

Bike Fit or Are You Sitting Comfortably?

Did you know that at 25mph, 80% of your effort goes into overcoming air resistance [5]? Also, if you're not relaxed on the bike, you'll not be letting the legs get on with the pedalling so will be losing out on valuable power. If you suffer from sore back, neck and shoulders from cycling it's a sure sign of a poor position; neck ache from the bars too low and neck/shoulder/elbow pain from over-reaching to handlebars. Knee pain is typically from the saddle too high or low; perineal (your "undercarriage") from the saddle too high, too forward/back, tilted up/down; and lower back from the saddle too high (rocking hips gives this away). Worse still, you can get knee ligament damage, tendonitis in your neck/shoulders/elbows and for males, impotence (erectile dysfunction) and for females, excruciating chafing and bleeding.

Bike fit can be done either by measurement [7] (either subtractive – "inside leg minus 10 inches" or proportional – Hinault/Genzling, Lemond, "109% inside leg") or anatomical analysis (knee bend angle, foot position, etc.) Some shops and frame builders use jigs or measurement systems, e.g. "Bio Racer".

So, how do I set my bike up then? All you need, for basic bike fit, is the following: a turbo trainer (ensure the front wheel is horizontal), plumb line, spirit level, straight edge, tape measure and a friend! Set yourself up the turbo trainer and warm up a usual. Start with saddle height. If your hips rock, the saddle's too high [6a]; if your knees splay out it's too low. If you just pedal with your heel this doesn't take into account your foot size [6b]. With your foot clipped into the pedal, your heel should be a quarter inch below the heel or 5 degrees down with the crank in line with the seat tube. This is equivalent to a 25-30 degree knee bend at the bottom of the pedal stroke [2a]. The classic way of positioning the saddle fore/aft (using the plumb line and spirit level) is by placing the knee so that your knee cap is vertically over the pedal spindle with the forward crank at the 9 o'clock position. However, Keith Bontrager proposes that this is purely co-incidental and that the accurate method is to find your body's centre of gravity (CG) [2b]. "The CG of a seated rider in a fairly aerodynamic position will often be about 1 to 1.5 inches (2.5 to 3 cm) in front of the bottom bracket...Invariably, a climbing rider will place his CG at a spot two to three cm behind the pedal spindle at the nine o'clock pedal position. This is the case for all riders." [2c] Finally, there are a number of methods for finding handlebar reach. One is that "The handlebars should be level with the raised knee cap, and the reach found by butting the thumb up against the knee and the middle finger reaching out to just touch the bars in the centre." [6c] Another is that, with the elbow on the tip of the saddle, the tips of the fingers should reach the stem. With the other hand at 90 degrees, the palm width is the stem length.

To make this fit work for you, you need to adjust the saddle tilt and the brake levers. You also need to be specific on whether this is for time trialling or road racing. Your saddle should be horizontal or slightly tilted up [6d]. The bars should be tilted slightly up with the tip of the brake levers touching a straight edge held against the bottom of the bars [6e]. For time trialling, there are the following differences compared to your road position: the body is rotated forward about the hips [10a], requiring a steeper seat tube angle and longer top tube; you have a "closed cup" hand position with the hands together and the elbows inside the shoulders [10b]; and you aim for a flat back, allowing for your natural back, neck and hip flexibility (e.g. Lance Armstrong [12] versus Chris Boardman [11]).

Once you've set the bike up statically, you need to fine-tune your position on the road. To get your handlebar position right, roll along the road in a medium gear with your bottom squarely in the saddle. Swap your hands between the hoods, drops and no hands – the bars should be where the hands fall and there should be no change in the tension in your body. Again, while rolling along the road, swap between riding in and out of the saddle. Each time, your bottom should return to the centre of the saddle. Finally, ride up a slight, steady incline. Swap between riding in the saddle with your hands on the tops to riding out of the saddle, hands on the hoods. When moving from one position to the other, this should be one, flowing movement with no change of the stress and tension in the body with no need for adjustments in either your hand or bottom position [6f].

And, finally, we must all remember that women are different to men! The same basic method for setting up the bike applies but women in general have specific anatomical differences compared to men: hinge at the lower back rather than the hips; more flexible; longer legs, shorter feet, torso and arms; wider pelvis; lower upper-body strength; lower centre of gravity. This all adds up to the following considerations when choosing a bicycle: steeper seat tube angle; shorter top tube; raised,

narrower, shallower handlebars (taking into account a woman's greater relative flexibility); shorter cranks; lighter frame tubing and wheels (consider 650c wheels for under 20 inch frame); women-specific saddles, handlebars, brake levers. It should be noted that there was a dramatic change in the thinking on women's bicycle design and fit in the early 1990s, resulting in a reversal of long held opinions, e.g. "Long thigh bones mean the saddle will have to be further back and the seat angle shallow." [4] More and more manufacturers are making bicycles and equipment specifically for women, including:

Bianchi ()

Chas Roberts (<http://www.robertscycles.com/>)

Corinne Dennis (<http://www.corinnedennis.co.uk/>)

Georgina Terry (<http://www.terrybicycles.com>)

Specialized ()

Trek WSB (Women Specific Bikes) (<http://www.trekbike.co.uk>)

When you've set up your bicycles, you can use the following table as a useful reference guide to recording the frame geometries and set up for your bicycles [8].

Measurement	Road Race	Time Trial	Training	Touring
Bottom bracket to saddle				
Centre saddle to bars				
Saddle to bar height				
Seat tube angle				
Head tube angle				

This talk was put together and first given to members of my cycling club, Verulam CC, St Albans, Hertfordshire at the club night Monday 12th January 2004.

References

[1] Kirby Palm; Making a Bicycle Fit; <http://www.nettally.com/palmk/BikeFit.html>

[2] Keith Bontrager; The Myth of "KOPS" An Alternative Method of Bike Fit; <http://www.sheldonbrown.com/kops.html>

[2a] "For maximum power, the cyclist's legs should be nearly extended at the bottom of the pedal stroke."

[2b] "The KOPS [Knee Over Pedal Spindle] rule of thumb has no biomechanical basis at all. It is, at best, a coincidental relationship that puts the rider somewhere near his or her correct position."

[2c] "The CG [Centre of Gravity] of a seated rider in a fairly aerodynamic position will often be about 1 to 1.5 inches (2.5 to 3 cm) in front of the bottom bracket... Invariably, a climbing rider will place his CG at a spot two to three cm behind the pedal spindle at the nine o'clock pedal position. This is the case for all riders."

[3] Peter Jon White; How to Fit a Bicycle; <http://www.peterwhitecycles.com/fitting.htm> (2001)

[4] Auriel Forrester, Pirko Korkkia; Differences between men and women (Coaching News, 4/97)

[5] Claude Genzling; Aerodynamics and the Role of Position on the Bike (CoachingNews, 2/88) "326 Watts needed to overcome air resistance + 63 Watts needed to overcome rolling resistance at 39.6 kmh."

[6] John Bettinson; Are You Sitting Comfortably (Veteran Leaguer, Winter 2003)

[6a] "On the warm-weather training camps, for instance, I notice saddles too low, knees bursting; saddles too high, riding tiptoe, backside rolling. Stick a pump in their back pocket and it would oscillate like a metronome."

[6b] "The old maxim, set the height so that you can just pedal with your heels, is still a good starting point."

[6c] "The handlebars should be level with the raised knee cap, and the reach found by butting the thumb up against the knee and the middle finger reaching out to just touch the bars in the centre."

[6d] "It [the saddle] must be flat or raised ever so slightly at the front."

[6e] "The bars should be tilted up ever so slightly and, with the modern ergo lever, the tip of the lever just touching a straightedge held against the bottom of the bars."

[6f] "You'll know when you attain that perfect position. The bike will feel so stable yet so manoeuvrable. Whether you're riding on the tops, on the hoods or on the drops either position will feel efficient under pressure; but much more than that, you'll be able to accommodate a wide range of cadence with equal effect. You won't squirm or nod because you won't need to."

[7] Doughty Geldard Firth; Some Thoughts on Estimating Bike Frame Size (CoachingNews, 2/90)

“...these formulae are usually averaged from data collected from a wide range of riders and bikes. In other words, the frame sizes they suggest will suit some riders, others not so well.”

[8] Christopher Carrington; *Your Position on your Cycles* (Coaching News, 1985)

[9] Gerald O'Donovan; *Thoughts on Frame Design* (Coaching News, January 1988)

[10] Edmund Burke; *High-Tec Cycling* (Human Kinetics, 1996)

[10a] The key to a flat back is pelvic rotation...With the pelvis rotated forward, the hump in the back can be eliminated.

[10b] “By narrowing the arms, the cyclist reduces the body’s frontal area and allows for the wind to be directed around the body.”

[11] Chris Boardman; *The Complete Book Of Cycling* (Partridge, 2000)

“No-one has got a position as extreme as mine for a time trial bike...I have a curved back...long arms and short legs.”

[12] Lance Armstrong, Chris Carmichael; *The Lance Armstrong Performance Program* (Rodale, 2003)

“He [Lance Armstrong] can’t lean forward because of his lumbar fracture [L5], and he compensates by hinging higher in his torso, resulting in a rounded upper back.”