Bikes & Gear > Member Exclusive

Demystifying Bicycle Geometry Charts: Crucial Numbers Every Rider Needs to Know

UNDERSTANDING STACK, REACH, AND TRAIL MEASUREMENTS CAN HELP YOU FIND THE BIKE THAT FITS YOU BEST AND WILL ALSO COMPLEMENT YOUR RIDING STYLE.

BY DAN CHABANOV Published: Feb 11, 2025 10:50 AM EST

Trevor Raab

When buying a new or used performance-oriented bike, you'll need to figure out what size frame you need. Frames are most often sized in either "T-shirt sizing," aka small, medium, large, etc. Or they will have numerical sizing. These sizes are determined by the lengths and angles of various frame measurements, also known as the frame's geometry.

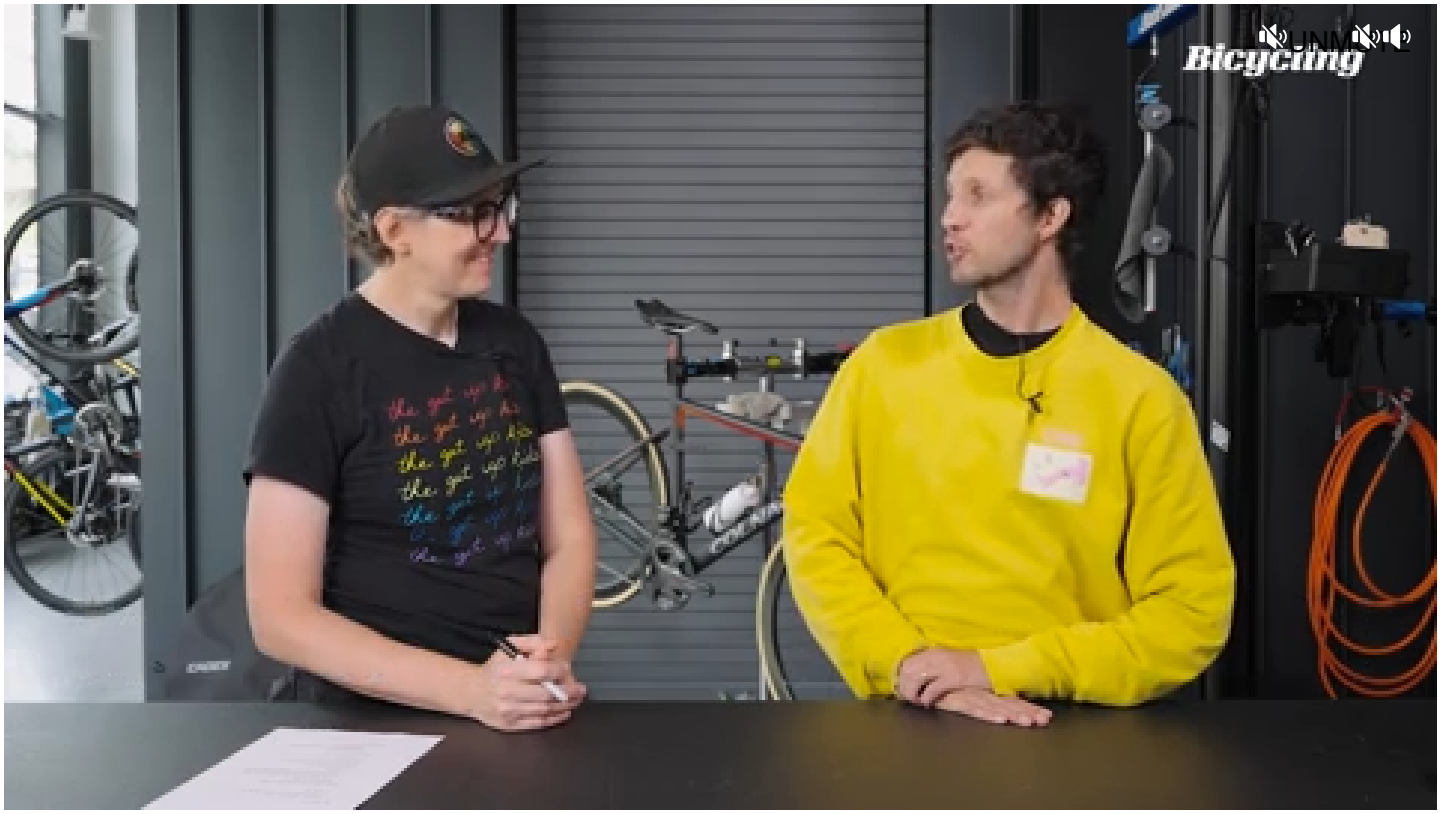
Local bike shops can often help customers answer basic sizing questions or even offer tools and services to help determine your precise dimensions. Still, it can be helpful to know and understand how to read a bicycle geometry chart (provided by the manufacturer for each model and size), its most important figures, and how

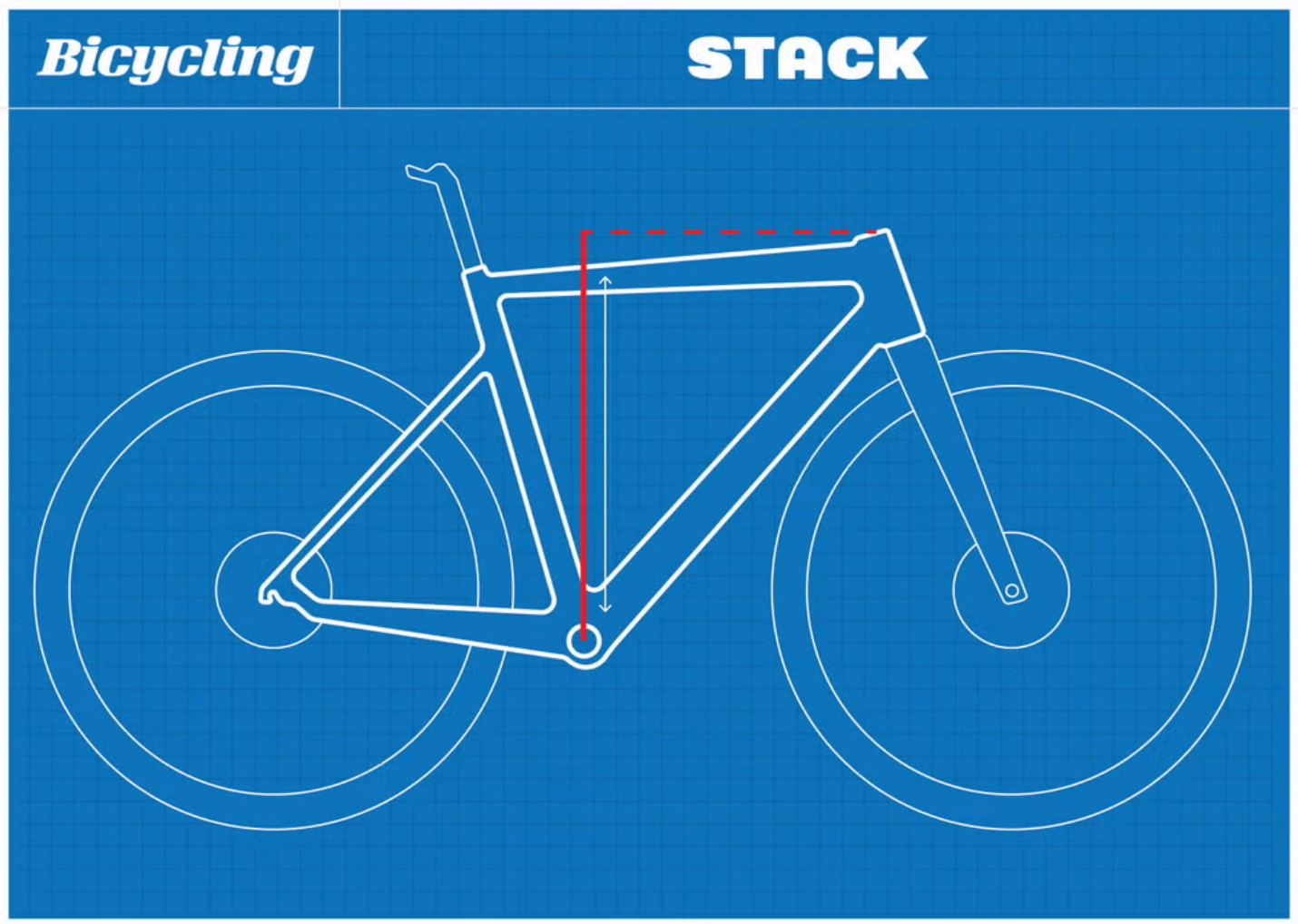
those numbers can help you determine the correct size for you and if the bike you are looking at well suited to the riding you want to do or handle the way that you want it to.

Stack and Reach are easily the two most important measurements in determining if a given frame will fit you. An easy way to think of them is as waist and inseam measurements on a pair of pants. These numbers are designed to be comparable across brands and bike models. Making them the default figures most riders use when deciding between multiple frames and various sizing conventions between different brands.

MORE FROM BICYCLING

All the Details on Campy Super Record Wireless

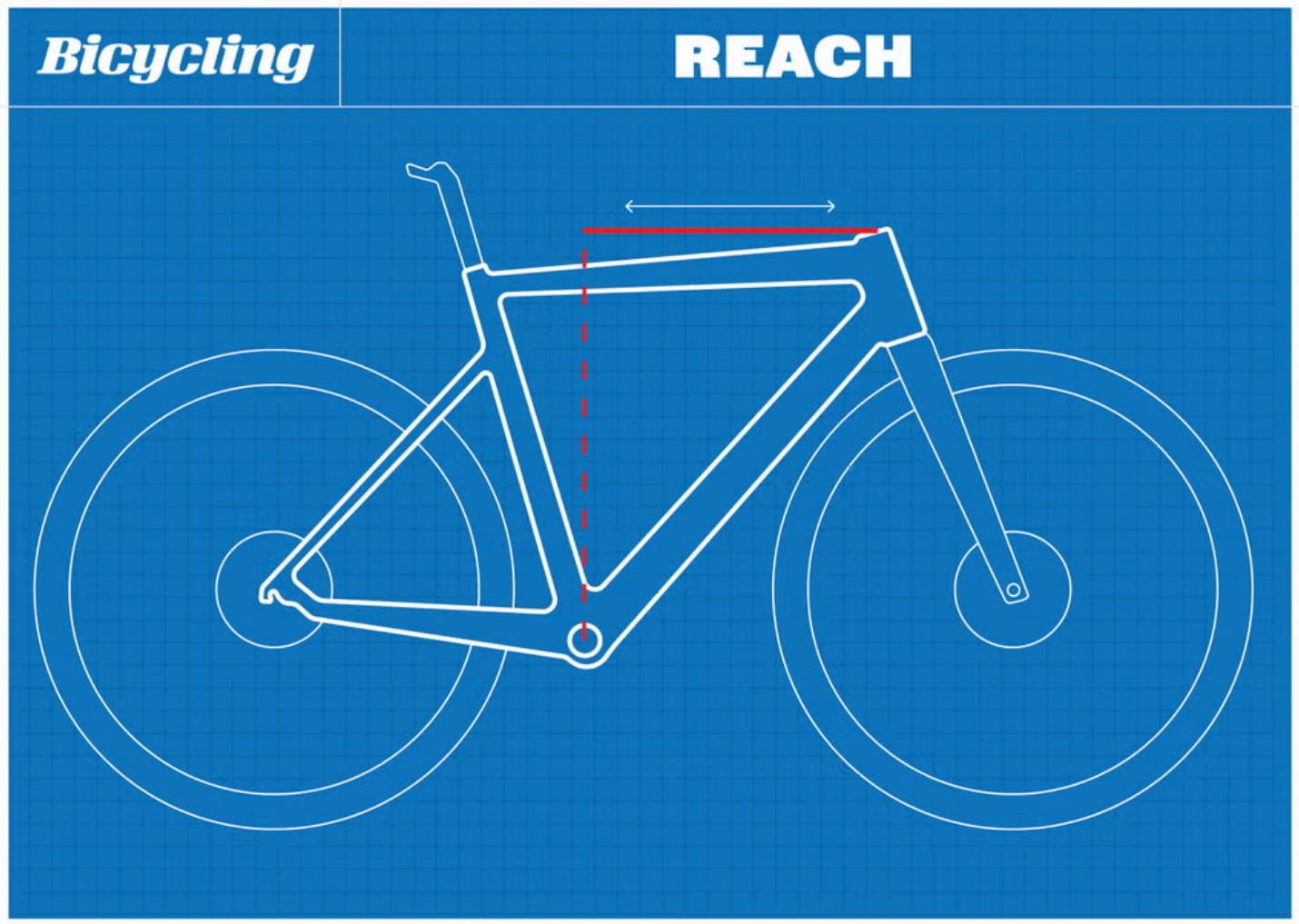




Bicycling

Stack is a measurement of the vertical distance between the bottom bracket's center and the head tube's top. The Stack number will give you an indication of how upright a bike’s cockpit is. A higher relative stack number will allow you to sit in a more upright position. While a lower relative stack will result in a more aggressive fit.

An important thing to remember about stack when looking at a bike with fully hidden cable routing is that many of these frames have a proprietary headset cover that you must use. Many brands, such as Specialized, have begun including this mandatory cover in their stack measurements. But it's always worth double-checking this since it could mean that the frame is slightly taller than advertised if it does not factor in the needed headset spacer.



Bicycling

Reach measures the horizontal distance between the center of the bottom bracket and the top of the head tube. Combined with your stem length and handlebar reach, this number indicates the length of your bike's cockpit. The higher the reach number, the more stretched out you will be.

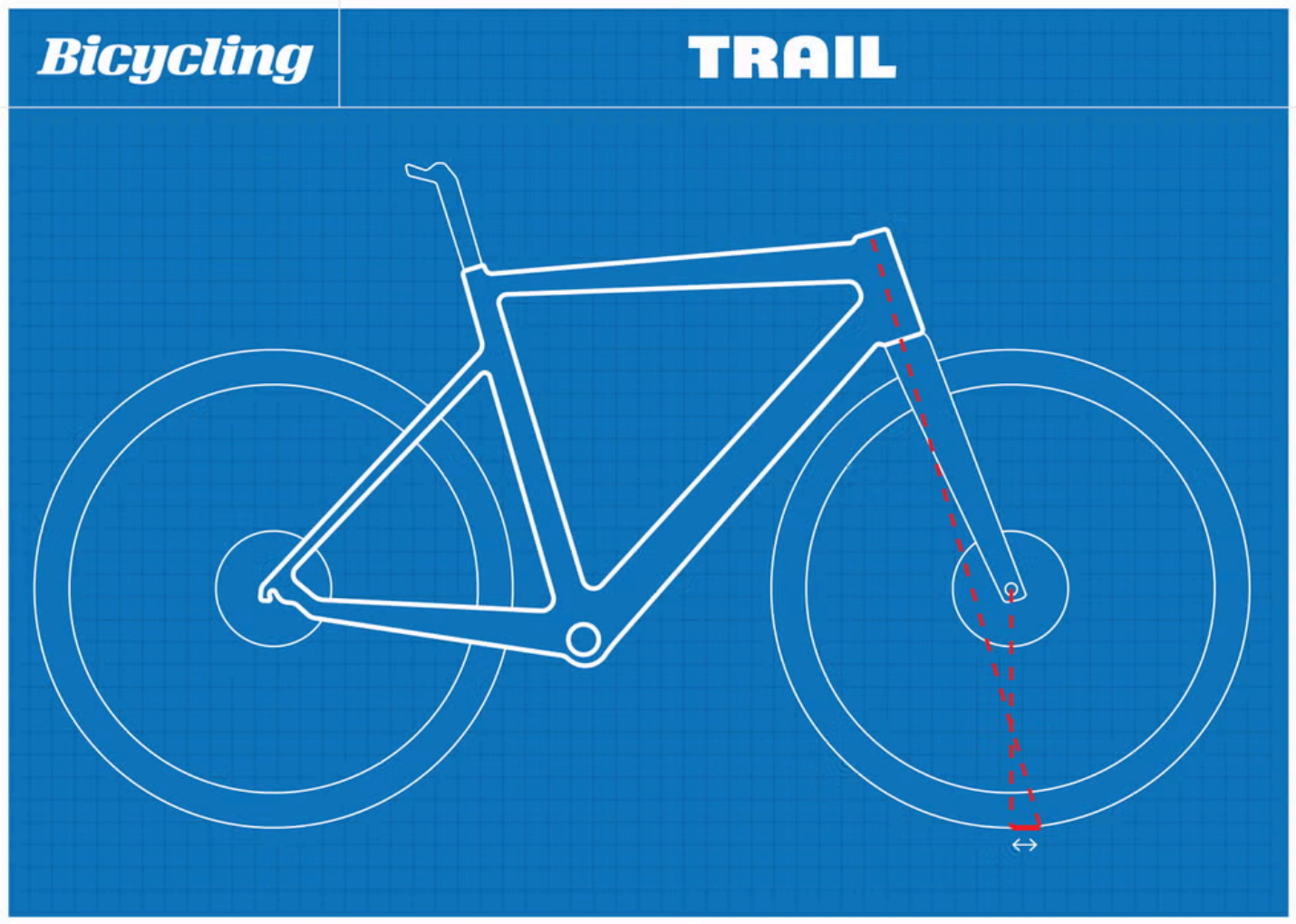
If you're buying your first bike, I recommend you test-ride various sizes and note their stack and reach numbers. This will help you compare sizes from multiple brands. If you're buying a new bike, you can look up the stack and reach figures of your current one to use as a reference.

You can compare reach numbers to understand what length stem and handlebar reach you would need for your new bike. Similarly, comparing stack figures would help you know the number of spacers or what stem angle

you'd need to accommodate your current fit.

Once you narrow down which size or model fits you best, it's time to think about how you want a bike to handle. Trail is so important because it's a simple way to describe how a bike's steering will feel. A high relative trail figure will mean that a bike will be more stable at speed and will have a tendency to self-correct. This is great for riding on rough terrain, where holding a line and carrying momentum is essential. A low relative trail figure will mean more aggressive or fast steering and a better ability to maintain a line through a corner.

You'll typically see the lowest trail numbers on aggressive road racing bikes, where the ability to quickly change lines and maneuver in a big group of riders is really important. While you will find higher trail numbers on mountain and gravel bikes.



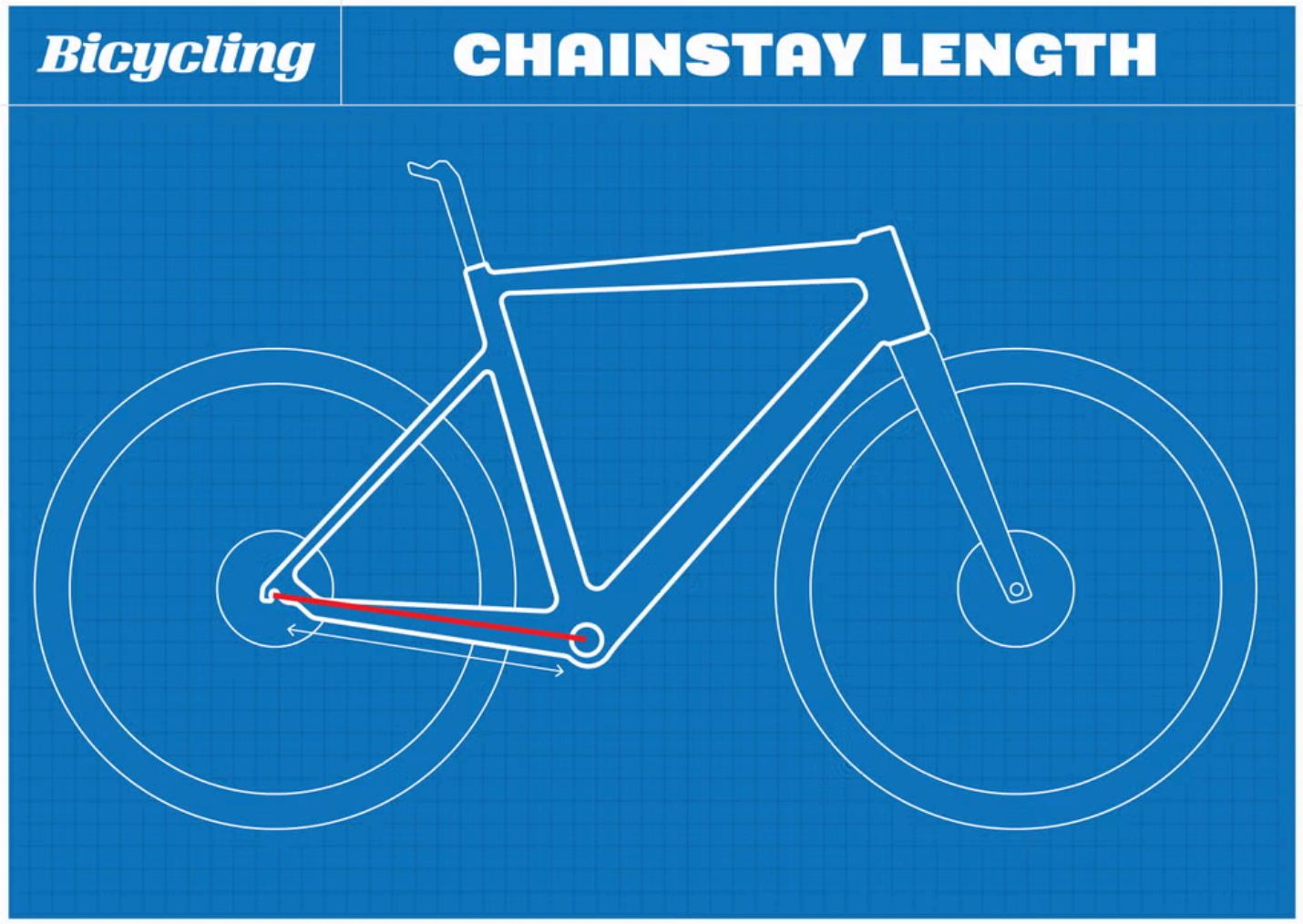
Bicycling

Trail is not always listed on a geometry chart because it's not directly measurable on a frame. Instead, it's a number that is derived from the head tube angle, the fork offset, and wheel size. Something as simple as changing a bike's tire from 28mm to 30mm would alter its bike's trail figure. This is why brands often describe bikes as being optimized around a specific tire size. It means that with this tire size, the frame will have the desired trail figure that the designers wanted. Some brands, such as Enve, have begun listing their bikes with multiple trail figures for various tire sizes to help give riders an idea of how a different tire will change how the bike handles.

You can use trail to figure out what you want out of your next bike by **calculating the trail number of your current bike**. Do you want that bike to be a bit smoother and more stable? Look for something with a higher trail figure. Want something more aggressive and quick feel? Then, look for a bike with a lower trail number.

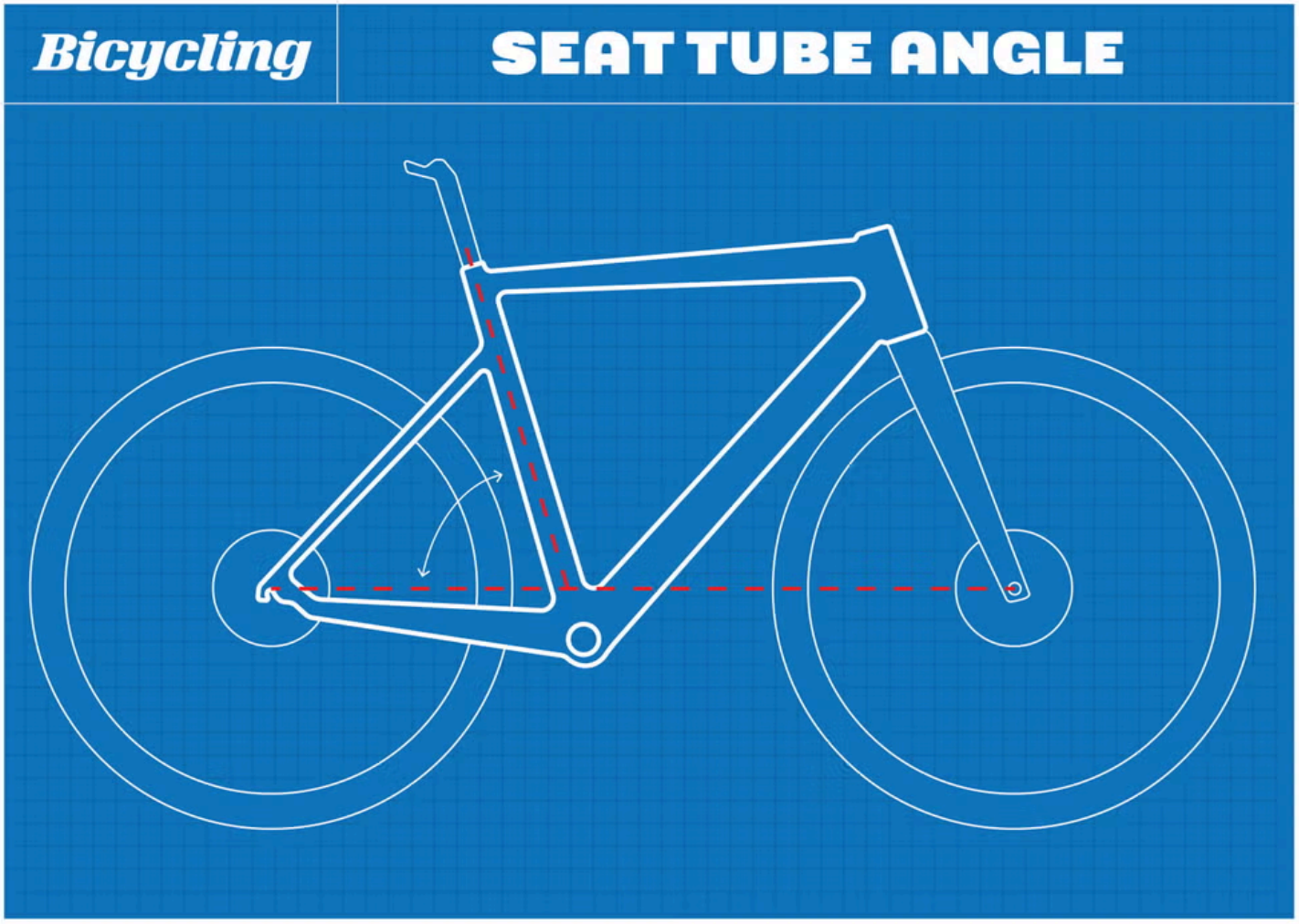
What about everything else on this chart?

I focus on Stack, Reach, and Trail as the three most important numbers for helping you figure out your next bike. There's a lot of other information on a frame geometry chart that can be helpful to understand as you go through the process.



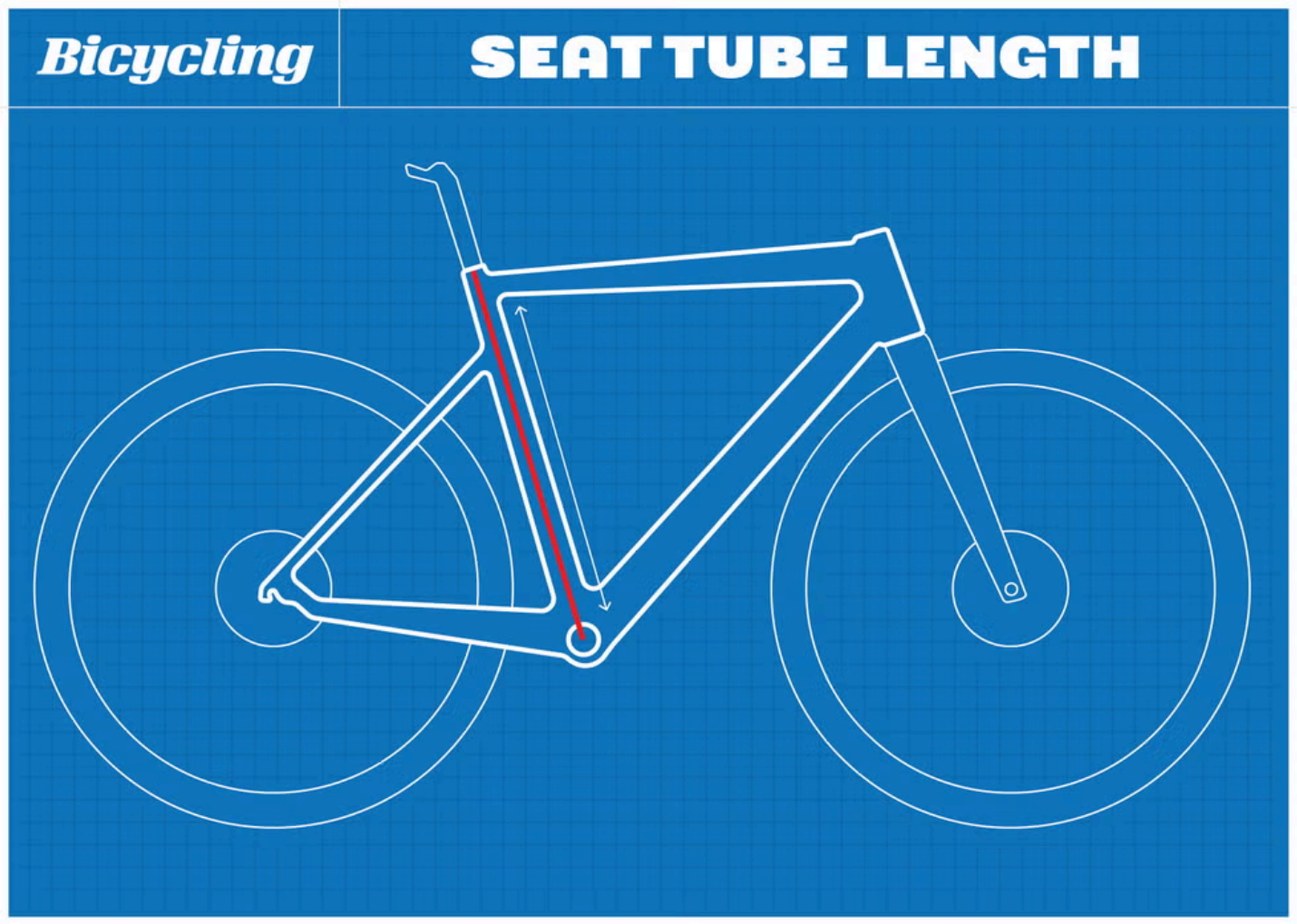
Bicycling

Chainstay length is a measurement from the center of the bottom bracket to the center of the rear wheel. It primarily affects your center of gravity on a frame and contributes to how a bike corners and how stable it feels overall.



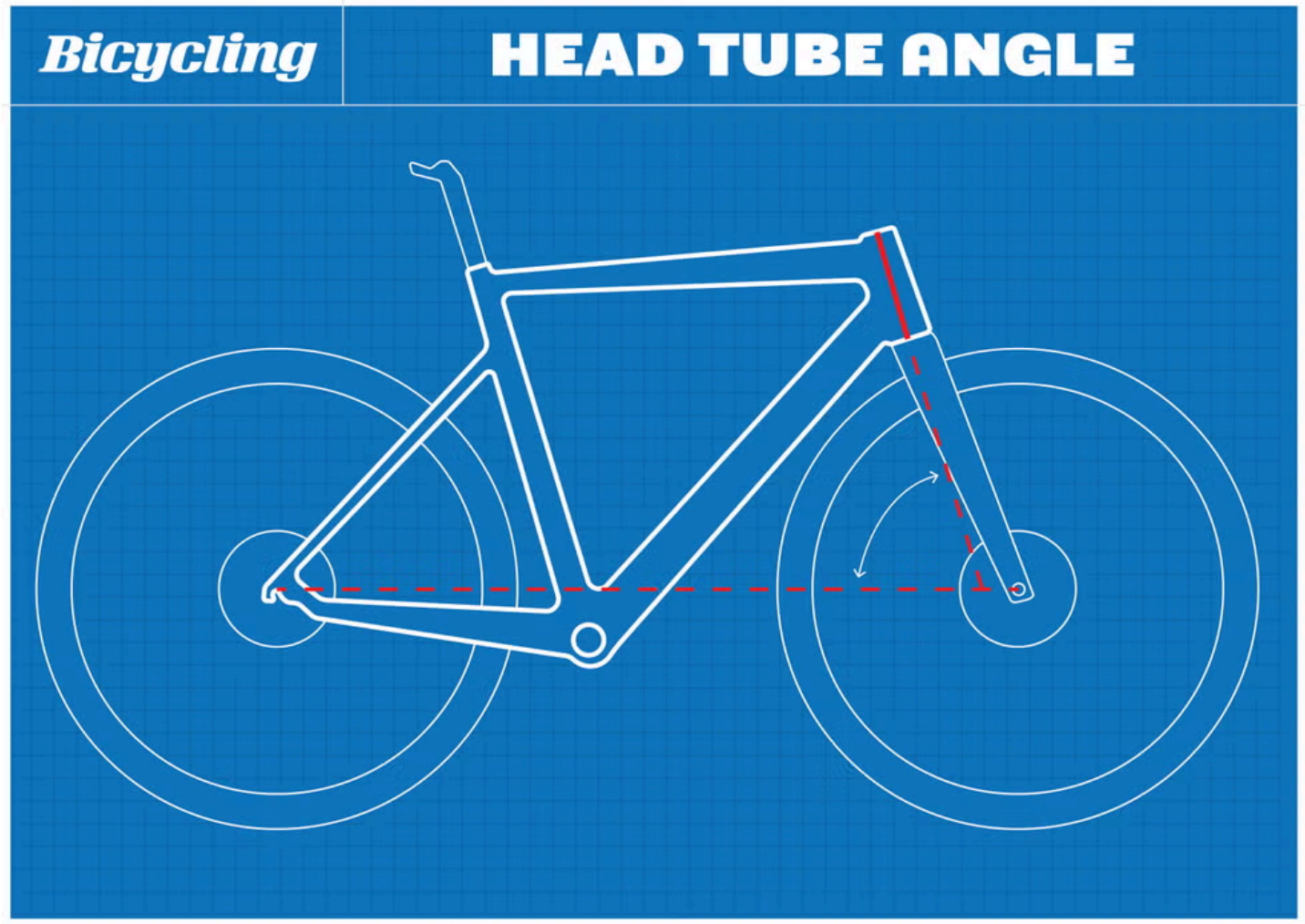
Bicycling

Seat Tube Angle is the angle of the seat tube relative to the ground. It primarily affects rider position, and you can adjust your effective seat tube angle by sliding your saddle forward or back in your seatpost.



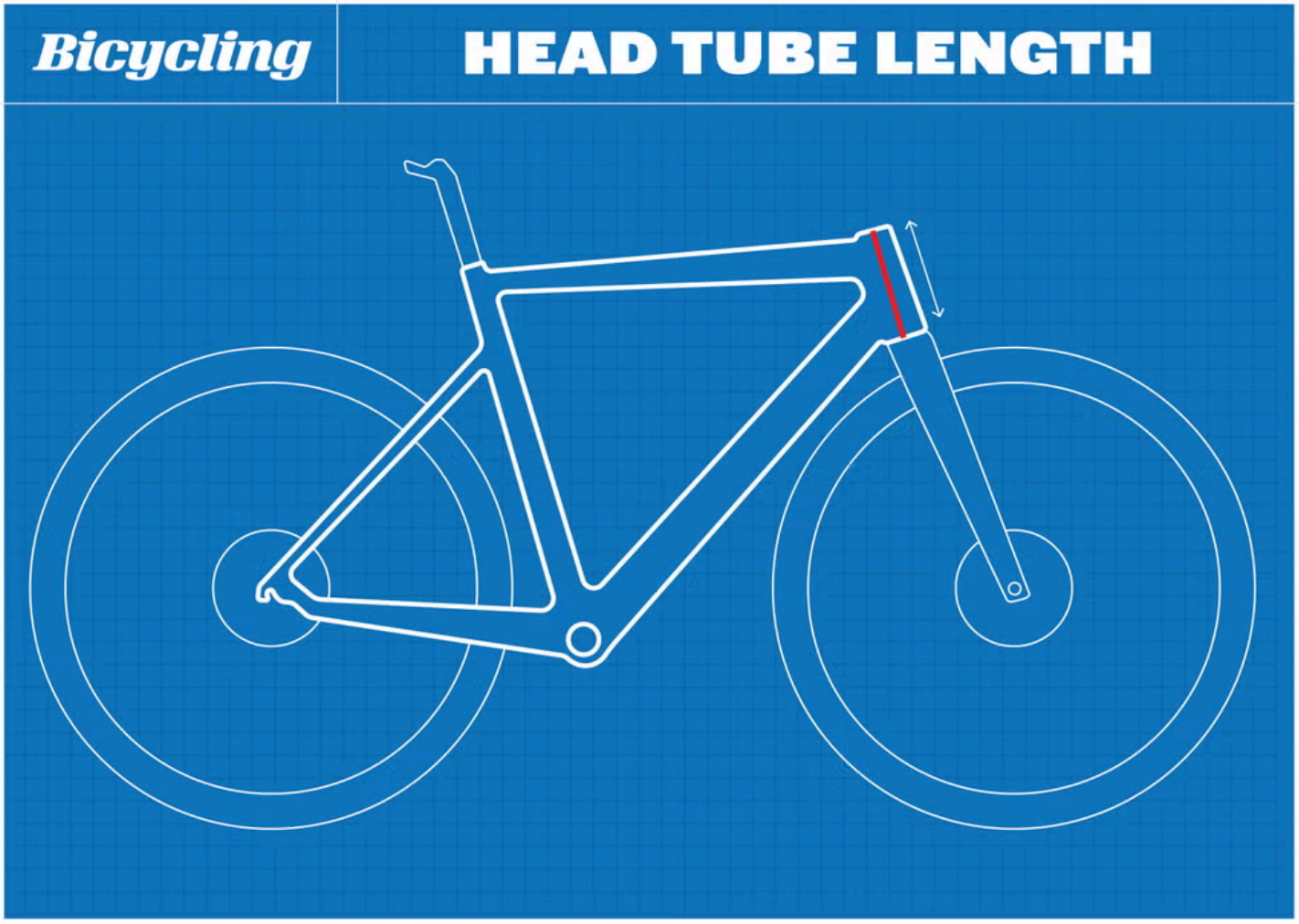
Bicycling

Seat Tube Length is measured from the center of the bottom bracket to either the seat tube top (CSTT), to the top of the top tube and seat tube intersection (CTT), or the center of the top tube seat tube intersection (CTC), or it's given as an effective measure to an imaginary horizontal top tube that extends from the head tube. This is a largely outdated measurement, but it can help determine the standover height and the length of a seatpost you need.



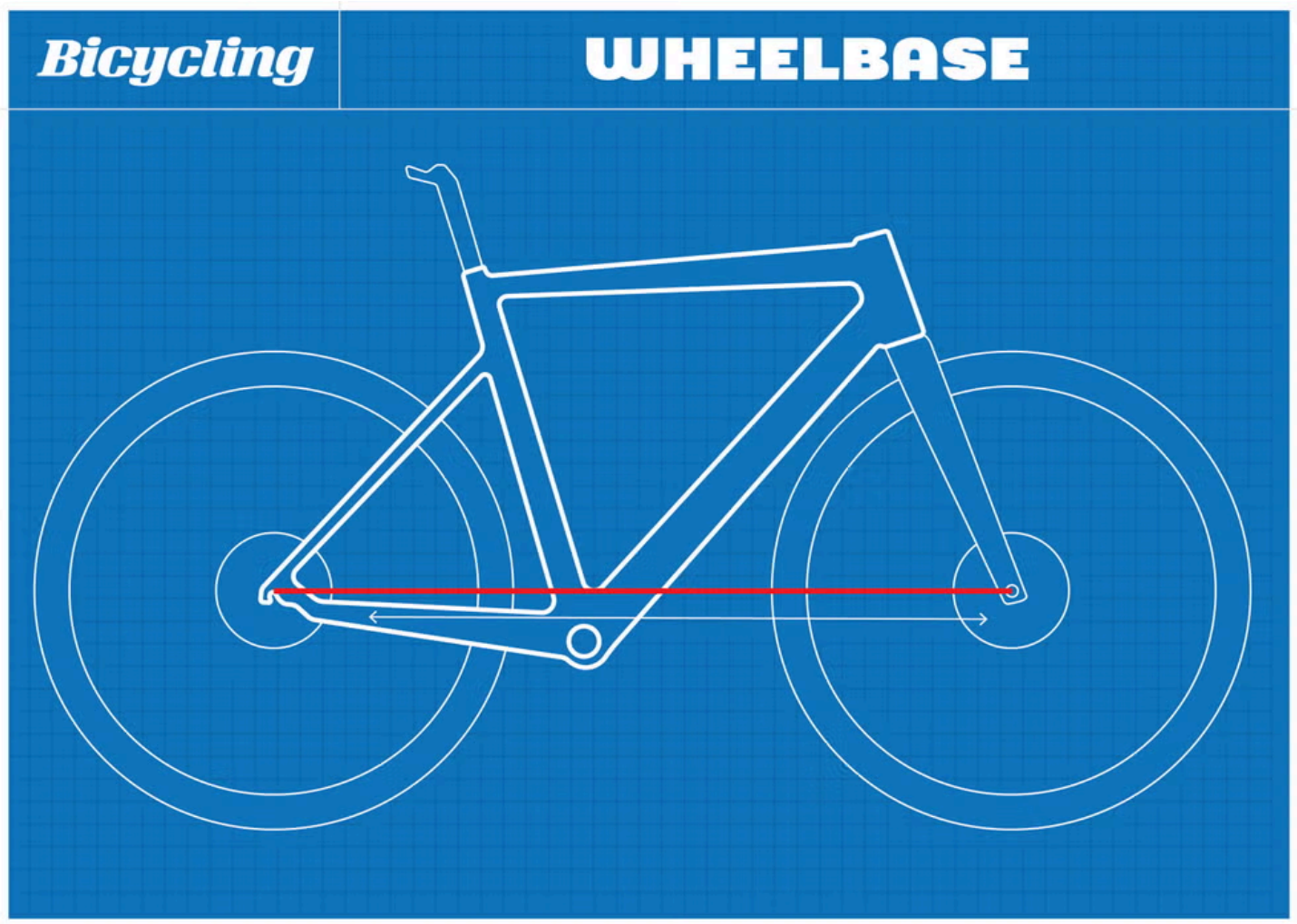
Bicycling

Head Tube Angle is the angle of the head tube relative to the ground. It's one of the measurements that helps determine the trail figure of the bike, making it a significant determining factor in how a bike handles. A slacker head tube angle will move the front wheel out in front of the rider. This provides more stability at speed but can make the front end feel floppy and less responsive at slower speeds. Mountain bikes typically have very slack head tube angles between 62º and 68º. A steeper head tube will put the front wheel closer to the rider, making for a more responsive bike, with the trade-off that it can feel twitchy at high speeds on particularly rough terrain. Road bikes will often have head tube angles between 71º and 74º.



Bicycling

Head Tube Length is measured from the bottom to the top of the head tube and will raise or lower a rider's position on the bike. However, stack is a better measure of this, so it isn't particularly relevant for most riders.



Bicycling

Wheelbase is the horizontal distance between the center points of the front and rear wheels. Historically, bikes with longer wheelbases have been considered more stable and have slower handling, while ones with shorter wheelbases have been considered more responsive. While there is a correlation between wheelbase and these traits, wheelbase alone is an incomplete metric for understanding a bike's handling characteristics.

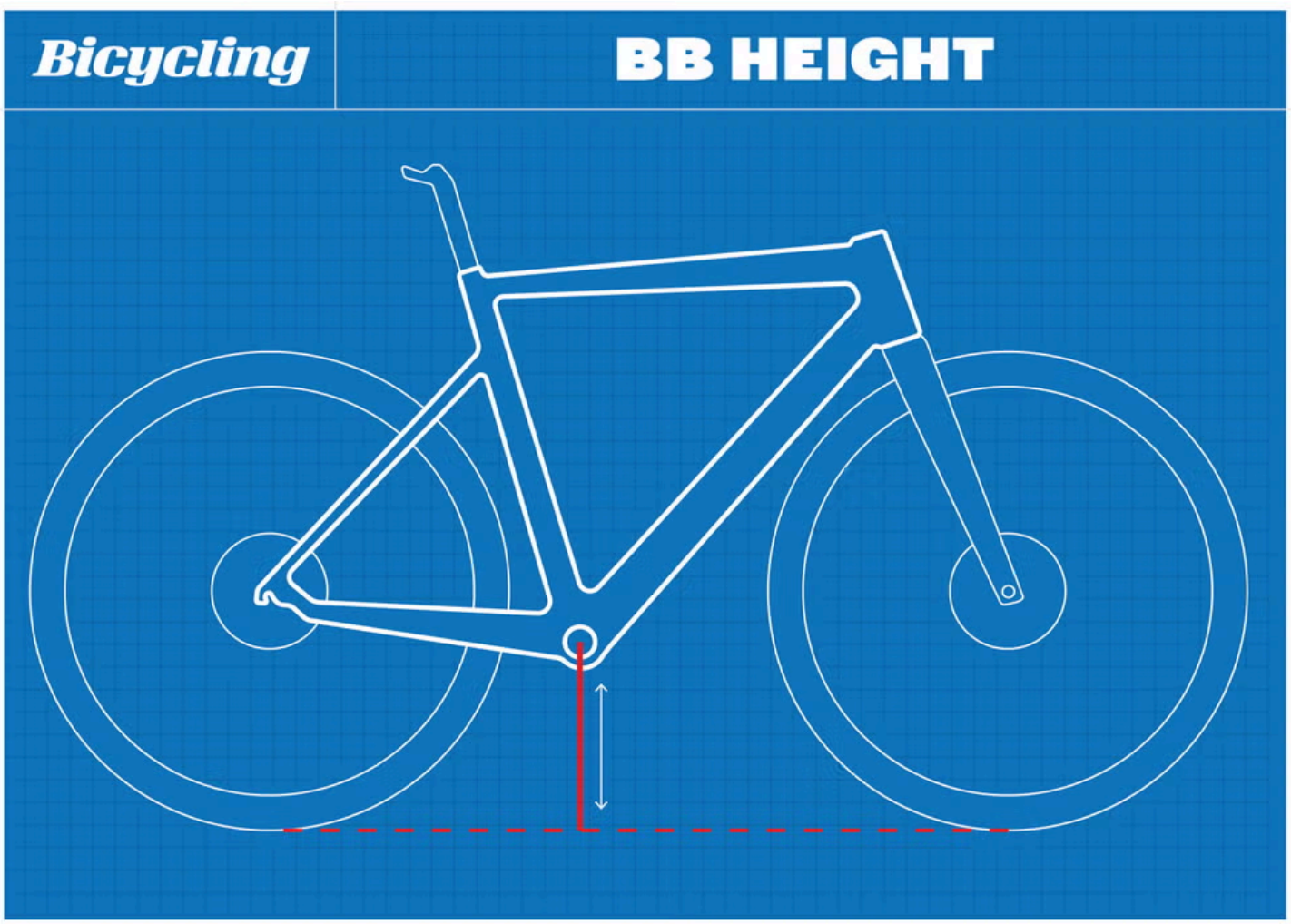
Standover Height is measured as a vertical line from the ground to the top tube's midpoint, where most riders would typically stand over the frame when they are stopped.

Top tube length like seat tube length, used to be a very important measurement, but with the widespread adoption of compact geometry designs and stack and reach measurements, it has largely fallen out of favor. It will often appear on a geometry chart as two measurements, one giving the actual physical length of the top tube and the second showing the effective top tube length. The second measurement is the one most riders will care about, and it measures an imaginary horizontal line from the center point of the top and headtube junction to the center of the intersection with the seat tube. This measurement affects how stretched out a rider will be over the frame, but reach is more reliable for comparing frames from different brands.

Front Center is measured from the bottom bracket's center point to the front wheel's center point. This number can indicate the bike's weight distribution and, by extension, its handling characteristics. It can also help determine whether toe overlap is present for a given size.

Fork Rake is the horizontal distance between the projected steering axis (if you just drew a straight line down to the ground from the headtube) and the actual location of the front axle. It is one of the measurements that helps determine a bike's trail and is crucial to know if you want to replace the fork on your bike.

Bottom Bracket Drop is measured from an imaginary line between the center points of the front and rear wheels to the center of the bottom bracket. It primarily affects how low to the ground a rider will sit on the bike, which can be crucial information for riders worried about ground clearance when pedaling over rough terrain or through a corner.



Bicycling

Bottom Bracket Height is measured from the center of the bottom bracket to the ground. It's a reverse measurement of bottom bracket drop. It's typically used less because this measurement will change depending on the tire size the bike is set up with.

Ride with Bicycling

Train to ride stronger

Workouts to boost speed, strength, and endurance—Bicycling offers hundreds to help you reach your goals.

READ MORE

Conquer 100 miles

Master the century with the ultimate holistic guide, complete with tips on fueling, recovery, event and route selection, and more.

READ MORE

Find the best bikes and gear

Expert advice on e-bikes, commuters, BMX rigs, and more to find your ideal two-wheeled ride.

READ MORE

DAN CHABANOV

Test Editor

Test Editor Dan Chabanov got his start in cycling as a New York City bike messenger but quickly found his way into road and cyclocross racing, competing in professional cyclocross races from 2009 to 2019 and winning a Master's National Championship title in 2018. Prior to joining Bicycling in 2021, Dan worked as part of the race organization for the Red Hook Crit, as a coach with EnduranceWERX, as well as a freelance writer and photographer.

Read full bio