

## Finding The Fit

**There's no getting away from it: whether buying the latest, lightest steed or continually experimenting with training techniques, mountain bikers - whether elite level Olympians or weekend warriors looking to finish the next fun ride - are continually looking for ways to improve what they do. Many however, overlook the single most important element - making sure your bike fits.**

Mountain bikers are like fingerprints - no two are the same. Your weekend riding pal may be the exact same height and weight as you, but look closer and you'll see huge differences that affect the way you should be riding your bikes. Some people have long legs and short bodies; others short legs and long bodies. Some people have short arms, others almost drag their knuckles like a mountain biking monkey. Some people have back or neck niggles, a few people are lucky enough to be super flexible. Some people have superb skills, while most of us favour a more reserved riding style. The point here is that no two riders are the same. Even if you and your pal are the same height, and even if you ride the same bike, your ideal bike set-ups will need to be different. This might sound like we're about to get technical - and yes there is a huge amount of bike fit info out there, many of it conflicting - but finding your ideal is really quite simple provided you start at the right place and follow the right basic rules.

### The Right Bike

Good bike fit really starts with a bike frame suited to your own makeup. And just as no two riders are the same, every bike brand has slightly different geometry. They might purport to be the same size, but you can guarantee that they won't feel the same. Of course, most of us already have perfectly serviceable bikes, so in most cases we're stuck with what we've got. That's ok, because there's a lot we can do to make that bike fit 90% perfect; but if you want it to be 99% perfect, then you have to start with the right frame. When people talk about frame size, most are thinking about the height of the frame. But with mountain bikes (and some road bikes) the modern cut away geometry and varying ground clearances (particularly full suspension bikes) finding the right bike size is more to do with the length of the frame rather than height. Obviously this is to attain the right reach, but it is also to attain a wheelbase that relates to the dynamics of what the bike does when you ride it.

Wheelbase is the distance between the axles of the front and rear wheels. The distance of these two points affects how the bike handles. Generally, the longer the wheelbase the more stable but less responsive the bike is. Ideally the wheelbase is as short as is practical, but this really only relates to the size of the rider because the handling of your mountain bike is directly related to having as much as your body as possible within the wheelbase of your bike.

A tall rider on a short wheelbase can be a recipe for disaster. The weight will be distributed incorrectly for climbing steep hills (too far back) and for descending steep hills (too far forward). Conversely, a short person on a long wheelbase will be super stable, but won't be getting the most out of their bike because their body will more than likely be too far in front of the drive chain.

So, if you're tall or you have a long body and arms relative to your legs you will need a longer frame. If you're short, often you'll find it hard finding a frame small enough. Frames do come in extra small now though, so most people are catered for. Actually, if everyone could find the right frame for their body you'd find that we all had the same length handlebar stem and same saddle position. But that isn't the case, which is why we end up with bike fit articles like this.

### Start At The Bottom

One of the most common mistakes people make when they start adjusting their bike fit is to start with seat height or handlebar reach. Obviously these are the two biggest comfort vs power areas, but actually you won't get them 100 percent right unless you have some other less obvious things sorted out first. And like any good plan, we start at the bottom and work upwards.

### Foot Position

Good bike fit starts with the positioning of your foot on the pedal. Where your foot sits on the pedal affects everything from seat height, reach, optimum power transfer and even injury problems. Generally, the favoured position is to have the axle of the pedal directly under the ball of your foot. This gives a good combination of leverage and stability for optimum power transfer. However, people with small feet might feel the need to move their foot slightly back to create a bit more leverage. Additional to this is the lateral or sideways angle of the foot on the pedal. This is important because it affects the natural tracking of your knee and hip. If your foot is at an angle that misaligns the tracking of these joints you can develop injury problems. Start by positioning your cleats according to how your hips naturally let your feet fall. Then using free-floating pedals to get find the final adjustment for you. It's a good idea to use slightly free-floating pedals so you can move your tracking slightly if you do get knee & ankle or hip niggles.

### Crank Length

Crank length is one of cycling's timeless debates. In mountain biking it is generally accepted that you use slightly longer crank lengths than you might on a road bike. This is because of the smaller wheels needing more leverage to maintain the same velocity, but also for more leverage when climbing steep hills in small gears. However, exactly what crank length you should use really relates to the size of the rider.

Actually, to be exact, the crank length relates to the size of the riders femur (thigh bone). One of the generally accepted principles of cycling is that the optimum power is obtained when your forward crank is parallel to the ground your knee cap will be directly over the pedal axle. People with long legs, or more correctly long femurs, usually have trouble achieving this. On a road bike they often slide the seat position further back to achieve this, but in mountain biking this would make steep climbs almost impossible because you wouldn't be able to keep your front wheel on the ground.

So even more than road cycling, crank length is important for mountain bikers. The way to ascertain what crank length you should be riding is to measure your inseam (crotch to ground without shoes). Most medium and large sized mountain bikes come with 175mm cranks, but if your inseam is less than 81cm then you should consider 172.5mm cranks. If your inseam is less than 76cm then 170mm cranks is probably best.

## **Finish At The Top**

Once you have the right foot position and crank length, it is very easy to find the right seat height and handlebar reach.

## **Seat Set Back**

This is the next most important thing after feet position and crank length. If you have the setback of your seat wrong, then it affects your seat height, reach and of course pedalling and handling efficiency.

Generally, mountain bikers have their seats a little bit further forward than road riders. This is to help keep the front wheel down on steep climbs, but also to give us room to lean off the back of the bike to avoid going over the handlebars or lose the family jewels on steep, tricky downhills. The best starting point is to clamp the seat post about halfway along the seat rails. Then we fine-tune this after setting everything else up.

## **Seat Height**

Just about everyone has heard that age-old guide to setting your seat post where your leg is straight when your heel is on the pedal. In short, this is way too general.

Several studies have shown that the best measurement for establishing seat height is to multiply your inseam by 1.09. The end result is your seat height in centimetres. You apply this measurement by placing the crank arm in line with your seat tube & running a straight edge along the top of your seat. The measurement is then applied from the centre of your pedal axle, up the crank arm, seat tube and seat post to the bottom of the straight edge.

Remember, however, that this is a starting point for your seat height. You then need to refine the seat height to cater for the thickness of your shoe sole and how high your pedal platform sits off the pedal axle. Almost every shoe and every pedal are different and can affect your seat height by as much as a centimetre.

For example, if the sole of mountain bike shoe is more than 7mm thick you usually need to put your seat up by the difference. Similarly, if you ever replace your seat you need to check that the difference between the rails and the top of the seat is the same. Or if you change crank lengths you have to alter your seat height by the difference.

Sometimes, a course may have extremely technical or steep downhills. This may mean lowering your seatpost by 5-10mm. This isn't ideal for general riding but could save you sailing over the handlebars or doing a damage to the nether regions on the back of your seat. This is where a quick-release seatpost clamp can be handy, so you can alter your seatpost on the go without losing too much time.

## **Reach**

With everything else now established we can now ascertain your handlebar reach. This isn't so crucial for performance, but it is a crucial comfort factor, which of course can affect performance. If you have a frame suited to your torso and arm length and everything to date has been done well, your ideal reach should almost come about naturally. If it doesn't then you need to re-assess, 1) the height of your handlebar stem, 2) the length of your handlebar stem.

As with everything to date, we start from the bottom and work up. Assess the height of the handlebar stem first because when you alter height you also alter reach because of the angle of the headtube. Generally, a good starting height for your handlebar stem is about 5cm below the height of your seat. With this established you can now think about the length of your handlebar stem. Generally, a stem of 100mm to 120mm will fine-tune any reach problems. If you have a 105mm stem & feel a bit cramped even with bar ends, then maybe try a 115mm or 120mm stem.

## **Fine Tuning**

It's important to realise that everything we have talked about thus far is simply a very good way to find an accurate starting point for your bike fit. But because we have covered all the variables as they affect one another it is now very easy to adjust things slightly to suit your own individual quirks such as riding style, type of riding, flexibility etc. Below are some common solutions to fine tuning issues:

## **Seat Too Low**

Then put it up! But not too much because even 3mm can make a huge difference. Also be aware that when you put your seat up you are also lengthening your handlebar reach because of the angle of the seat tube. If you have to raise your seat by more than 5mm you'll probably have to move it forward by half that. Likewise, if you lower your seat you may have to move it backward on the rails by half the distance you lowered it.

## **Legs Tight or Knees Sore**

Presuming you ride reasonably regularly and haven't increased your hill training markedly, the reason probably comes back to the relationship between leg length and crank length. You can assess this by dropping a plumb line from your kneecap down to your pedal axle when the crank is parallel to the ground. Remember that the line should be close to intersecting the pedal axle. If the line is more than 5mm in front of the pedal axle you need to either move your seat back or get a longer crankset. Moving your seat back is OK, but it can upset other factors such as your seat height, handlebar reach and ability to keep the front wheel on the ground on steep climbs... so hopefully now you see why crank length was one of the first elements in good bike fit.

## **Uncomfortable Reach**

If after all this you are not comfortable with your reach it is probably because your frame is not quite the perfect length. For reasons already described, on mountain bikes it is better to alter the handlebar stem length than the seat setback. But remember you have to assess the handlebar stem height first.

If you find it hard on your arms and shoulders or back to ride long distances it is probably your handlebar height rather than reach. Lifting it up by 10mm can make a huge difference to comfort.

For those who can't quite decide on handlebar height, try the following exercise. Sit up straight on the seat with your body 90-degrees to the ground. Now dangle your arms at your side with your hands bent backward parallel to the ground. The distance between the top of your seat and the palms of your hands might be a better measurement to use as the difference between your seat height and handlebar height.

### **Recognising the Optimum**

Presuming you're now comfortable and can ride the bike for a couple of hours without your body starting to creak, we can give you a few final tips to help confirm you have a set-up that is not only comfortable, but also efficient in regard to transferring power.

The first is the angle of your back in relation to your arms. Just like as engineers design a humpback bridge, the angle of your arms and back should mirror each other. This way they actually support each other equally.

The second relates to power: when your pedal stroke is at its longest point (crank in line with seat tube) the angle between your legs and torso should be approximately 90-degrees. This has been proven in various studies to be the optimum angle for power to be produced by a complete pedal cycle of simultaneous pushing while pulling.

### **Something for Women**

It's an unfortunate fact of life that most brands make their bikes to suit men. The recent advent of extra small frames has helped women find bikes with a closer fit, but there is still a need to fine-tune some bike fit rules.

Women are not only generally shorter than men, but they are proportionally quite different.

In general, women have shorter torsos. This affects two things, 1) handlebar reach, 2) crank length relative to the 90-degree rule.

What this means is that woman usually end up with a frame that is too long for them. You could move the seat forward, but that means you're body and legs are no longer at that 90-degrees for optimum power. You could get a really short handlebar stem, but this adversely affects handling up front. A taller woman could go to a smaller and thus shorter frame, but then she might have problems with the larger difference between seat height and handlebar height. So you begin to see the problems for women.

There are two solutions to this problem, 1) get a custom made frame, which isn't very practical, or more likely 2) get the shortest frame that suits your leg length, then get a seatpost with no setback and a shorter handlebar stem.

Any of these three factors by themselves isn't particularly desirable, but by combining all three so that you only have to make small compromises a woman can cater for her shorter torso without making huge changes to position and effectiveness on the bike. If a new frame isn't practical the non-setback seatpost and shorter handlebar stem can be achieved for less than \$200 and will make a positive difference.