
- Rear Wheel
  - Preload
  - Damping Compression
  - Damping Rebound

If your bike does not have some of these setting then you will have to compromise on the setting of your bike or buy aftermarket suspension if necessary. You really should set up your bike in the right order. It is best to start with the preloads, front and rear as this is based on your weight and relatively easy to set up, then work your way down.

## SET UP BIKE TO YOUR WEIGHT- Preload

### Rear Preload

Whatever your weight, when you sit on the bike, you want the bike to **squat just a little bit** (about 30mm) but not too much. You want to ensure that the bulk of your rear suspension travel is available for when you actually ride the bike as opposed to supporting your heavy frame. At the same time you should have a **little bit of sag left**. If the bike drops too much then increase preload and if you are very light and the bike barely moves under your weight, then soften the preload.

Below is a more detailed explanation. This is easy to set up but can be a bit confusing so just follow the steps one at a time.

**Step 1:** First find the fully **UNLOADED** length of your rear suspension. Put your bike on its centre stand. If you do not have a centre stand find a means of lifting the rear wheel up under the engine so that there is no weight (including the weight of the bike) on the rear axle and wheel. Measure the distance between the rear axle and a fixed point directly above like a bolt or mark. Note this measure measurement. Do not use a rear wheel bike stand as there is still the weight of the bike on the swing arm.

**Step 2:** Find the **NORMAL** length of you rear suspension. This is amount the suspension drops under the weigh of the bike alone without the rider. Put the bike on level ground and bounce it up and down to free any stickiness. Measure between the same two points as above, i.e. the rear axle and the fixed point directly above.

**Step 3:** Find the **fully LOADED** length of your rear suspension. This is the length of the suspension with the rear wheel on level ground and the rider seated on it in his normal riding position in full biking garb. First bounce up and down on the seat to loosen the suspension then get into your normal riding position with all weight on the bike and both feet on the bike. To prevent yourself from falling of (if you have not already) lean the bike against a wall and get your mate to measure between the same two points as above i.e. rear axle and the fixed point directly above.

Next thing is to understand a couple of buzz words. "Static sag" and "Rider sag".

**RIDER SAG** is the difference steps 1 and 2. This is the amount the bike drops when your heavy arse sits on the bike.

**STATIC SAG** is the difference between step 1 and step 3. It is how much the bike's weight acts on the rear suspension or how much you can lift the bike rear **without** the rider on it before it tops out.

*A top racing suspension company suggests that rear wheel rider sag should be around **30-40mm** and static sag should be around **5-10mm**. However, this may vary depending on your bike and manufacturer. The more rider sag you have, the softer the bike suspension will be. I personally use 35mm for road and a few track days use.*

Therefore if your rider sag is less than 30 mm then your preload is too hard, if it is more than 40 mm, then it is a bit soft. Once you have set your rider sag as close as possible to 30-40 mm, next check your static sag. If you have more than 10mm then you may need stiffer springs. If however, if your static sag is less than 5mm or you have no static sag then your springs may be too hard for your weight.

If you have to compromise then try to have at least a bit of Static sag in order to stop the bike from topping out.

***Note** that books, videos, media and pub acquaintances will all have different opinions on the naming and figures quoted above (and below). Avoid being obsessed with numbers.*

*I will try to **explain** the underlying principles of setting up your own bike. There are too many scenarios and permutations surrounding the effects of tweaking each setting that it would take me forever to cover them all. Therefore I will only touch on a few of the more common effects.*

## Front Preload

Some people set the front suspension based on rider sag and static sag. This is especially useful in determining if you need softer or stiffer springs. Use the same system as above to determine Rider sag (35-48mm) and Static sag (25-30mm). However I prefer the below method to optimise my current **original** front forks.



You want your bike to use as much front suspension "travel" as possible without "bottoming out" (no more travel) even in extreme conditions. So let's establish how much suspension travel you are currently using.

Wrap **cable ties** around the smooth part (stanchion) of front forks **near** the rubber seal to the forks. Ensure that it does not scratch the stanchion and it is not too tight as to damage the rubber seals.

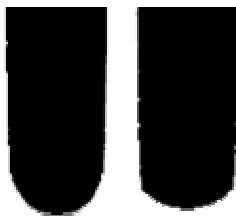
With the cable ties in place ride your bike as normal using as many riding conditions (corners, braking, accelerating, wheelies and stopples) that you are likely to meet. Then increase or decrease your preload until the cable tie stops about 10 mm before "bottoming out".

**Reducing preload should give you more travel.** If the forks bottom out, reset the cable ties and increase preload until the cable tie stops around 10mm above the limit.

You should always leave about 10mm travel for emergencies like slamming into **uncharted potholes**.

Done

## DAMPING



The damping, both rebound and compression are best adjusted after riding your bike and feeling how it handles to you. **You cannot use your mate's settings.** The reason why there is so much debate and controversy regarding suspension set up is because it is a personal experience and depends on how and where you ride your motorcycle.

Some people, media and websites will charge or tell you what they think is best for you whilst amongst top racers it is a closely guarded secret. You have to find your own settings that you are comfortable with and **take notes as you experiment** with different settings.

Setting the right amount of damping depends on the type of bike, how you ride the bike of bike, and **shape and pressure of tyres** you use. Also it depends on your riding style and how much suspension travel you want at any particular moment. This article will try to explain what to look out for and how to tweak it.

If you can adjust the damping but cannot adjust the rebound and compression separately, then you will have to find a compromise between the two for your bike. If you run out of adjustment, then depending on if the damping, either rebound or compression, is too slow or too fast then you may need to **change the damping oil** to thinner or thicker suspension oil relatively.

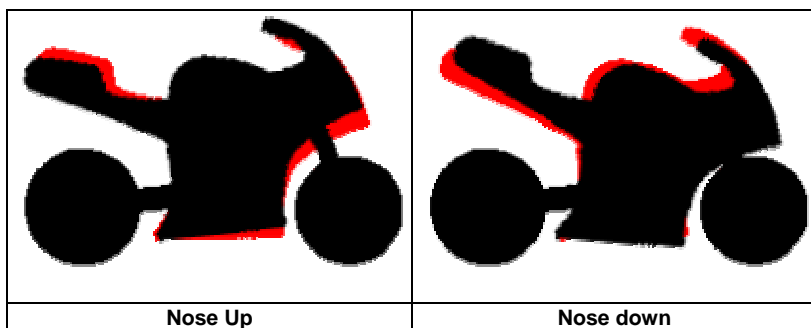
Note that your suspension will handle differently under different conditions i.e. high or low speed, wet or dry conditions, therefore **experiment with setting up your bike under the conditions you would like to use them.**

To start with, set your bike damping rebound and compression to your manufacturers or your preferred setting.

I do not know the exact terminology used in your manufacturers owners manual but note that

**Soft damping = little damping = decreased damping**

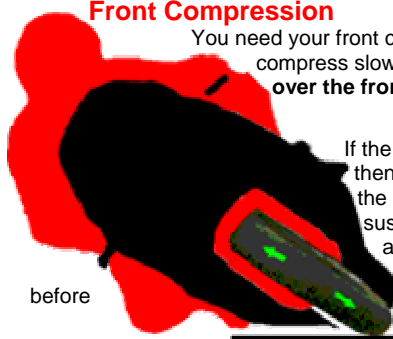
**Hard damping = excessive damping= increased damping**



## FRONT WHEEL

### Front Compression

You need your front compression under braking and when riding over uneven humps. You want your front suspension to compress slowly and controlled when you brake. As your bike **"nose dives"** under braking, it **transfers more weight over the front wheel**. This helps slow the bike quicker.



If the front suspension **compresses too quickly** (too soft) you risk the suspension **bottoming out** and then your bike will feel vague and since it nose dives too quickly the back wheel may loose contact with the road and **move sideways**. On the other hand when compression damping is **too high** the suspension can't react quickly enough to compress over bumps and will skip and **chatter**. You will have an uncomfortable ride and your braking is compromised, especially **in the wet**.

Another important aspect of front compression is when you brake just before a turn. As you brake the corner, the bike will naturally "nose dive", this will **shorten the wheel base and alter the geometry** of the bike making the bike turn quicker into the corner. It is important that your bike compresses predictably and safely in a corner/turn.

**SOFT:** If your compression is too soft, your bike will nose dive too quickly, then as you turn into the corner, the bike will **collapse** into it and you end up having to compensate.

**HARD:** On the other hand if you have too much front compression damping, do not get enough nose dive and the bike will be **reluctant to turn** and may drift wide on entry to the corner.

Go for a ride on your bike and try braking and turning into corners at different speeds. This will cause a bit of nose dive so try different setting. If your bike bottoms out, increase the front preload. [See preload notes above](#). Keep notes.

## Front Rebound

Front rebound damping is to control the rate the bike “sits up” after the front suspension has been compressed i.e. from nose down position. If it is too soft, the front end will **pop up** too quickly after any situation causing the front suspension to compress e.g. braking or cornering causing the bike to “see-saw”. This may result in lack of traction. If rebound damping is too high you may have **lack of “feedback”** and in extreme cases where the suspension can't react quickly enough to extend again it will **pump down** until it bottoms out which is simply dangerous,

*An alternative to manufacturers setting for front rebound is to place your bike on level ground and have your mate or rear wheel stand support the back of the bike. Press hard on the **top of the yoke** without pressing the brakes and let go. The suspension should rebound to its original position within a second.*

*If it takes more than a second then you need softer rebound but if it takes less than a second or it rebounds past its original position then you should make your rebound harder. This method may work but really it is **too simplistic** for real world riding.*

One critical area where you want your front rebound to work well is through them corners and turns. As you fly down the road and brake before or into the corner, the front suspension compresses, then as you let go of the brakes, the front wheel will rebound fully. You do not want your front end to **sit up too quickly especially mid corner**. It does not matter whether you brake before the turn but this is more critical if you brake into the turn.

**SOFT:** If it rebounds too quickly in the corner your bike will sit up very quickly creating a longer wheel base. The front wheel “shooting” out also causes the bike to drift wide or a feeling of the front end “**washing out**” If this happens, increase (harden) your rebound to slow the rate the front wheel rebounds.

**HARD:** On the other hand if the rebound is too hard, when you let go of the brakes and on to the throttle in a corner, because the wheel is compressed for longer you will have a shorter wheel base for longer. This may cause the bike to feel **wooden** in the corner and turn too quickly. Soften her up.

To set up your front rebound damping you are going to have to go through a few corners a few times and it is best that you have sorted out the preload and front compression first. Basically you want to be able to

1. brake hard either before the turn or up to the apex of the turn, (whichever suits you)
2. let go of the brakes
3. get on to the throttle without the bike “see-sawing” i.e. sit up or dive

by adjusting only the **rebound damping only** (remember that we have sorted the compression so don't mess it up.)

## NOTES

### No advanced damping control

if you cannot adjust the rebound and compression separately but you can adjust the damping, then you will have to go for a compromise. Since most accidents happen in a turn, then I will suggest that you set it up for cornering. Try to get the bike to enter and exit a corner with minimal rocking or seesawing to the front end. These setting should be ok for bumpy tarmac.

### Keep a record

Keep a note of the settings you are using as well as the make and pressure of your tyres. Different tyres shapes, sizes and pressure can affect your readings and therefore you may want to keep a record of all your setting especially if you are a track addict or racer. Also keep a note of the weather and cooler temperature will thicken the oil in your forks while on a hotter day, your fork oil may thin a bit. You do not want to go through all this again

### Counting Clicks

If your bike uses clicks to adjust damping, and you want to adjust your damping settings, do not simply turn it a few clicks till you think you have the right new settings. Fully count the clicks in to ensure you were on the right old settings then count it out to the right new settings. Example you think your front compression is on 5 clicks out and you want to try 7 clicks out. Do not simply turn it 2 clicks out. Count the 5 click in, and then count the 7 clicks out.

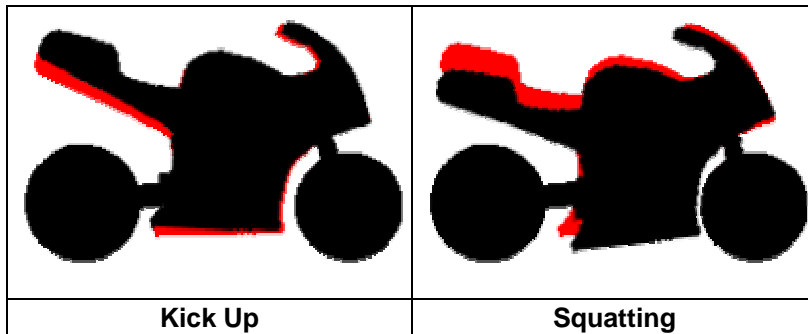
### Set Up

Do not adjust more than one setting at a time unless it is to a previously recorded set up as you will not know which setting cause the most effect. I commute to work and I used to make one small (a click) adjustment a day. Sometimes I would leave it for a week because the conditions were not right to feel the new settings in action. On the track, I would suggest one setting change per session, minimum.

### Altering Bike Geometry

You can alter your bikes geometry by sliding your front forks up through your front yoke.. i.e. your forks will stick up through the yoke a bit more than standard thereby causing your bike to have a more nose down bias. This makes the bike turn in faster, it doesn't increase the corner speed and you will loose ground clearance (CBR riders take note)

I will not recommend moving your front forks more than 5 mm



## REAR WHEEL

Once you are done with the preload and front wheel damping let move onto the rear wheel. You can set it based on comfort and uneven road using the same methods as you would with the front wheel. Also you could try to do what's called:

### Suspension Balance

Take the bike off its stand onto level ground and stand next to it. While holding your motorcycle upright, put one foot on the foot peg next to you and press hard on it. The front and rear of the bike should squash down and raise at the same rate. If not adjust rear damping compression and rebound to compensate

Now you have a comfortable bike with adequate suspension balance. Now let's fine tune it a bit. Again there are no tricks to setting up your rear wheel suspension, you have to understand what causes your rear suspension to work. Since rebound occurs after compression we will deal with compression first.

### Rear Compression

Like with the front wheel; if your rear compression is too hard you will have an uncomfortable ride because the rear wheel simply bounces off bumps and ripples in the road also giving a vague "feel". Conversely, if it is too soft, you may get excessive "squatting" under heavy acceleration causing the bike to feel **lethargic** or even "bottoming out" on those rough roads.

When you accelerate, you need a bit of rear end squatting to give the tyres a chance to get some traction and absorb excessive power to the back wheel. However, it is that squatting action under heavy acceleration that can cause problems when coming out of corners.

**SOFT:** Let's imagine that you are exiting a corner on your motorcycle, and the bike is leant over and you start to accelerate smartly. If the compression damping is too soft, you will get too much rear end "squatting" causing a "**nose up**" situation. This will cause your bike to **drift wide on exit** of the corner. This is not the same as a too much of **front compression** damping which causes the bike to **drift wide on entry** to the corner.

**HARD:** On the other hand if your rear compression damping is too hard, you will not get enough "squatting" and therefore may not get enough traction. This will cause a bit of rear **wheel spin**, or the rear wheel suddenly "**kicking up**". You can imagine what can happen in extreme circumstances.

To set your rear compression damping up properly, it is best to have the front end sorted out first. That way you know you that your entry into the corner is as smooth as possible. Then you want to be able to put on the gas as you exit the corner and your bike should hold its line and inspire confidence.

### Rear Rebound

Nearly the end of this setting up drivel. You have exited the corner and the bike is now flying forward in a straight line. At this point you want the rear rebound damping to keep the rear wheel in contact with the road, thereby giving you maximum traction

**SOFT:** However if it is a long corner then your rear rebound will come into play mid-corner. If your rear wheel kicks up too quickly, it will unsettle the chassis of the bike making it "**wallow**" and "lurch" mid corner. A lot of people wrongly try to cure mid corner "wallowing" by increasing rear preload. This may "stiffen" the rear end but you may loose a bit of suspension travel. The cure is to increase (harden) rear rebound.

**HARD:** However if your rear suspension is too hard, your back wheel will not sit up quick enough. This will cause you the have the back end squatting causing a "nose up" situation for longer. This may cause you to drift wide similar to the effects of soft compression. Also since the rear shock does not extend quick enough, you may get a feeling of vagueness or loss of traction

That's it.

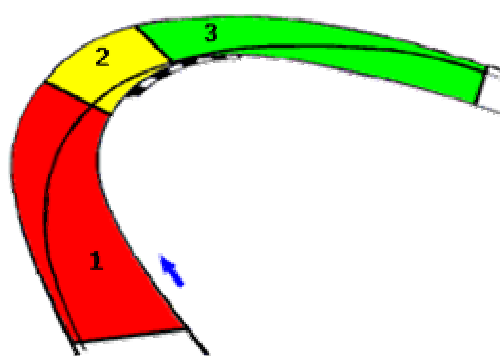
If you have reached this point and found out that your original set up was the best then oops sorry. At least you have a few more buzz words to drop in the pub with other bike mates.

## SUMMARY

First get your **owner manual** out and familiarise and compare your current suspension settings with the recommended settings in the manufactures hand book. Still not satisfied?

Then set-up your preload, front and rear, so that you can use as much suspension travel as possible when riding your bike. This is based on your weight, so if your weight fluctuates then keep an eye on it.

Next adjust your damping so that your suspension does not compress or rebound too fast or too slow to upset the bike and be uncomfortable. I believe that if you can get your bike suspension set up for cornering then it should be OK on a straight line.



### 1 - Front compression

This is when you want your front compression to control the "nose down" effects of braking so it turns in to corner properly

### 2 - Front rebound

You have let go of brakes, adjust front rebound so that the front forks extend at a controlled rate allowing you to keep your line.

### 3 - Rear Compression

You want the rear end to squat a bit as you apply the power.

Make sure that the **rear rebound setting** keeps the rear wheel in contact with the road.

**Note:** this image is only for illustration only. Your braking, turning and exit points and lines may vary, especially in the wet.

## CONCLUSION

The point of this article is to **educate** you on how your suspension works so you can attempt to sort it out yourself. You should be able to feel the bike through the handle bars and the bike seat and be brave enough to note down the current settings and have a go at altering it to suit yourself.

I found that it is difficult to set up the bike for all condition. I recently changed my front brake pads and they were biting harder which made the bike nose down quicker. As summer approaches, I like to ride a bit faster. My weight is fluctuating. All these scenarios have caused me to change my setup. Top racers alter their setup at every track.

However if you are not competent with DIY, remember that if it isn't broke, don't fix it

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### Sean Onipede

Big thanks to.

**Mike Sladden**, (second opinion and accuracy)

**Rob Richardson** (a few pictures)

*(short bio: I am the fastest commuting, speed filtering, street fighting, all year riding, track addict, bullshitting biker out there. Please email me at [sean@londongman.com](mailto:sean@londongman.com) with your comments)*

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