



## **Bicycle Biomechanics**

Many fitting systems take only body measurements into account when they recommend a frame size. Body measurements are useful, but should only be a starting point. Flexibility and strength varies from person to person, and they can also affect sizing. Other factors, including limb length differences, medical problems, and past injuries also factor in. Daily activities play a role, too. For example, a carpenter, who is always moving, working over head, bending, lifting, and twisting, will have different needs than a desk-bound office worker who has shortened hip flexors and hamstrings, and shoulders rolled forward from sitting. A comprehensive evaluation of the rider is needed to make an accurate fit.

### **How the body moves during bicycling**

A rider sitting on a bike should be balanced on the sit bones. The pelvis should be rotated forward, and the back should be flat or “neutral.” When the rider pedals, the pelvis and upper body should remain nearly motionless and relaxed, with arms slightly bent and chest open. Weight should be equally balanced between the hands and the saddle.

Muscle groups work reciprocally during the pedal stroke. Contraction of the hamstrings bends the knee, and contraction of the quadriceps straightens the leg. When a rider is pedaling, the gluteus maximus should be powering through the top of the pedal stroke. The calf muscles are engaged in the down stroke, with the biceps providing stability. Triceps and lats provide resistance and stability for the upper body on the upstroke as the hamstrings provide the power. The chest muscles are engaged throughout.

### **Proper Position on the bicycle and importance of flexibility**

Flexibility will greatly affect a rider’s proper fit and performance. The most common problem for cyclists is tight hamstrings. A rider with tight hamstrings and gluts will not be able to rotate the pelvis forward so that the sit bones are sitting square on the wide section of the saddle. When the pelvis is unable to rotate forward, the spine cannot stay straight. A curved spine pressures the lower back and causes back pain. The neck goes into extension, rather than being in line with the spine, and adds pressure to the upper

back and neck. The ribs fold down and breathing function is compromised. The arms straighten to bear more weight, and lose their function as shock absorbers.

Similarly, restricted movement in the external hip rotator muscles can limit a rider's ability to pedal efficiently by moving the legs out in a bow legged fashion and not allowing the legs to track straight up and down. Hip rotator tightness can translate into back, leg, foot or hand pain.

A proper bicycle fitting takes into consideration the two extreme ranges of motion of the legs. One extreme is with the knee bent with the crank arm in line with the seat tube, which is relative to hamstring flexibility and muscle activation, and the other is with the crank arm at its highest point which is relative to the hip flexion and glut flexibility. To properly fit the height of the seat and the handlebars to the athlete, we look at the optimum height that the athlete can pull the leg up while extending the other leg without rocking the pelvis or rolling it backwards in order to maintain the ability to produce power and to take long deep breaths.

The position of the body when getting out of a chair is similar to the position of efficiency and power when riding a properly fitted bike. The trunk leans forward, and the hips are flexed at about 45 degrees. This position uses the powerful gluteus maximus and quadriceps muscles to raise the body out of the chair. If a person tried to stand up from a chair with his/her back flat against the wall, it would be hard. In fact, the hips would automatically flex because it's the only position that would enable the body to use the power of the gluts and quads. It's the same on a bicycle. If a rider thinks of sitting on the bike as if a chair were being pulled out from underneath, his/her body will automatically assume the position that supports the weight of the torso using the quads, gluts, and core. The spine will be in line from the lower back straight through the neck, removing pressure from the traps and neck muscles. The eyes will be able to gaze forward down the road. The rib cage will be open for easier breathing, and the arms are relaxed and slightly bent to help take up road shock.

When you start to tire, you should be aware of your position to help fight added fatigue. Stretching and core strength exercise every day will help tremendously, and is as important as riding. This will help keep proper form on the bike, so you are more comfortable and efficient.

If you have any questions, comments or would like a personal fitting, please contact me:

Bob Olsen  
Wheel Werks  
115 North Main Street  
Crystal Lake, IL 60014  
815-444-6897  
[bob@wheelwerksbikes.com](mailto:bob@wheelwerksbikes.com)  
[www.wheelwerksbikes.com](http://www.wheelwerksbikes.com)



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