

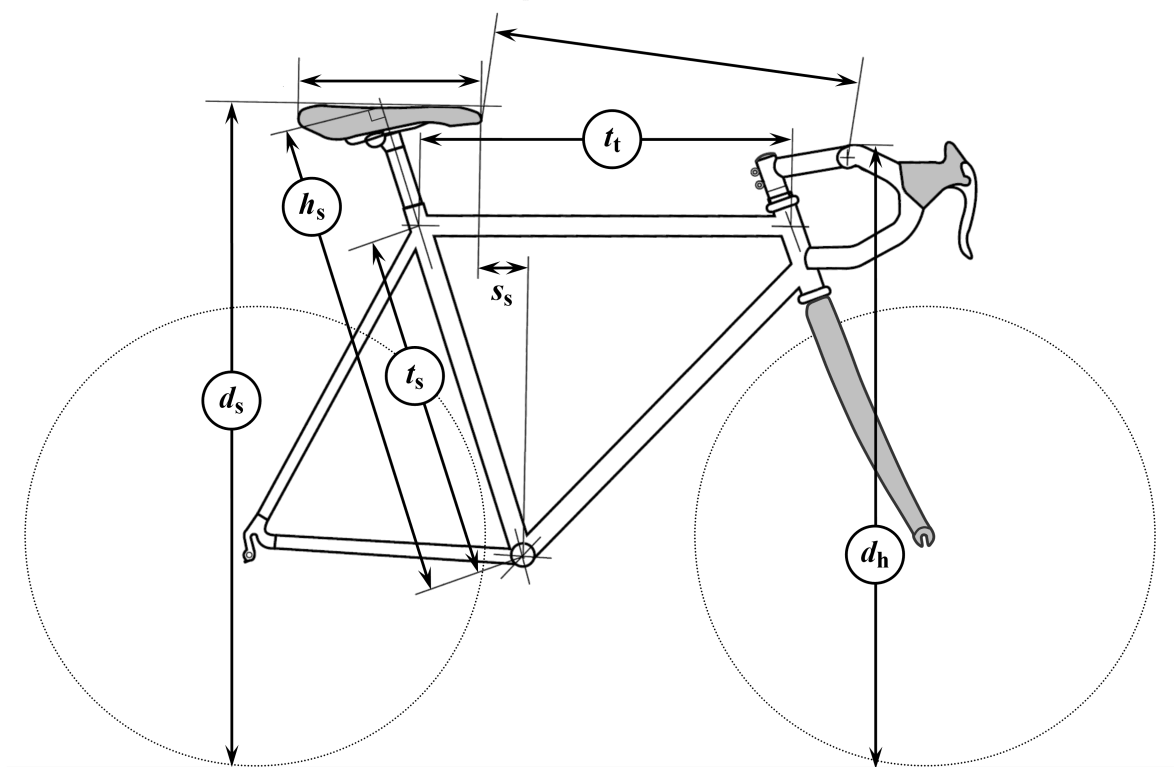
Uncompromising position: here's how to achieve optimal bike fit

BY CHARLES HOWE

Last month, we described how to measure your body in preparation for this month's article, which tells how to turn all that data into recommendations for bicycle sizing and fit. First, however, it's a good idea to obtain the critical dimensions of your present bike.

The baseline: your present bicycle

Begin by carefully measuring, in millimeters, the following frame dimensions. Make sure the top tube is level, or, for frames with sloping top tubes, that the bicycle is on a level surface and the tires are of identical make, width, pressure, and condition:



1. t_s – seat tube length (or frame size ‘center-to-center’). From the radial axis through the bottom bracket to the junction of the centers of the seat and top tubes, in a line parallel to the seat tube.
2. t_t – top tube length. The distance between the center of its junctions with seat and head tubes.
3. e – stem extension. As specified by the manufacturer.
4. h_s – saddle height. Same as #1, but continued up to the well of the saddle.
5. s_s – saddle set-back. The perpendicular distance from a plumbline hung over the nose of the saddle to the center of the bottom bracket.
6. d – saddle-handlebar difference. Measure perpendicularly from the ground to the well of the saddle (d_s) and from the ground to the top edge of the handlebars (d_h), then subtract the two values.

Record these values, and keep a careful record of each change in bicycle set-up (date, parameter, amount of change).

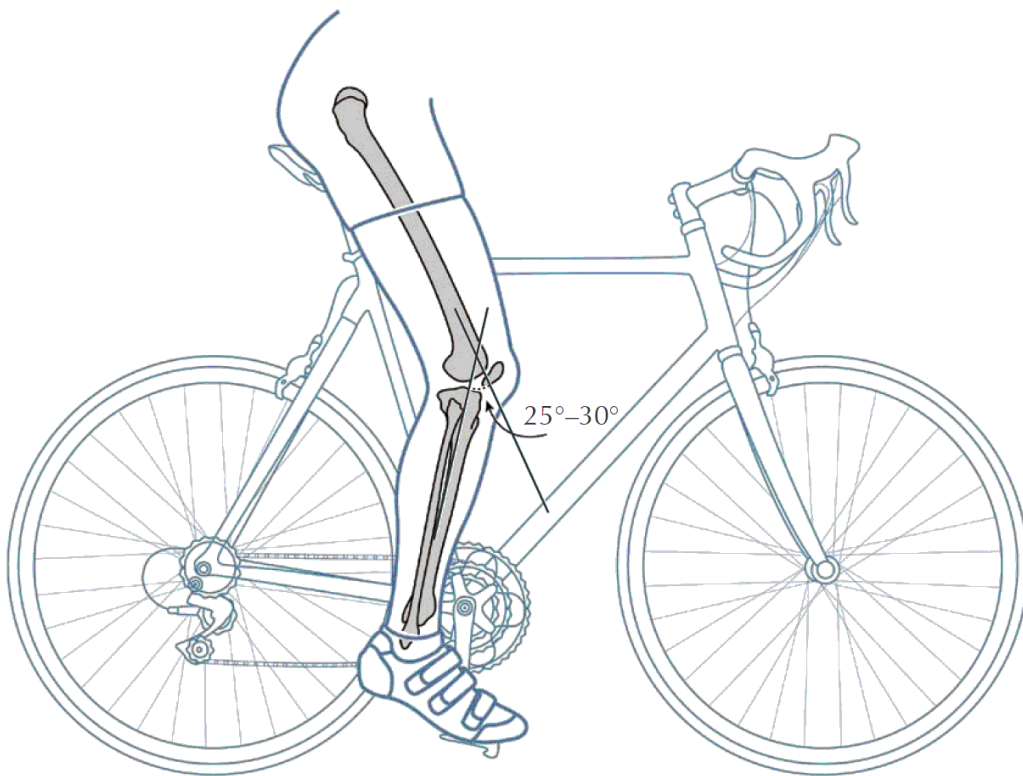
Calculating frame dimensions

Recommended frame dimensions calculate bike dimensions in mm as follows:

1. *seat tube length* = $i \times 0.65$ or 0.66
2. *top tube length* = $(t + a) \times 0.485$ or 0.49
3. *stem extension* = $(t + a) \times 0.105$ or 0.11
4. *saddle height* = $i \times 0.87$ - 0.88 , taking foot length, pedal/cleat stack height, shorts, and saddle firmness into account; generally, the saddle is moved up and forward for events of shorter duration requiring higher power outputs, down and back for road races and hilly terrain
5. *saddle set-back* = use KOPS (Knee Over Pedal Spindle) as a referencing guideline, where the position of the tibial tuberosity (bump just below the kneecap) is measured in relation to the pedal spindle, with the bike on a level surface.

Dr. Andrew Pruitt of the Boulder Center for Sports Medicine recommends that with the pedal at bottom dead center (6 o'clock), the tibia should be vertical, and a line drawn from the femoral head in the hip to the center of the knee joint, when extended, should form a 25-30° angle with the tibia. To obtain this measurement, you need a goniometer, such as is available from <http://chponline.com>). For the vast number of elite cyclists he has measured, this measurement is 30°, with very small variation.

6. *saddle-handlebar difference* = $a \times 0.125$



Remaining specifications, such as wheelbase, chainstay length, head tube angle/fork rake, and bottom bracket height should be determined by desired handling characteristics and intended use of the bicycle. For instance, a touring bicycle will have a relatively longer wheelbase and chainstays, with a shallower head tube angle and/or less fork rake, all of which make for more stable but slower handling, whereas a racing bike will be just the opposite, with a shorter wheelbase and steeper head tube angle and/or more fork rake, for more responsiveness.

How does it all look and feel?

Once again it must be emphasized that these formulae should not be taken ‘hard and fast,’ or substituted for a visual inspection and perceptual feedback:

What is the overall impression of the how the bike fits?

- ▶ Is the saddle too high? Is your knee joint too extended at the bottom of the pedal stroke? Do your hips rock noticeably?
- ▶ Is the saddle too low? Is your knee joint angle markedly acute?
- ▶ Do you appear to be “bunched up”? Is your torso angle markedly upright, even when you are on the drops? Do you have trouble sustaining you position on the handlebar drops? How near to horizontal is your back when you are on the drops? If a plumb line were dropped from your nose, where would it fall in relation to the handlebars?
- ▶ Are you too extended, or “stretched out”? Do you strain at all to reach the brake lever hoods or handlebar drops, such that you seldom use these positions, and are most always on the tops of the handlebars? Are your arms locked out when you are riding in the drops? Do you find yourself frequently “riding up” on the nose of the saddle?

Is there any pain or discomfort?

- ▶ Anterior knee pain may indicate a saddle that is too low or too forward, while discomfort posterior to the knee (e.g., the distal end of the hamstrings) is often caused by a saddle that is too high or too far back.
- ▶ Forefoot cant affects knee alignment, and therefore knee comfort. Most people tend to ride knocked-kneed, and require some amount of forefoot varus (canting of the forefoot upward on the inside), while others will require forefoot valgus (downward canting of the forefoot on inside). Specially-made shims called The Wedge (<http://www.bikefit.com/products.php>) can correct for either condition, while the Specialized BG line of shoes has a very minor amount of forefoot varus, equivalent to one Wedge. Some individuals will need more correction than this, or different degrees of correction for each foot, and these shoes may be inappropriate in such cases, as well as those with a neutral forefoot or who are in need of valgus correction.
- ▶ Lower back pain/discomfort may be caused by too much extension (a position that is too “stretched out”), while too little extension can result in neck pain.
- ▶ Pain in between the shoulder blades may indicate handlebars that are too wide.

References

Burke, E.R. Proper fit of the bicycle. *Clinical Sports Medicine* [13\(1\):1-14](#), January 1994.

Martin, J.C., and W.W. Spirduso. Determinants of maximal cycling power: crank length, pedaling rate and pedal speed. *European Journal of Applied Physiology* [84\(5\):413-8](#), May 2001.

Charles Howe has been involved in the sport of cycling since 1973, as a tour director, race director, official (road Cat 2), club officer, coach, and a recreational /competitive rider.