FITTING AND DESIGNING FRAMES
For Ultra Distance Cyclists

By Alex Meade

Ultra distance cyclists present unique challenges to the framebuilder. As with any type of bicycle, fit is critical, but fitting and designing an ultra distance bicycle involves considerations that differ from other types of bicycles. The intent of this article is to give an overview from a framebuilder's perspective of aspects of frame design important for ultra distance cycling, and to prepare you for the process of working with a custom framebuilder for your next bike.

Successful ultra distance riding requires time in the saddle far longer than most race situations. While a racing bicycle might be designed to maximize raw power at the expense of comfort, positioning for a degree of comfort is key for ultra distance bicycles. And, while a comfortable fit might also be a design objective for a touring bicycle, the need to carry bulky or heavy cargo loads will push the design in a different direction than what might be needed by an ultra distance rider carrying minimal gear.

Fit is a broad term, but in general it relates a set of body measurements to the design of a bicycle. In the simplest interpretation, a bike "fits" if the rider can stand comfortably over the top tube. Taken to the next level, multiple body measurements are used in formulas to determine the various dimensions of the frame, stem, handlebars and cranks. These formulas have been developed over years of experimentation and analysis, and represent averages of the population of riders. Ideally, because no individual rider is average, a bicycle should be fit to the whole rider and not simply to a set of measurements, and this is one of the advantages of working with a custom framebuilder.

My method of fitting is similar to many builders. I use body measurements and formulas to arrive at a starting point. In the best situation, a customer can then come to my shop where the starting point is translated into angles and dimensions on a stationary adjustable fitting bike. From this starting point, I make a series of systematic changes to the adjustable bike, observing and collecting feedback from the customer on the bike, to arrive at the optimal position unique to that cyclist.

For ultra distance cyclists, determining the correct fore-aft position of the saddle relative to the crank is critical, in part because this is the least adjustable fit parameter on a finished bike.

Saddle rails have limited adjustment range and seatposts are not available in a wide range of setback. So the frame

must be designed with a seat tube angle that will allow correct rider positioning with the saddle of choice. Too far forward generally results in excessive upper body strain; too far back sacrifices power. Arriving at the correct saddle position can take well over an hour on the adjustable bike, but it is by far the most important parameter. This critical part of the process should be done with the intended saddle.

Once the saddle is positioned, the bar extension and height is determined, again starting with formulas and proceeding through a set of systematic changes on the adjustable bike.

The bar position for an ultra distance cyclist is generally not the same as for a racer. Bar position can also be dramatically affected by rider flexibility, injury history, gender and age.

With bar position fixed, I then re-check the saddle location to be sure there have been no interactions between bar position and saddle location.

It's not unusual for the entire fitting process to take several hours. Once complete, I encourage customers to modify their current bike through seatpost and stem changes, to get as close as possible to the determined fit in order to try out the new riding position prior to building the custom frame. It's often impossible to get the saddle and bars to the ideal position on the rider's current bike because of the previously mentioned limitations, but generally a rider will be able to get an early idea of how the custom frame will fit and feel by approximating the changes on his/her current bike.

In addition to fit, intended setup has an important influence on custom frame design.

Wheel size is of course an early decision in the design process, and with a custom frame, smaller riders can opt for wheels smaller than 700c, freeing up many constraints on the frame design and often improving the aesthetics. Tire size is almost as critical to the design. The maximum intended tire size influences the length of the fork and the chainstays, the brake reach, and whether the chainstays can be straight or need to be curved or indented.

If the rider intends to use fenders, the frame design should allow for fender clearance. Ideally, a builder will fit the intended fenders to the frame during construction to ensure that the mounting points are compatible.

Cantilever brakes offer tire size flexibility and the frame must be designed accordingly, with appropriate mounting points and cable stops. Disk brakes are gaining popularity beyond MTB and CX, but they require a wider fork crown for rotor clearance, and heavier rear stays and fork blades to accommodate the different location of forces on the frame. Disks can interfere with racks and fenders if the frame is not designed with complete knowledge of the intended setup.

In determining the ideal steering geometry, I find it helpful to watch a rider. When possible, I take a short ride with a customer to evaluate steering needs. Since a custom fork can be made with virtually any amount of rake, steering characteristics can be preserved for any size rider, while avoiding toe overlap for smaller riders. Geometry allowances are often made for bikes intended to carry loaded bags.

Part of the work in designing your frame is to ensure that the intended positioning can be achieved using seatposts and stems in readily available sizes. Expect your builder to provide you with specifications for the seatpost setback, stem length and angle, and spacer stack you'll need with your new frame.

Selecting tubing size and thickness is almost the last step in the design process. Each tube is selected based on the dimensions of the frame, rider weight, and intended use of the bike. Seemingly small factors, like bar height and whether or not a handlebar bag is intended, go into selecting each tube. While minimum weight is always desired, most riders are not interested in a bike with quirky handling characteristics resulting from tubing too light for the application. Fortunately, all of the major bicycle tubing manufacturers make tubing of exceptional quality, so today's choices in tubing for custom frames are almost limitless.

About the lead photo: ensuring racks, fenders and brakes all work together is best done by the builder before the frame is painted. Frame mounting points match the components, racks and fenders are modified as needed, and scratching a nice new finish is avoided.

About the author: Alex Meade has been building custom frames since 1999, with extensive experience in frames for randonneurs and ultra distance cyclists. He holds a MS in Mechanical Engineering from Stanford University, and has been a product design engineer for over 30 years, holding 12 US patents. In 2007, on a bike he designed and built for that event, he finished the 762 mile Paris-Brest-Paris in under 56 hours, earning him membership in La Société Charly Miller. A gallery of his bicycles can be seen at www.alexmeade.com and he can be reached at alex@alexmeade.com or by calling 859-351-8443.