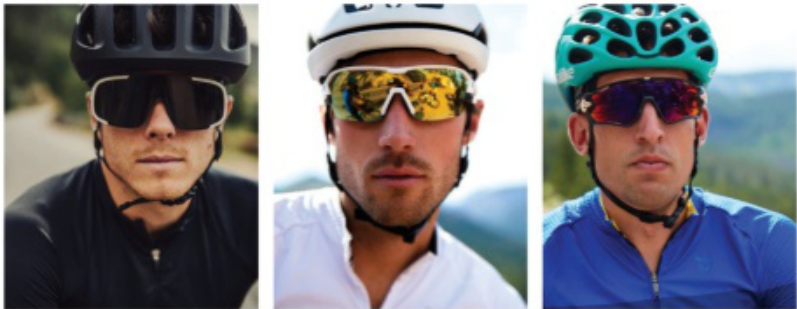




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PRIMAL



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ON THE COVER*2020's Coolest Gear*PHOTO BY
BRAD KAMINSKI**VeloNews**

GEAR ISSUE 2020

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EDITORIAL

EDITORIAL DIRECTOR, CYCLING **Ben Delaney**

EDITOR-IN-CHIEF **Fred Dreier**

EUROPEAN EDITOR **Andrew Hood**

TECHNICAL EDITOR **Dan Cavallari**

SENIOR EDITOR **Betsy Welch**

CONTRIBUTORS **Trevor Connor, Jim Cotton, Julie Young, Lennard Zinn**

ART

ART DIRECTOR **Heidi Carcella**

PHOTO DIRECTOR **Brad Kaminski**

PHOTO EDITOR **Hannah DeWitt**

CONTRIBUTING ARTIST **David Brinton**

MEDIA

VICE PRESIDENT OF MARKETING **PJ Rabice**

DIRECTOR OF PRODUCTION & CIRCULATION **Heather Arnold**

DIRECTOR OF MARKETING & AUDIENCE DEVELOPMENT **Dave Trendler**

DIGITAL DIRECTOR, MEDIA OPERATIONS **Anna Horsch**

ADVERTISING

ADVERTISING INQUIRIES sales@pocketoutdoormedia.com



CHIEF EXECUTIVE OFFICER **Robin Thurston**

CHIEF OPERATING OFFICER **Danielle Quatrochi**

SENIOR VP OF SALES & BUSINESS DEVELOPMENT **Tommy O'Hare**

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What's your Keeper — the piece of gear you've put through the wringer and can't do without?

BD *Specialized Airnet helmet for the perfect fit, airy feel, and user-friendly function of the rubberized sunglass-arm holders. But does it count as a Keeper if I crashed it?*

FD *Pedros yellow tire levers. I've broken them. Lost them. Left them in the laundry. They're always there when I need them.*

AH *My Specialized mountain bike shoes — they're beaten and battered, but fit like a glove.*

DC *Anyone who has ever seen my garage knows I have more than just one Keeper. But I'll go back to the original: My Jandd seat bag I bought way back in 2000 that may look a bit worn, but functions like it came off the shelf yesterday.*

BW *My Mosaic RS-1 road bike. Although it's one of the first that Aaron made and may get called "vintage" on group rides, it will always be the first non hand-me-down or Frankenbike bike I ever owned. I love the feeling of bombing down Flagstaff on steel!*

LZ *Lazer helmet with integrated LifeBEAM heart monitor.*

HC *My 1999 steel Dean soft-tail — my first real mountain bike. Since then, it's been my single-speed, the chariot hauler, and now my husband uses it as his commuter bike.*

BK *My 2007 Moots Vamoots road bike.*

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CYCLING ON FORM



A PRO METHOD
OF RIDING FASTER
& STRONGER

TOM DANIELSON

WIN YOUR RIDE

From gravel to gran fondos, Wednesday Worlds to the local crit, you can win every ride. Cycling coach and former WorldTour pro cyclist Tom Danielson shows you how in his new training guide *Cycling On Form*.

Cycling On Form reveals how the pros train: by training the whole rider. Danielson shows how pro cyclists train their weaknesses and race their strengths. He shares mental training strategies and ways to stay focused. His insight into executing a great ride comes from experience. He distills sports nutrition into simple, daily habits.

It's time to do more than intervals. *Cycling On Form* unlocks a pro method for riding faster and stronger that will help you win your ride.

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WIN YOUR RIDE

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Gear obsession is my profession

I have an unhealthy relationship with gear. Because of this, you can have a healthy one.

OK, perhaps I'm playing too much the martyr here. I get to play with all the toys, and I have a lot of fun doing it. But one of the side effects of gear obsession is a honed sense of minutiae. People often ask me if I can really tell the difference in stiffness between a 45mm-depth rim and a 60mm-depth rim. After all these years, the answer is yes. Maybe that takes a bit of the fun and mystery out of gear, but my general rule of thumb is it's always better to know than not know.

I'm hardly the only gear-obsessed nerd in the *VeloNews* office. All of us have a (somewhat unhealthy) ability to notice things that might slide under another rider's radar, even some of the most seasoned cyclists out there. Are tubulars really more plush than tubed tires? Yes, but they're not necessarily faster. Can you really tell if frame A is more stiff laterally than frame B? Yes, though it's not always about layup; just

as often it's about geometry.

We're a motley crew of roadies, gravelers, and mountain bikers who can tell you what the fastest tubeless tire and rim combo is for your road bike — as Lennard Zinn does on page 12. Or if you need to know what's happening in bike geometry as road bikes trend toward dirt roads, Ben Delaney fills you in on page 40. Have you seen the Message suspension fork from Trust? I'll walk you through this linkage mountain bike fork on page 36.

Much of this knowledge comes from knowing the right folks. The engineers and designers who are out there making the products have a ton of insight, and they come with stories to tell. On page 45, for example, Fred Dreier talks to the key players at Argonaut Cycles and Chris King to tell the story behind the development of the T47 bottom bracket.

That history colors our future. On page 21, Jason Sumner offers a glimpse of something new from Skratch Labs that makes it more

feasible to drink your nutrition. And Ben Delaney's back at it again on page 20 to get you up to speed on indoor riding — and the bikes you'll likely be riding in your basement pain cave in the near future.

The fruits of our dutiful gear testing (OK, our playing) all follows in these pages. We hope this Gear Issue helps you make better purchase decisions in 2020, and develop a better sense of the minute nuances between the incredible technology we're spoiled with in this new decade.

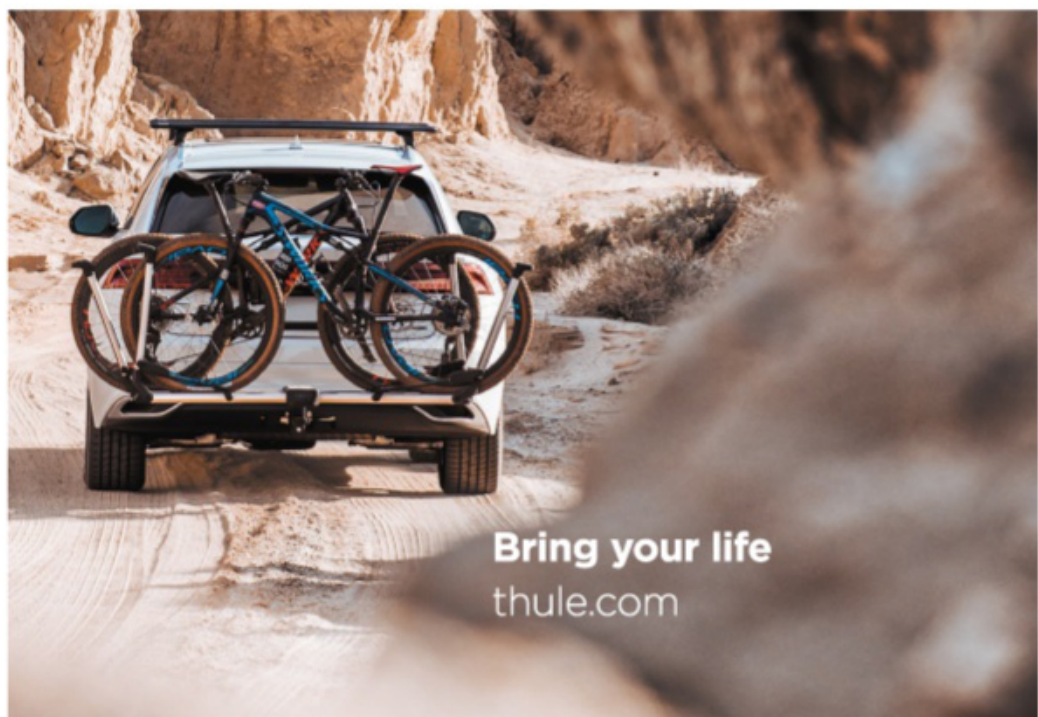
—DAN CAVALLARI

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It connects to a wide variety of pannier racks and comes with a shoulder strap for easy loading in the grocery store. And the zipper top keeps everything contained within.



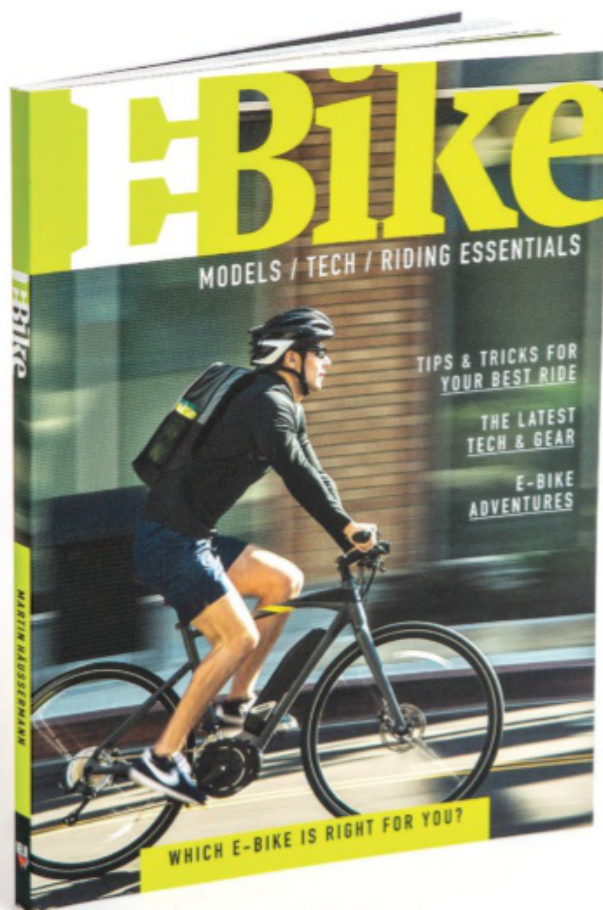
HUTCHINSON OVERRIDE TIRES \$65

Choose from 700x35mm, 38mm, or 45mm, and create your gravel adventure from there. The low center profile makes for low rolling resistance, while low profile side knobs bite in over rough roads and light gravel.

**E-BIKE: A GUIDE TO E-BIKE
MODELS, TECHNOLOGY &
RIDING ESSENTIALS**

by Martin Haussermann **\$20**

This handy book offers electric bike shoppers the essential guide to this exciting new way of riding a bike from features, benefits, pros and cons, and the best ways to take advantage of motor-assisted cycling.



CERAMICSPEED UFO CLEAN \$30

It's non-toxic, biodegradable, and actually works. UFO Clean is designed to prep chains for wax treatments, and even dissolves old wax from between chain rollers.



FIDLOCK TWIST BIKE BASE AND BOTTLE \$40

The low-profile mount stays out of the way after your CX warmup lap is done. And if you've got a small frame, it's easy to get your bottle in and out, since it moves sideways rather than upward.

WANT

Continuous refinement yields enhanced enjoyment.



TREK DOMANE+LT Starting at **\$6,500**

A Fazua drive system gives you a bit of extra boost when you need it. But otherwise, the Domane+LT looks and feels like a regular road bike — a really svelte one at that.



TOPEAK PREPSTATION PRO \$900

55 tools populate this rolling tool case. The trays swing out for easy access to each layer, and the wheels extend outward to stabilize the entire unit. The handle folds down too for easy storage.



LIGHT & MOTION VAYA PRO COMMUTER LIGHT COMBO \$100

200 lumens up front, 100 lumens out back, and small enough to stash in your pocket when you reach your destination, these USB-rechargeable lights will become indispensable on your daily commute. The smart sensors detect movement and turn on automatically too.



BONTRAGER ADVENTURE WOOL BLEND CYCLING HENLEY \$90

A lightweight Merino blend combines with smart features like a three-button collar for venting and a drop-tail design to keep the jersey covering what it should. Bikepacking? MTB? Gravel? Coffee Shop? Ready for all of the above.

NEED

Without these items, you may never be able to ride again.



WACACO NANOPRESSO JOURNEY SPRING RUN \$80

We've thought long and hard about it, and nope, we can't live without this. Make an excellent shot of espresso just about anywhere. The awesome bike graphics make it a fun inclusion in your travel gear.



EVOC PRO ROAD CASE \$895

If you're looking for a safe and easy to use option when you fly, the Pro Road Case requires you to remove your wheels and pedals. That's it. The handlebars stay on, and stay protected. The case is collapsible too so you can stow it when it's not in use.



BOYD TRAILBLAZER WHEELS \$1,650

Are they mountain bike wheels or gravel wheels? Both. The Trailblazers come in both a 29er and a 27.5 configuration, and can handle tires over 32mm for gravel and from 2.1 to 2.5 for mountain biking. At 1,375 grams for the pair (29er) and a 26mm internal rim width, the Trailblazers could hit the racecourse or the multi-day adventure route.



KATE'S REAL FOOD BARS Prices vary

These organic bars pack a lot of energy, but no artificial ingredients. We've tasted many of the flavors and have enjoyed each one. These are a tummy-friendly option for your next long ride.



PACTIMO DIVIDE WIND JACKET \$107

Light at just 125 grams (size medium), bright, and breathable, this nifty wind jacket stows in your back pocket. It's ideal for cool mornings. The thin mesh on the back conforms to your body and moves with you.





WHAT IS THE FASTEST TUBELESS SETUP?

Lennard Zinn went in search of the fastest combination of tire and rim. Here's what he found.

BY LENNARD ZINN

Of all of the forces opposing your efforts at propelling your bike down the road, those working on the wheels and tires comprise a significant percentage. Tubeless tires and rims can maximize speed, as they have improved to the point that there is now no faster road tire/wheel setup. Get the combination of the tubeless tire, wheel, and pressure right, and you'll have "free" speed.

Optimizing speed from your tubeless wheels and tires also requires hitting the tire diameter, tread compound, tread pattern, and rim shape — as well as spoke count and shape.

AERODYNAMIC DRAG

Aerodynamic drag increases exponentially with speed. It doesn't take twice as much power to go twice as fast relative to the air; it takes four or more times as much power. Since rider power is limited, going faster without producing more of it requires improving the aerodynamic shape of the object moving through it.

The 1960s solution was fewer spokes in the wheels. It took a dramatic turn in 1984, when Francesco Moser broke the world hour record riding disc wheels. Steve Hed then created the aerodynamic innovation that every pro bike racer now depends on: the deep-section rim.

Hed once again pioneered the next step, a wider rim that took the tire shape into account. This gets the rim and tire together to more closely approximate a National Advisory Committee for Aeronautics (NACA) airfoil shape for aircraft wings. The tire is wider than first-generation

TIM DE WAELE/GETTY IMAGES

Deep-section rims and tubeless tires both contribute to speed.



deep-section wheels, but the nose of a NACA airfoil is significantly narrower than the thickness of the wing further back. To approximate this shape, a bicycle rim not only needs to be wider than the tire where they meet, but it also needs to continue to get wider before it tapers toward its spoke bed.

ROLLING RESISTANCE

Friction within a rolling tire slows it down, and like aerodynamic drag, friction increases with speed. Unlike aerodynamic drag, however, rolling resistance only goes up in a linear relationship to speed, so the slower the rider is going, the more important rolling resistance is relative to aerodynamic drag, and vice versa. The graph (see page 16) illustrates how below about 12mph, rolling resistance exceeds aerodynamic drag.

On a smooth surface, the tire can be hard and lose little energy when rolling, like a steel ball bearing rolling on glass. Since it rolls on surfaces much rougher than glass and requires traction for propulsion, braking, and cornering, compressed air inside cushions impacts, and rubber tread provides traction.

Friction within the tire results from

chafing of the inner tube against the inside of the tire casing and of the threads in the casing against each other as the tire flexes; on top of that, internal energy losses within the rubber itself result from hysteresis — or, the lag between the application of a force on a material and its deflection in response. Overcoming this lag absorbs energy.

Until recently, road racers generally believed that smaller, harder tires were fastest and rode races other than Paris-Roubaix on 22 or 23mm tubulars, using yet narrower tires in time trials. Greg LeMond illustrated the cost of this in the final time trial of the 1986 Tour de France. Racing on 19mm tires pumped up high, he slid out and crashed on a sharp corner. Wider, softer tires would have not only given him more traction for that corner, but also would have rolled with less resistance. LeMond then had to change bikes and worry about losing his yellow jersey to teammate Bernard Hinault, who did win that time trial.

A shorter contact area deflects less deeply into the tire. A wider tire will have a shorter, wider contact patch on the road than will a narrower tire at the same pressure, because

the surface area of the contact patch must be the same to support the same load. Less deflection will result in less internal friction/hysteresis loss in the wider tire.

With reduced pressure, the tire must support the same load with fewer pounds per square inch to do it, so the surface area of its contact patch will increase. Tire deflection will deepen with the longer contact patch, resulting in more internal friction and hysteresis loss. This makes the case that higher pressure reduces rolling resistance, but only on a smooth surface.

On a rough road, the internal friction/hysteresis losses due to the larger contact patch of the softer tire is counterbalanced by the fact that deflecting the entire bike and rider on each bump costs more energy than does absorbing the bump into the tire. Only the tiny mass of a small part of the tire moves up and down on each bump, rather than the entire bike and rider. This is the “sprung weight vs. unsprung weight” argument explaining why suspension vehicles are faster on rough roads than ones without suspension. Lower pressure is faster on rough roads, and bigger tire diameters then protect the rim.

DAN CAVALLARI

This chart illustrates the aerodynamics profiles of a standard clincher and hookless rim.

THE TUBELESS ADVANTAGE

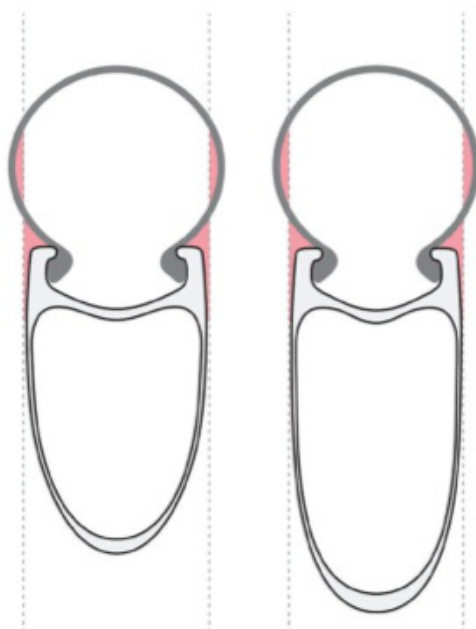
It's safe to run a tubeless tire at lower pressure than a tubed tire since there's no tube to pinch when hitting sharp bumps. This in turn reduces rolling resistance on rough roads. Eliminating the inner tube's hysteresis and its friction against the inner tire casing further reduces a tubeless tire's rolling resistance. First-generation tubeless road tires, which were completely airtight and designed to be used without sealant, had so much rubber coating their insides that their weight was the same as a comparable tire and tube, and the frictional rolling losses were similar. Modern, tubeless-ready tires with sealant are lighter and do have lower rolling resistance than tubed tires.

HOOK-BEAD RIMS VS. HOOKLESS RIMS

To improve aerodynamics, Hed went to the wind tunnel and caulked the edge of the rim where it meets the tire's sidewall so the air flowing from tire to rim meets no edges to create turbulence. Caulking tires to rims is unrealistic as well as inadmissible by UCI rules, so the key is to smooth this transition without it.

Until the advent of tubeless tires, handmade tubular tires were the rolling resistance champions. The edges of their thick base tape and the glue sticking out along the rim edge is not aerodynamic, however. Specialized Lead Engineer Dr. Chris Yu says, "From a speed and performance standpoint, we've known for a while that clinchers are superior to tubulars. They allow for better control of the shape interface between the rim and tire casing and when paired with the right inner tube, offer lower rolling resistance. This is the reason why all our pro athletes have raced TTs on clinchers for the last several years. With tubeless, if done properly, we can amplify those performance advantages. More importantly, by CT-scanning the

STANDARD CLINCHER



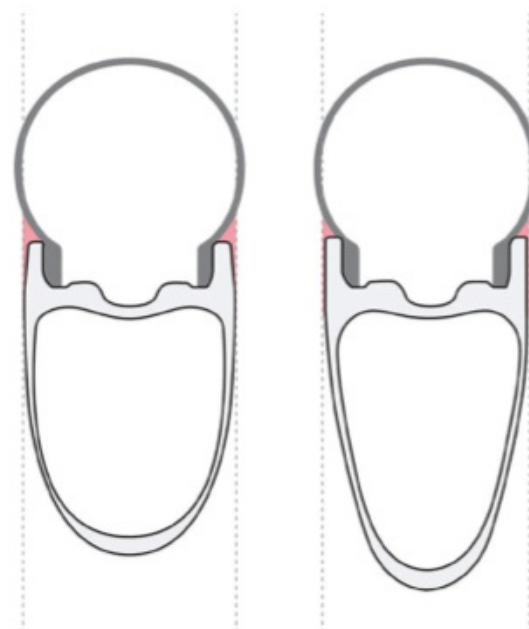
inflated tire bead and rim interface in-house, we're able to design a system that is secure, and we also gain the insight on how to optimize the shape transition from rim to tire."

Like automobile rims, hookless rims lack the 'crochet' hooks at the inner edges of the rim walls to grasp the tire beads, so they can better optimize this shape transition from rim to tire. (See above) A standard hook-bead rim squeezes the clincher sidewall further inward than does a hookless rim, rendering the tire/rim combination less aerodynamic.

Aero carbon hookless rims have many advantages. A hook-bead rim mold requires a soft outer ring, or the hooks of the hardened rim lock to it. This single-use soft mold top is less accurate and less sustainable than the long-lasting solid-metal mold for hookless rims. The edges of hookless rims are thicker, stronger, and less easily damaged when hitting bumps than the fragile edges of hook-bead rims.

To work safely with tubeless tires, hookless rims require precise rim wall dimensions, a bead lock (a raised inner edge of the shelf the tire bead sits on), bead-shelf diameter, and central valley diameter, width and ramp slope. If you've ever watched installation of a car tire on a rim, you know that the compressed air blasted in through the valve must not escape from under the bead even before it's seated; it must instead push the tire beads up the ramps of the rim valley, over the bead lock, onto the bead seat,

HOOKLESS RIM



and firmly up against the rim walls.

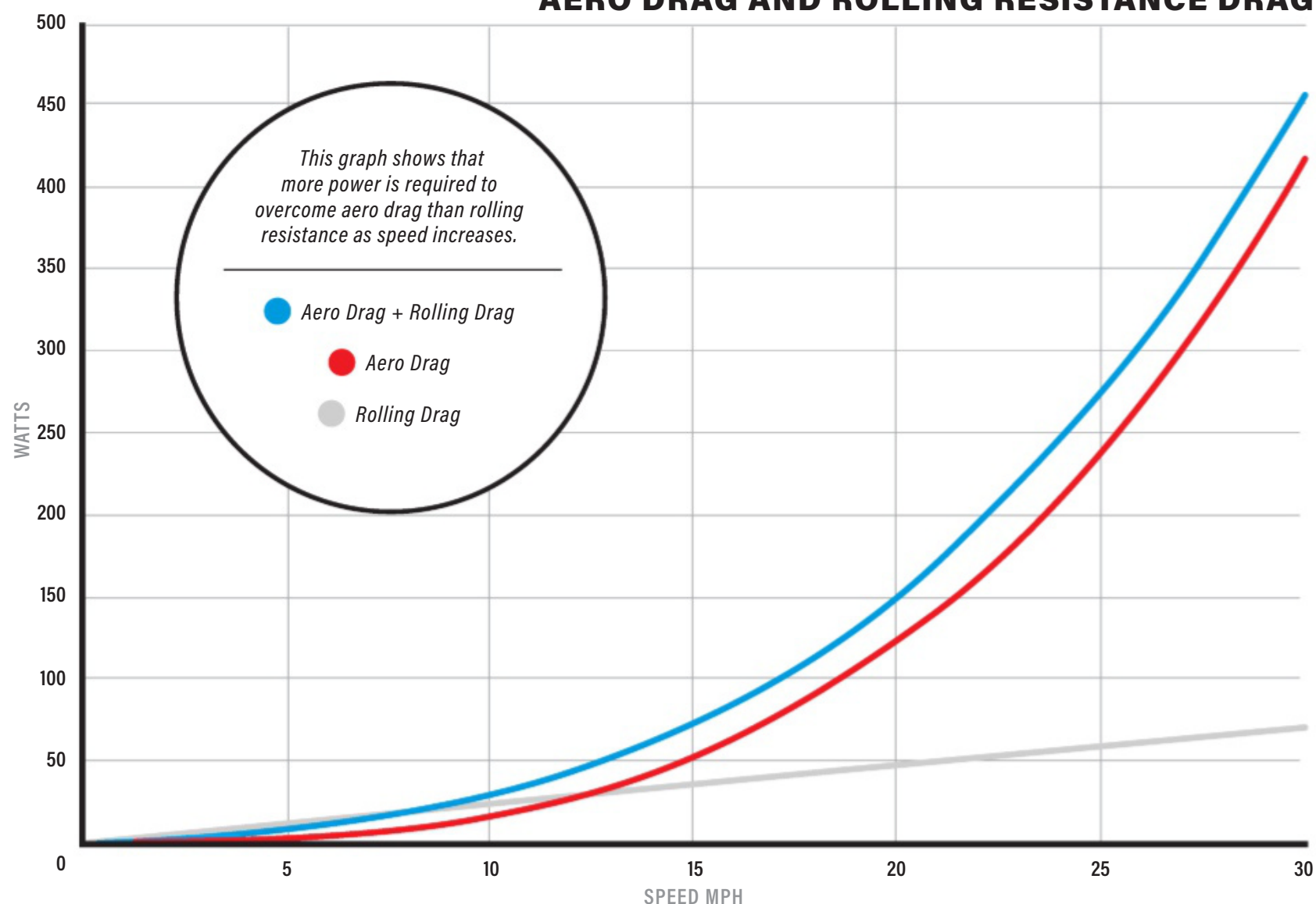
Specialized Tire Product Manager Wolf Vorm Walde made solid-steel rims that don't change dimensions as tire pressure increases, in order to test tire retention. He says, "Straight-wall (hookless) rims show lower burst pressure compared to hooked rims. We do not recommend using any tires with a max pressure above 5.5bar (80psi) on straight-wall rims."

TIRE AND RIM WIDTH

"Tire dimension would depend on factors like road surface condition as well as how technical the course is," says Yu regarding the fastest tire setup. "We can quantify time lost or gained through turns based on g-loads and rider confidence, which is admittedly subjective but correlated to tire width. And rim profile would depend on course profile and wind profile."

According to Specialized's tire product manager Oliver Kiesel, "Typically, if we measure rolling resistance, we have three factors that vary: tire load, air pressure, and rolling speed. The graphs show how rolling resistance changes by changing one of these factors."

Schwalbe product manager Felix Schäfermeier says, "Our general recommendation for individual competitions against the clock is a tire width of 25mm in the front and a 28mm tire on the back wheel. We recommend that the external rim width is at least 1mm wider than the (front) tire. 25mm in front is the best choice to reduce the aerodynamic

AERO DRAG AND ROLLING RESISTANCE DRAG

drag on the majority of aero rims with an internal width between 19 and 22mm. Since the frame is covering the rear wheel, the wider 28mm tire doesn't have any negative impact on aerodynamics, and it saves a few watts of rolling resistance and provides more traction."

ENVE's marketing manager Jake Pantone says, "The athlete should be riding a low-rolling-resistance tubeless clincher tire on a rim that is roughly 5 percent wider than the tire. As tire and rim volume increases, the need for a rim to be wider than the tire diminishes, because the increased radius of the larger tire allows for the air to attach to the rim more easily at yaw. When paired with a 28mm tire (inflated will measure around 30-31mm), an SES AR rim and tire are essentially the same width."

TREAD COMPOUND AND TREAD PATTERN

Tread compound has no aerodynamic effect, but plays a big role in rolling resistance, traction, and durability. Tread compounds are generally proprietary to the manufacturers.

"We redesigned the tread pattern of the new Pro One model range to reduce the aerodynamic drag in sidewind conditions," says Schwalbe's Schäfermeier. "Under headwind conditions, differences between tread patterns are really minor. The impact of a road-racing tire tread design on rolling resistance is not really relevant."

Specialized's Kiesel says, "Slick-center road tires are the lowest in rolling resistance that we normally measure in our drum tests." He adds that Continental's Grand Prix 4000 tread pattern (slick with interspersed areas of cross-hatching within shark fin shapes coming up from the edges of the tread) tests "the fastest in aerodynamic wind tunnel tests. Since this design was designed much earlier than comprehensive aero tunnel testing became a realistic method in the bicycle industry, this design performance was a fluke."

THE FASTEST SETUP IS...

Tubeless tires now best tubulars in rolling resistance, and their clean transition with the rim, particularly with hookless rims, beats tubulars

aerodynamically as well. The optimal width of the tire has grown by 2-5mm since the standards at the turn of this century, and the rim widths for optimal speed have grown by more than double that.

A 27-30mm-wide (external width) rim mated to a 25-26mm-wide front tubeless tire creates an aerodynamically optimal setup, assuming the tire width is measured when installed on the wheel, since the tire label only gives a rough guide. On the rear, use a 25-28mm wide tubeless tire on the same rim. It's possible to gain a bit more aero advantage with a hookless rim.

Of course, the final answer depends on x-factors like mating the tire pressure to the weight of you and the bike for the particular road surface; course profile; and much more. Dialing it in optimally requires scientific study that only the most well-funded teams could undertake. As a general rule, however, you will be in the ballpark with the above setup and tire pressure for a 150-pound rider around 70psi for a 25mm tire and 60psi for 28mm (80 and 65psi, respectively, for a 170-pound rider). 🚴

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DE-MYSTIFYING PERFORMANCE E-BIKES

Versatility, power, and weight evolve. BY LENNARD ZINN

E-bikes will inevitably become a higher percentage of the bikes on the roads and trails near you. While the technology is far more refined than a decade ago, e-bikes are still in their infancy. As consumers clarify what they want and manufacturers figure out how to deliver it, development continues apace.

And while aesthetics will constantly change year to year, the most important technological development is largely focused on three characteristics: versatility, power, and weight.

E-bikes of interest to longtime road riders tend to be pedal-assist only, either class 1 (motor assist only up to 20mph) or class 3 (28mph max). Class 2 e-bikes have a throttle, don't require the rider to pedal, and top out at 20mph.

Performance e-bikes for road and gravel riding fall into one of two general categories. Mid-motor class 3 e-bikes offer full-time motor assist. These tend to have a single chainring not fixed to the crank; it rotates at a different rate than the feet. These bikes continue to get lighter thanks

to technological improvements that drop 9-pound motors like the Bosch Performance Line down to 6 lbs, while producing more torque.

However, the requirement for both high-torque and high-battery capacity to maintain constant assist up to 28mph means that 33 lbs is about as light as the bikes get. High-end e-bikes have 36-volt batteries made up of lots of single lithium-ion cells banded together; the weight of the case around those cells may vary, but all batteries with a given capacity will weigh essentially the same. A 500 watt-hour battery weighing 6.5 to 8 lbs is standard for this type of bike.

The other general road/gravel performance e-bike type is lighter (under 31 lbs) and provides assist only up to 20mph or even 15mph. These super-light class 1 e-bikes have essentially no greater drivetrain friction than a standard bike when the motor is not running, and are ideal for riders who can keep up with their group on the flats and only desire motorized assistance when climbing or accelerating.

The most important technological development is largely focused on three characteristics: versatility, power, and weight.

The battery is generally used less over the course of a ride and is often hidden on or in an oversize down tube. It has about half as much capacity (and weight) as high-performance class 3 road/gravel bike batteries. The motor offers less torque, can be either in the bottom bracket or in the wheel, and weighs considerably less than a class 3 bike's mid motor. The Spanish Ebikemotion X35 36V/250W rear-hub motor and 250 Wh battery system weighs 7.7 lbs including wiring and accessories and is supposedly "totally transparent for the user when (the) motor is switched off."

Many performance road/gravel e-bikes of this latter type allow easy removal of the battery and motor, converting it to a standard, lightweight carbon bike. With a hub motor, it's apparent why substituting a standard wheel results in a normal drivetrain. However, since mid-motors generally add frictional drag by turning planetary gears driving the chainring at a different rotational frequency than the crank arms, it's trickier to offer a mid-motor e-bike that can transform into a free-pedaling lightweight racing bike. One German manufacturer, Fazua, offers such a system.

The entire Fazua Evation mid-drive system weighs 10.1 lbs. It provides 250 watts of power and up to 400 watts for short bursts. Remove the motor packaged with the 36V, 252 Wh Lithium-ion battery to drop 7.3 lbs off the bike. A three-lobed key on the bottom bracket gearbox plugs into the motor shaft. The gearbox contributes the remaining 2.9 lbs of system weight, accepts standard cranks (yes, a double with a front derailleur), and spins freely with the motor removed.

Perhaps more importantly, after a year of delays waiting for American regulatory approval, Fazua Evation motor drives are now available on a wide array of bikes in the U.S. That means versatility, power, and weight reduction are all coming to the U.S. market this year. 

WHAT'S NEW IN BIKE FITTING

The right position can improve metabolic performance.

BY JASON SUMNER

Not so long ago, “professional” bike fitting was akin to “alternative medicine.” Weights attached to strings were the tools of the trade, measurements were done by eyeball, methods were unabashedly unscientific.

But then in the mid-2000s, technology began to slowly creep into the equation in the form of 2D and then 3D motion-capture analysis. Dedicated bike fitting companies such as Retül and Guru sprang to life. Nowadays any bike shop worth its salt offers some form of professional bike fitting services.

“A decade ago we saw this explosion of technology come into the space,” said Mat Steinmetz, a longtime professional bike fitter and founder of 51 Speedshop, a manufacturer of high-end time trial bike components. “Now it’s gotten to the point where it’s basically an expected service.”

So what is new in the world of bike fitting? The short answer, especially if you’re on a WorldTour team, is qualified performance testing and validation. Instead of simply addressing the issue of comfort on the bike, bike fit is being used to gain speed and efficiency.

“We’ve been doing motion capture and looking at joint angles for a while now,” said Todd Carver, the Human Performance Manager for Specialized and founder of Retül. “Now we are adding in a performance testing element, looking at both the metabolic



and aerodynamic effects of various positions on the bike. It’s basically become three bike fits in one.”

For example, this off-season Carver will work with riders from Deceuninck-Quick-Step. He’ll start with a traditional Retül motion-capture fit to dial in the basics and assure comfort. “Then we’ll move over to what we call the Move Bike and take them through a variety of stack heights and other variables in real time while pedaling,” Carver said. “At the same time we’ll test the rider metabolically through the recording of oxygen consumption at various positions and then essentially convert that to a metric where we can see exactly how efficient in watts produced the rider is in a given position.”

Finally, Carver will take riders onto the track to analyze the aerodynamic impact of that ideal position. “What we may find is that if we take the rider too low, they start to work harder and are penalized by, say, 8 watts,” he said. “But then you might go on to the velodrome and see that the position is 16 watts better aerodynamically, so there’s a net gain.”

The idea is to find that perfect balance between a position that a rider can comfortably maintain for a six-hour Tour de France stage, while also remaining physiologically and aerodynamically efficient enough to do their job.

Bike fit frequency has changed

too, said Chris Jacobson, product line manager for PRO Bike Gear and Bikefitting.com, which are both owned by Shimano. “There’s a lot of misguided knowledge about when you should get a bike fit,” Jacobson said. “It’s not just when you get a new bike, which has been the common conception for a long time.”

Just like an annual physical, most riders benefit from yearly bike position check-ups, assessing things such as changes in flexibility. But few riders are willing to shell out up to \$300 for the procedure, assuming that one fit is all you need. Now, with the onslaught of component variability such as wider bars, short nosed saddles, and shorter stems and cranks, the need for those bike fit check-ups has risen further.

“Anytime something changes, whether it’s wider bars on a gravel bike or a new set of shoes, it really makes sense to get an understanding of the impact of that change,” said Jacobson, who does fits using a 3D Pedaling Analyzer, which has the ability to adjust crank arm length and then measure the force application in real time. “The reality is that you don’t have lifetime numbers. Your interface with the bike changes whether its new components or changes in physical ability, flexibility, or age. Getting fit can assure that you get into a position that’s functional and efficient.”



GET SMART, BIKES

Interactive trainers meet stationary — and not-so-stationary — indoor machines **BY BEN DELANEY**

Zwift did not create indoor training or the concept of training software, but it has fueled a rapid expansion of the interactive hardware available to riders to make indoor riding more fun. Smart bikes are the latest category of interactive training tools. They combine the measured and dynamic resistance of smart trainers with the stability and convenience of a dedicated indoor bike.

It's important to note that smart bikes are different than a normal indoor bike like you may have seen in a gym or even the higher-end electronic home models like a Peloton. The primary difference is that smart bikes are cyclist-focused, wattage-based tools designed to integrate with third-party software like Zwift, TrainerRoad, and FulGaz. By contrast, Peloton, NordicTrack, and others have their own closed ecosystem for workouts and classes. These can be great tools for the gym crowd, but if you're looking for power-based training and virtual racing, these don't work. **VN**

Wattage-based tools designed to integrate with third-party software like Zwift.

WATTBIKE ATOM \$2,599

The initial WattBike had a large resistance dial akin to a gym bike. The Atom features shift buttons that work in linear fashion, with 22 virtual gears. The buttons do not replicate a Shimano or SRAM shifters. WattBike has integrated with Zwift so when you shift you can see the gear change briefly on screen, but the gear changes themselves feel a bit vague.

The Atom's stability is excellent, even under hard sprints. Adjustability is good but not always easy; hash marks make the fit trackable, but some adjustment requires Allen keys instead of a simple dial.

There is only one 170mm crank.

STAGESBIKE \$2,700

Before Stages launched as a power meter company in 2012, the team behind the technology had been working in the indoor cycling market.

In terms of stability, the StagesBike is rock solid and yet easy to wheel around. The smartphone pad and tablet holder are handy for indoor riding, as are the two USB charging ports.

Similar to the WattBike Atom, the StagesBike has shift buttons that operate sequentially and do not mimic standard outdoor shifting. Gear indication in Zwift isn't available yet, but is coming, we're told.

TACX NEO BIKE \$3,199

The Neo Bike was the first smart bike, launched at the 2018 Eurobike trade show. With a long history in trainers and smart trainers, Tacx brought a few cool things to bear in the bike: surface treatments that replicate rough surfaces with micro stutters in the electronic brake; outdoor-bike-like

shifting; an integrated dashboard with a gear indicator and basic training metrics; and the ability to work with or without power.

The base of the Neo Bike is stable, but the cockpit extension of the little shelf and tablet holder can wiggle a bit when you're really wrenching on the bars. Two little fans engage when you're pedaling, but they don't really cool you off.

The main bummer is the frame; the seat tube can rub the inside of some riders' legs, and the bar's fully forward position may not be stretched out enough for some riders.

WAHOO KICKR BIKE \$3,499

At the cost of a good outdoor bike, the Kickr Bike is the only one on the market to offer automatic elevation changes to mimic gradient undulations on Zwift courses. The bike tips from -15 up to 20 percent. The levers, are best in class in terms of feel and function. You can program the buttons to operate like Shimano, SRAM, or Campagnolo electronic shifters. As with the Tacx Neo, shifting feels crisp.

Wahoo delivers excellent interactive resistance with the Kickr Bike. Like the Kickr smart trainers, the Kickr Bike will hold resistance eerily smoothly (okay, there is a smoothing algorithm employed here) during workouts. But better than the Kickr, the Kickr Bike is more forgiving when you fall behind on your cadence when doing a workout. Some smart trainers will essentially seize up on you, as they take the 'power=rpm x torque' formula very literally. The Kickr Bike will quickly back off when you start to flail, then allow you to get back on top of the gear before it re-engages.

The main downside is that it is the least stable of the four smart bikes.



SKRATCH'S NEW (LIQUID) FOOD FOR THE LONG HAUL

Drink your calories and avoid GI stress.

BY JASON SUMNER

When the race outcome is on the line, how do you get enough fuel into your body? A savory rice cake packed with calories sounds great. But taking your hands off your bars to dig into your jersey pocket and unwrap your food isn't practical, especially if you're charging toward the base of a big climb, or navigating high-speed, technical singletrack.

So why not just drink your food?

You can: Maltodextrin-based drink mixes provide 200-300 calories per bottle. But the current array of food-in-a-bottle elixirs are often hard to mix, don't taste great, and can cause race-wrecking gastrointestinal distress by delivering calories to your body faster than it can absorb them.

In late March, endurance athletes will have a new option. Skratch Labs is launching its new Sport Superfuel Drink Mix, which has the same aim as its maltodextrin-based counterparts, but does so using a different carbohydrate polymer that it claims alleviates those gastrointestinal landmines.

"Standard maltodextrin starts out as a large single molecule with a high caloric density and a low osmotic pressure, which allows a lot of calories to be dissolved into solution," says Skratch Labs founder Allen Lim. "But that's one of the dangers with maltodextrin: you can fool yourself into putting too many calories into a

bottle. You think you're safe, but if you drink it too fast, it empties from the stomach really fast because it's already liquid, and by the time it's in your gut, all those larger molecules have broken into little molecules. It's the number of molecules, not their size, that ultimately exerts pressure on the gut."

Conversely, Skratch Sport Superfuel uses what's known as highly branched cyclic dextrin, which Lim says clusters into a ball (hence the cyclic). "And because it's tightly clustered, it tends to not break apart as fast so you don't get these big Trojan Horse-type explosions, which reduces the risk of GI distress," Lim says.

Why hasn't anyone else gone down this road before? Lim points to cost as a primary barrier. Skratch Sport Superfuel Drink Mix will sell for \$5.62 per serving (\$44.95 for an 8-serving pouch), with each serving delivering 400 calories plus 100g of carbohydrates and 416mg of sodium. By comparison, an equal 400-calorie serving of maltodextrin-based Hammer Perpetuem costs about \$2.31, though the recommended dose is actually just 270 calories per serving.

"There's not much of a margin with our product," says Lim. "That's why I don't think other companies have pursued this avenue and why we'll only be selling it through our website. Bike shops aren't going to be

interested because they expect a 50 percent margin. But we feel like it's worth it just to give athletes another tool in the tool box."

Skratch's soon-to-launch powder has already gained a following within the professional ranks. Riders from the EF Pro Cycling team used prototype Skratch Sport Superfuel for much of the 2019 season.

"We were basically the guinea pigs when [Skratch] started testing it in January last year," says reigning U.S. national road race champion Alex Howes. "I probably used it at 70 percent of the races I did, including three bottles of the stuff at nationals. The other stuff I'd used in the past I'd have to shake for 20 minutes to get it dissolved and I still had stomach issues a lot of the time."

"I just found that it was a really good way to get energy without GI issues," added fellow EF rider Tejay van Garderen. "It was really good for cold days when you didn't want to take your gloves off to get into your pockets, or if we were racing on cobbles and you couldn't mess around with unwrapping a bar."

But Lim isn't giving up on eating rice cakes, either. "This is not an absolute substitution for drinking a lower carbohydrate drink with salt and eating real food. That works just as well," he says. "But I really believe this new product can help people who are in that niche where they want to — or need to — be able to drink their calories." 

"You can fool yourself into putting too many calories into a bottle." — ALLEN LIM



MEN'S

ROAD

LAZER G1 GENESIS HELMET \$220

Well-vented and incredibly light at 211 grams (size medium), the G1 looks sleek and is ideal for hot summer rides. Adding the optional Aeroshell turns the G1 into an aero helmet, and serves a double function as a weather shield. This is one of our favorite helmets of the year.

RAPHA PRO TEAM SHOES \$355

Rapha isn't the first to make woven shoes, but its entry certainly is impressive. Rapha created its own woven upper called Powerweave, from jacquard woven fabric. It keeps moisture retention to a minimum on hot days, and it features a hydrophobic coating to protect you when the weather turns foul. Rapha has also reduced the volume of the shoe over the top of the foot for a snug, natural fit.

ASSOS EQUIPE RS AERO SS JERSEY \$189

The Equipe RS Aero jersey fits exactly as you'd expect, given its name. It's tight and eliminates flapping, and the elastic 3D-knit fabric keeps it comfortable and coordinates with your body's motions. The jersey breathes well and is stabilized using a specialized textile in the rear that limits stretch. On top of that, the jersey offers UPF50+ protection.

ASSOS EQUIPE RS BIB SHORTS \$9 \$249

Assos has a lot of nifty names for its technology — A-Lock, rollBar, ergoBox. All you need to know is that it all works toward a common goal: stabilizing the shorts and insert so it all stays where it's needed for optimal comfort and performance. And indeed these shorts are among the most comfortable we've tested recently. Assos remains tops in bib shorts.

100% GLENDALE GLASSES \$185

Sure, style is subjective. Do you like the big eye-shield look? We do, and 100% pulls it off with heaps of peripheral vision and a frame that sits comfortably on your face. The temples are adjustable to accommodate your helmet's fit system and the lens is coated to repel water and oil.

VELOTOZE AERO SOCKS \$38

Socks are often an afterthought, but with details like these, the Aero socks deserve some consideration. The texturing breaks up airflow to reduce drag, and silicone grippers keep the socks from sliding down. A ton of watts? No, but in road racing, milliseconds count. Don't leave any watts on the table.



MEN'S

GRAVEL

LEM MOTIV AIR HELMET **\$225**

A full-carbon exoskeleton keeps this lid light and adds strength over low-density foam. At 220 grams for a medium, it is light but not the absolute lightest on the market, and its airy design keeps your head cool. Comes in six color options.

BONTRAGER GR2 SHOES **\$140**

Grippy, big lugs on a walkable sole speak to the hike-a-bike-friendly orientation of this gravel shoe. And laces, synthetic leather and a rubberized 'GnarGuard' coating on the toes and heels speak to the designer's sense of style and sense of humor.

VELOCIO RADIATOR MESH **\$139**

Here's the deal: this jersey is the best we have found for roasting-hot days. The Polartec Delta mesh material on the front makes it feel like you're hardly wearing a jersey at all, yet the recycled fabric on the sleeves and back offer sun protection and hold shape at the pockets.

SPECIALIZED BG GRAIL **\$35**

Gloves are often overdone or just done wrong, with excess material or annoying Velcro. Not here. These gloves are well balanced, with synthetic leather palms with minimal but well-designed padding; thin, breathable mesh backs; and soft nose wipes on the back of the thumb.

ROKA MATADOR SUNGLASSES

\$195 (*mirrored lens*)

A unique aesthetic belies plenty of benefits to the rider, like distortion-free lenses that provide clear views regardless of head position. The temple arms on these 29 gram shades feature titanium cores so you can bend them to your head's shape. And the Geko material on the nose-piece keeps the glasses firmly planted even when you're sweaty. Go ahead, shake your head as hard as you want to test it out.

CASTELLI ENDURANCE 2 **\$159**

These bibs hit the sweet spot of comfort and value, with a Progetto X2 Air Seamless chamois, mesh backing, and compression fabric that feels light and cool in the heat.



MEN'S

MTB

100% ALTEC HELMET **\$165**

100% has its own protective system, the Smartshock, which features 14 Points of contact to address rotational forces. It's also well-vented to keep you cool on long days on the trail. More importantly, the back of the helmet extends low for added coverage, and a multi-point adjustable visor allows you to wear goggles with the Altec.

FIVETEN KESTREL PRO BOA SHOES **\$200**

With a Boa dial for quick adjustments and a velcro strap across the toe to snug it up in the right places, the Kestrel Pro shoes offer a comfortable, soft fit with weather protection throughout. A sticky rubber sole grabs your pedal platform solidly without interfering with your pedal/cleat interface. Go for the subtle black color if you'll wear them post-ride, or the look-at-me orange if you're feeling feisty.

STIO OPR SHORTS **\$140**

These stretchy, soft, and tailored cut shorts look great on and off the bike and complement just about any jersey. Two zippered pockets offer ample storage for small bits like your phone. A DWR finish offers some water repellency, too. They're well-vented, comfortable, and versatile.

VELOCIO MODAL TEE **\$80**

This light, soft tee is made from Modal, a material that is derived from beech trees. It has a lower environmental cost than cotton, and it certainly feels a whole lot better against the skin. The Modal tee breathes well and is ideal for hot days on the bike, or casual wear around town.

OAKLEY SUTRO EYESHADE GLASSES **\$166**

Oakley brings back retro aesthetics as it celebrates 35 years of the Eyeshade style. They're big and loud, on purpose. The vented Prizm lens offers plenty of airflow and enhanced color and contrast so you can see obstacles more quickly and easily in a range of light conditions. They're available for a limited time, so grab them while you can.

HANDUP SUMMER LITE NIGHT RIDER GLOVES **\$18**

These are ready for the hottest summer rides. The super lightweight Air Lite mesh tops feel barely-there yet can still take a beating without ripping or tearing. A thin Clarino leather palm prevents material bunching and provides plenty of grip on the bars. They're affordable and stylish — and Handup has plenty of more outlandish designs if you're looking to get loud.

CLUB RIDE WOODCHUCK LINER CHAMOIS **\$55**

Compressive without pinching, the Woodchucks stay in place no matter how much you shift and sway. The chamois is thick and comfortable enough for 3-hour-plus rides, but it doesn't feel bulky like a diaper. The elastic waistband lays flat and comfortable on your hips, integrating nicely with any shorts. There are even side loops so you can secure them to compatible baggy shorts.





WOMEN'S

ROAD

S-WORKS EVADE WITH ANGI \$275

The Evade packs a lot: aerodynamics, minimal weight, high safety standards, comfort, and connect-edness. It features the lightest weight version of MIPS available and Specialized's own ANGi Crash Sensor — which pairs with Specialized's app (and Strava) — to provide GPS activity tracking and texts your emergency contacts when the helmet sensor detects a crash.

SMITH ATTACK CHROMAPOP SUNGLASSES \$259

Smith's Attack glasses are an evolution of the popular Pivlocks, with a larger field of vision and a better lens-changing system. The ChromaPop lens has fantastic clarity and color definition, and the glasses include a lighter-colored lens too. The MAG interchangeable system uses magnets to quickly and easily remove the arms—without the twisting or bending that causes fears of breakage.

SHIMANO S-PHYRE RC9 W \$425

While they aren't the lightest shoes on the market, Shimano's RC9 shoes checks all the other boxes on the halo list. They're super stiff and have a comfortable, well-structured upper with plenty of perforation to keep you comfortable when things heat up. The dual BOA closure lets you dial in the fit, and easily make micro adjustments on the fly.

CASTELLI PROMESSA JERSEY \$80

Super soft and breathable, the Promessa Jersey excels on hot rides. The front of the jersey is stretchy, while the back has enough structure to maintain shape when your pockets fill up. It's a classically feminine look that doesn't sacrifice performance. Three stow pockets and one small zippered pocket give you enough space to carry what you need.

MACHINES FOR FREEDOM ENDURANCE BIB \$235

A women-owned apparel company that showcases bodies we don't often see in advertisements (especially cycling-specific marketing) is worth our attention. The aptly named Endurance bib offers a supportive chamois that's designed to accommodate a wide range of sit bone widths, a compressive, 7.5-inch inseam short, and panels cut to provide a figure-flattering silhouette.



WOMEN'S

GRAVEL

KASK PROTONE \$299

At 215g (M), this 20-vent helmet maintains aero properties and ample venting, and is great for long days exploring back roads. Thick Cool-Max pads pull sweat away from your head to keep you cool. They're also removable and machine-washable. The retention system has multiple points of adjustment to fine-tune the fit, and the faux-leather padding on the chin strap offers a surprising level of luxe comfort.

GOODR OG GLASSES \$25

Sometimes you don't want or need \$200 frames between your eyes and the gravel that's flying up from the wheel in front of you. But you still need a quality lens, a good fit, and style for days. Goodr's polarized lenses cut glare and block UVA & UVB rays, while the lightweight, snug fit and grippy coating on the frame keep them from slipping. And for \$25, you could get a pair to match every kit.

FIZIK TERRA X5 SHOES \$150

While the industry is frantically trying to figure out what makes a gravel shoe a gravel shoe, this combination of minimal weight, breathability, and off-road chops checks all the boxes. The single BOA closure reduces weight, and the perforated MicroTex upper with scuff guards provides comfort and durability. The carbon sole gives you road-shoe-like power transfer, while the minimal tread gives you just enough grip for hike-a-bikes.

VELOCIO RECON MICROBIAL JERSEY \$140

This pull-over, zipper-free jersey has a more casual look, but otherwise retains all the trappings of a high-end summer jersey: Soft, lightweight material breathes well, and Velocio added a carbon-knit thread to the textile to make it anti-microbial (less stinky). You still get three rear pockets, and the reduced bulk that comes with removing the zipper means the Recon also works well as a cold-weather mid layer.

RAPHA CARGO BIBS \$270

With a cargo pocket on each thigh and two pockets on your back, these bibs can completely take the place of a pocketed jersey or give you that much more on-body storage. Rapha designed the rear pockets to clear the waistband of baggies, so you can wear these bibs any number of ways. The endurance chamois and compressive fit provide all-day comfort, and the main panels of the shorts feature Rapha's water-resistant Shadow fabric, expanding the short's versatility even more.

DEFEET AIREATOR SOCKS \$15

Many of the most popular #sockdoping companies are putting their design work on a Defeet Aireator sock. These 6-inch tall socks have a lightweight mesh-type construction on the top of the foot and ankle for breathability, and they'll last season upon season.



WOMEN'S

MTB

SMITH FOREFRONT 2 **\$240**

Smith's Aerocore technology pairs with MIPS to keep this full-coverage lid lightweight, while the multi-point adjustable harness creates a secure and comfortable fit. The adjustable visor means you can easily wear sunglasses or goggles, and Smith just kills it on the colors.

POC ASPIRE CLARITY GLASSES **\$220**

Clarity lenses from Carl Zeiss enhance color contrast and clarity, which means you'll see obstacles more clearly regardless of shifting light conditions. The lightweight Grilamid frames feature plenty of flexibility for a stable fit, and hydrophilic ear pieces to help plant the glasses in place even when you're sweaty.

LIV SHUTTLE FLAT SHOES **\$110**

Liv's GRIPR rubber sole gives you tacky traction for both contact with your pedal's pins and when walking through technical terrain. A reinforced toe guard stands up to abrasion, and the perforated TPU upper is durable and breathes well. The mesh pocket on the tongue to stuff your laces and the reflective threading in the laces are smart user-friendly details.

WILD RYE FREEL SHORTS **\$120**

Run by women and for women, Wild Rye offers the Freel shorts with durable, four-way stretch nylon to stand up to splashes, branches, and crashes. A gusseted crotch prevents chafing, the side pocket is big enough to hold a phone, and the front hand pockets make them versatile enough to wear to the bar. While they're lightweight enough to be an XC short, the longer length (12 inches for a size 8) and the split at the hem mean they'll fit over knee pads.

KITSBOW ICON SHIRT **\$220**

Kitsbow's Icon is made of Pendleton Merino wool and cut to be both functional on the bike and flattering everywhere. Subtle shoulder vents and stretch gussets allow for mobility and breathability, while Schoeller abrasion panels on the elbows add extra durability. With a base layer, it makes a great cool weather top or you can layer it over another jersey to extend the range even more. Wear it on the bike, wear it at the bar, pack it on your travels. The American sewn Pendleton wool will hold up and look good for a long time to come.

SWIFTWICK PURSUIT SEVEN SOCKS **\$22**

Tall, dark, and Merino! The seven-inch height protects against bushes and branches that scratch and cut. The dark, neutral colors won't clash with the rest of your kit and won't show stains from mud (or blood). And the mid-cushion, four-season Merino wool will insulate in the winter and help cool in the summer, all while managing moisture.

Suspension **vs.** Rigid Gravel

BY BEN DELANEY

For most gravel races, riding a hyper-stiff aero bike is jarring and silly, yet schlepping a fat-tire, full-suspension beast is overkill. So where is the middle ground? What is the ideal amount of compliance for a gravel bike?

Even the first production gravel bike — the Salsa Warbird — had design elements that tried to dampen vibrations. Now we have full-suspension gravel with the Niner MCR 9 RDO, as well as plenty of bikes that sit somewhere between the two, with frames flexing around pivots like Trek's IsoSpeed system on its Checkpoint, or Cannondale's Topstone design. We have leaf-suspension Lauf forks and suspended cockpits like on Specialized's Diverge. And then we have aftermarket suspension parts

like Redshift's suspension stem and seatpost.

What is the ideal set-up? As with anything in cycling, the answer depends on who you are, where you live, and how you like to ride.

FROM TRANS IOWA TO TODAY

Salsa product manager Joe Meiser can trace the Warbird, launched in 2013, back to the 2009 Trans Iowa, an ultra-distance gravel race he won on a prototype frame built with a low bottom bracket, generous tire clearance and, critically, compliance, achieved with thin, bowed-out seatstays that flex under load.

So what's the right amount of compliance? And how do you quantify that?

"Right" is really dependent on the rider and course," Mesier said. "We

really see opportunity for damping like our Class 5 Vibration Reduction System for the majority of riders. We quantify it by taking measurements of vibration and events at the axle versus at the saddle or bars. We asked the question when developing Class 5 VRS: 'To what extent can we isolate the rider from what is happening at the road to minimize fatigue without making the bicycle unnecessarily heavy or more complex?'"

Relatedly, we here at *VeloNews* performed similar vibration measurements on various endurance bikes, also measuring at the handlebars and axles, back in 2011. While there were measurable differences between the bikes, the largest differences by far were achieved by simply putting on larger tires (at the time, 25mm was a "wide" tire) and reducing pressure.

Salsa Warbird
Carbon
GRX 810 Di2
\$5,699



“By adding suspension, you’re keeping the tires in contact with the ground, and giving the rider more control.”

And, of course, Meiser and the team at Salsa built the Warbird with plenty of room for tires, now up to 45mm.

FULL-SUSPENSION FARE

Niner showed off a plastic prototype at Sea Otter in 2018 of a full-suspension gravel bike. The cycling world freaked out. Last year, Niner had an actual bike, built with a 50mm Fox fork and a 50mm shock.

Niner Bikes marketing manager Zack Vestal said the bike came about after staff at Niner got into doing longer gravel rides out of their Fort Collins, Colorado office, and started asking why there were

no suspended gravel bikes.

“The idea behind suspending the gravel bikes is about rider comfort for the sake of less fatigue, more fun on the bike, and a better experience riding on dirt,” Vestal said. “But it’s also really about control. A race like Crusher in the Tushar, it has some really high-speed sections but is a little sketchy on a rigid gravel bike. By adding suspension, you’re keeping the tires in contact with the ground, and giving the rider more control. That’s just a fundamental part of suspension, whether we’re talking cars, motorcycles, or bikes.”

Vestal disputes the idea that mountain-bike suspension and gravel suspension are the same thing, because gravel and mountain bike riders do different actions. “In mountain biking, a significant portion of the experience is about the downhill; you’re coasting, crank arms horizontal, weight evenly distributed front to back,” Vestal said. “Gravel is about

covering distance and pedaling. The suspension needs are different.”

Niner is not calling the MCR 9 RDO a race bike. “That being said, it wouldn’t surprise me if people took it racing,” Vestal said. “Look at Grinduro, or Crusher in the Tushar.”

CHOICES ARE GOOD

One of the many fun things about gravel right now is how wide open it is: the event formats, the bike designs, the whole scene.

For most amateur racers, gravel bikes that have some built-in comfort in the frame, seatpost, and, of course, the tires will be adequate without any moving suspension parts. Low-slung seatstays and carbon posts with some built-in flex are fairly standard as a Goldilocks solution to the hyper-stiff vs full-suspension extreme ends of the spectrum. That said, if you have the option to test ride a gravel bike with a bit of suspension, we encourage you to do so. 

**Niner MCR 9
RDO 5-Star
Shimano GRX
\$7,000**



Telescoping **vs.** Linkage Fork

BY DAN CAVALLARI

Esker's Elkat is equipped with one of the most popular telescoping forks on the market: Fox's 36. That fork has a set of lowers, within which the stanchions slide. When the fork is activated over an obstacle, the stanchions telescope inward to absorb the shock. Voila, you have a telescoping fork.

Trust's The Message fork, on the other hand, is a linkage fork that also absorbs the impact forces your front wheel encounters to help the rider maintain control and comfort. The Message goes about it by shifting the wheel rearward and upward — much like a rear suspension linkage.

If both a telescoping fork and a linkage fork accomplish the same thing, then what's the big controversy? That's revealed in the ride.

FOX 36

If you've ridden a mountain bike built in the last couple of years, you know what to expect with a telescoping fork. Riding the Elkat reinforces the notion that the telescoping fork works exactly as it should, especially for riders who enjoy high speeds and skying it out from time to time. Telescoping forks excel at saving poor technique — compressing fully when you make a mistake that would otherwise throw you over the bars.

But like all telescoping forks, the Fox 36 on the Elkat has some drawbacks. Brake dive is unavoidable, for example. This happens when you hit your brakes hard and the fork compresses. In this scenario, you sacrifice control. And suspension movement while you're climbing steeps means

you're fighting the front end, thereby wasting energy.

You can counter brake dive by firming up the fork's compression setting. But then you lose some of the fork's plushness, and it may not perform well over smaller bumps. That's the story with telescoping forks: trade-offs to find a sweet spot.

Stiction can also hamper telescoping forks. That's the friction between the sliding stanchions and the fork lowers, which means your suspension is essentially resisting movement when you need it. That friction can cause the stanchions to get bound up — especially over rapid-succession bumps — as they attempt to slide downward into the lowers.

Yet telescoping forks remain the gold standard because compression damping has advanced to a point

**Fox 36
Factory Grip2
\$1,080
(FORK ONLY)**



that it's possible to find a good middle ground. Yes, you'll get some brake dive, but you'll also get plush travel for the majority of your ride. Choose a telescoping fork if plushness is more valuable to you than perfect cornering stability and lack of brake dive.

TRUST THE MESSAGE

Dave Weagle created The Message with the notion that front suspension should work as efficiently as rear suspension does. He sought to eliminate the steering vagueness associated with telescoping forks, thereby creating more control while cornering.

In that sense, The Message hits the nail on the head. Its steering feels more solid and planted than any telescoping fork, largely because there's no suspension slop when you push into a corner. The wheel tracks exactly where you point it. Cornering is by far The Message's greatest strength.

And climbing with The Message will have you wondering how you survived the days of squishy front ends in the first place. The suspension moves very little and feels stable and planted. It's fairly easy to get the front end up and over steep obstacles, despite appearances.

The Message soaks up small bumps at low speeds impressively well. Think pebbly gravel roads and relatively smooth singletrack. On the way down, The Message feels surprisingly bottomless on square edge hits. Launch off a rock and land a bit flat; the bottom-out you expect won't come.

But high-speed, rapid-succession bumps felt jarring, as though the fork wasn't activating at all. It's possible there's a sweet spot to be found with some compression tinkering though.

Finally, there's almost no brake dive. That means you get far more control under heavy braking, which is ultimately safer and faster.

*Cornering
is by far The
Message's
greatest
strength.*

So while The Message is clear — linkages are more efficient — the setup takes some time. You'll need to tinker with the various settings and air chambers to find the sweet spot. The Message could stand to be a bit more plush, but generally, it points clearly to the future of front suspension. Choose a linkage fork if steering stability and control is the most valuable suspension characteristic for your ride, at the expense of plushness in certain situations. 

**Trust The
Message**

\$1,975

(FORK ONLY)



Forever **vs.** Now Bike

BY DAN CAVALLARI

You're mature enough now to commit for the long term.

You're ready to plant some bike roots. You're after timelessness, versatility, and a handcrafted build that's made just for you. As technology changes, you'll look at your Forever Bike and have no regrets, even if it's not wearing the coolest and newest.

I love Merlin's Extralight titanium frame, on which I requested S&S couplers to make travel easier, enough to make it mine. It's got double-buttressed 3/2.5 oversized titanium tubing, it's disc-brake-compatible, and it's got clearance for wide road tires. And I watched it get built right here in the USA. I'd happily hang it on the wall for posterity one day.

Custom is key: My Extralight was made specifically for me, with geometry designed for my body and details

made to my spec. Those decouplers, for example, don't come standard; I needed them so I could travel easily with my bike. The Forever Bike is unapologetically all about me, me, me.

My Extralight comes with disc brakes and has geometry on par with today's race bikes (73-degree head tube angle, 70mm bottom bracket drop, 410mm chainstays, for example). It's a modern classic already.

Above all, I love the T47 threaded bottom bracket. This "standard" is still in its infancy and has largely been adopted only by smaller builders until Trek began using it on select bikes in 2019. Threads drastically reduce the likelihood of bottom bracket creaks. This is future-proofing in action.

Yet, the frame is noticeably devoid of aerodynamic shapes. The round

tubes are objectively slower than truncated airfoil shapes. While weight doesn't matter as much here — indeed, the Forever Bike is likely to be heavier than the Now bike — the weight comes in the form of materials rather than tube shapes. It's all about longevity and durability.

Quite on purpose, there's no power meter on my Merlin. It's all about enjoying the ride, not measuring it.

The frame, while forgiving, still feels stiff and responsive. It feels an awful lot like a race bike; the only difference is it's more comfortable.

The Forever Bike is all about me now, and me later. It's a bit about performance and a lot about romance. And that's just perfect for this long-term relationship.

The bike of the moment has staying power, too. The primary focus on

**Merlin
Extralight XLR**
\$3,200
(FRAME ONLY)



the “Now Bike” is speed — as much of it as you can get, with the best technology that’s available right now. Orbea’s Orca is a prime example of a bike packed with everything that goes fast, right now.

For starters, even the Orca, Orbea’s all-around bike, now looks an awful lot like its dedicated aero bike, the Orca Aero. That category blending happens on purpose; aero tube shapes make sense on any bike, but until now it was difficult, if not impossible, to create a bike with aerodynamic refinements while maintaining low weight and comfort. Yet here we are, enjoying exactly this new reality, due to dropped seat stays and smart carbon layups. While the bike of tomorrow will still maintain a few distinct characteristics that set the two categories apart, the categories will continue to blur that line.

While the Orca does feature a lot of aero tube shapes designed to help

air flow over the frame more efficiently, the shaping isn’t as dramatic as the shapes on the Orca Aero. This is largely to save weight. Bigger tubes equals heavier bike.

The bike of now is also all about integration. Cables are nowhere to be seen, either because the drivetrain is wireless — like SRAM’s eTap AXS — or because the wires, cables, and hoses are cleverly hidden within the cockpit and frame. This is all done to prevent aerodynamic drag, but also to make the bike look as sleek as possible. That means setup isn’t nearly as convenient, nor are component

swaps, but the end result is as sleek and fast as it gets.

The geometry screams race bike. A 73-degree head tube angle and short, whippy 991mm wheelbase make the Orca ultra-responsive for quick changes in direction. The ride quality isn’t as buttery smooth as the forever bike, but that’s not what the Orca is made for. It’s stiff and punchy, ideal for endless cols and finish kicks.

Funny enough, the Orca, and all-around bikes like it, are the bike of the future. Forever? Not quite. But expect bikes to look a lot like this one for years to come. 

The Forever Bike is all about me now, and me later. It's a bit about performance and a lot about romance.

**Orbea Orca
M20LTD-D
\$5,000**



Stable vs. Twitchy Handling

BY BEN DELANEY

If you have read more than a couple of bike reviews, you've probably read terms like "nimble," "agile," or "twitchy" for race bikes, or "confidence-inspiring." What the heck do these terms mean? Generally, what the writers are trying to convey is how a bike handles direction changes. Here, we'll look at the factors that go into handling so you can understand what these terms mean, and how to make sense of a bike's geometry figures.

FRONT-END NUMBERS: THE STABILITY FACTOR

One of the critical elements of bike handling is the front-end geometry, which is determined by the interconnected numbers of head tube angle, fork rake, and trail. Quick-handling machines like road race bikes have steeper head tube angles and less trail, while slower-handling rigs like gravel bikes have slacker angles and more trail. See the illustration for a visual explanation of what each element is.

"I call it the stability factor," said Dean Bikes founder John Siegrist, who has been handbuilding bikes since 1989. "And you can isolate the variables of head tube, rake, and trail. As the head tube angle gets shallower, from 73 to 72 to 71, that increases the stability factor. As you reduce the fork offset, you increase the stability factor. A 40mm offset is more stable than 45. And both of these variables determine the trail. More trail increases the stability factor."

How much stability is good depends on what type of experience you are after.

Steep bikes let you maneuver with a light touch — desirable in race bikes when riding on smooth roads in tight quarters. Slack bikes allow the machine to stay on course without bumps flicking the front wheel to and fro — desirable for applications like gravel.

At the most extreme ends of the spectrum, a "twitchy" track bike will

As with so many things on a bike, handling is all about balance, but if you are looking for a single number to determine 'twitchy' or 'stable', look to a bike's trail number.

RACE BIKES (56)

	HEAD TUBE ANGLE	RAKE	TRAIL	BB DROP	WHEELBASE
TARMAC	73.5	44	55	72	990
OLTRE X3 (55)	72.5	43	62	68	988
EMONDA	73.5	40	58	70	983
TCR (M/L)	73	45	57	65	997
SUPERSIX EVO	73	45	58	72	989
Fuji Track	74.5	35	56	45	954

ENDURANCE BIKES (56)

	HEAD TUBE ANGLE	RAKE	TRAIL	BB DROP	WHEELBASE
ROUBAIX	73.5	44	55	76	995
INFINITO	72	43	68	68	999
DOMANE	71.9	48	61	78	1008
DEFY	72.5	50	58	70	1010
SYNAPSE	73	45	58	73	995

GRAVEL BIKES (56)

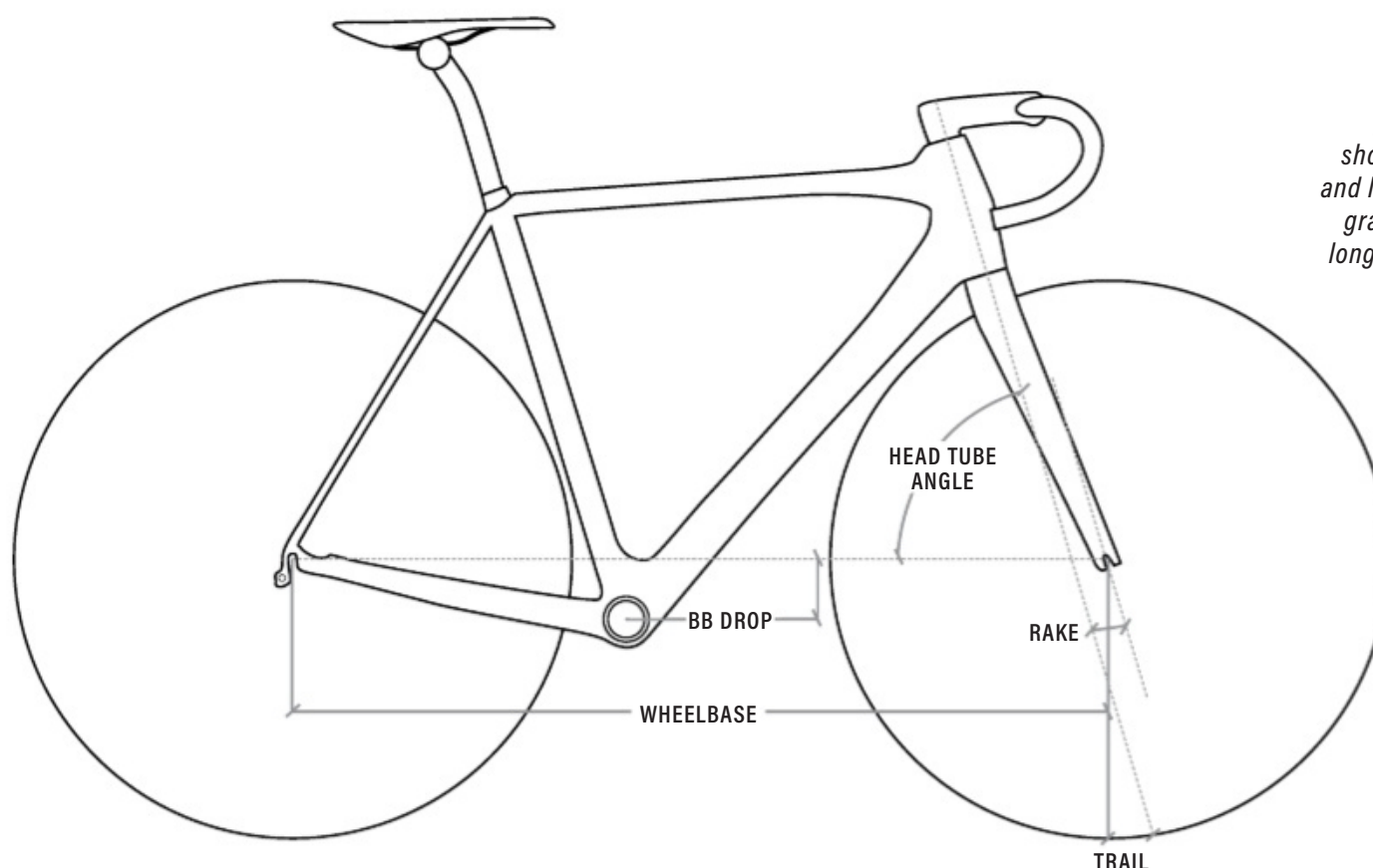
	HEAD TUBE ANGLE	RAKE	TRAIL	BB DROP	WHEELBASE
DIVERGE	72.5	50	58	85	1011
IMPULSO ALLROAD	71.5	45	70	68	n/a
CHECK-POINT	72.2	49	61	76	1020
REVOLT	71	50	71	70	1036
TOPSTONE	71.2	55	58	61	1030
Chamois Hagar	66.7	57	93	80	1154

**Evil Chamois
Hagar
\$4,799**



**Cannondale
SuperSix EVO
Carbon Disc
Ultegra
\$4,200**



BIKE GEOMETRY DETERMINES HANDLING

Race bikes generally have short wheelbases and less trail, while gravel bikes have longer wheelbases and more trail.

often have a very steep head tube angle and a very small amount of trail, while a “stable” super-slack gravel bike like the new Evil Chamois Hagar has a very laid back head tube angle and an enormous amount of trail.

FRAME LENGTH AND DROP NUMBERS

“Most all aspects of bike geometry affect the handling somehow,” says Specialized road product leader Stewart Thompson. “This includes head tube angle, fork offset, wheelbase, bottom bracket drop, and more. Stiffness, weight, and rider weight distribution affect how a bike responds to rider input as well.”

Generally, a longer wheelbase (the distance between the front and rear wheel hubs) means a more stable ride, or a higher stability factor in Siegrist’s terms. Again, look at the “twitchy” track bike that is 200 millimeters shorter than “stable” Chamois Hagar, with road bikes running from race bikes to endurance bikes to

gravel bikes along that twitchy-to-stable spectrum.

“A bigger wheelbase means the bike tracks better, and is more stable on a longer straightaway, such as you’d want on a gravel bike,” Siegrist said.

Bottom bracket drop (how far the center of the cranks sit below the wheels’ hubs) also contributes to how a bike feels. Generally, lower means more stable. Again, look at the spectrum ends of the track bike versus the Chamois Hagar.

THE X FACTORS —AND THE BALANCING ACT

Beyond the a frame’s geometry numbers, the bike’s construction itself can play a role in handling.

“I was on a test a number of years ago, where we all rode Émondas that had identical lab stiffness values, but were achieved with material in different places,” said Trek road product marketing manager Anders Ahlberg. “One bike hit that stiffness with more material in the chainstays, another in the down tube, etc. Until the engineer

running the test told us, we were fighting about how a few of the bikes must have had different geometry.”

And there is certainly divergence in philosophy on what ‘good’ is for any given type of bike geometry. For instance, at Specialized, the geometry on the endurance Roubaix bike was recently changed to align with the quick-handling Tarmac race bike.

“We had used slacker geometry and longer wheelbase as a way to provide a smoother ride on the Roubaix,” Thompson said. “Now, with the FutureShock and balanced rear compliance, we no longer have to compromise on handling geometry to provide control and compliance to the Roubaix rider.”

As with so many things on a bike, handling is all about balance - both of the various angles and elements of the frame as of the type of riding you like to do.

But if you are looking for a single number to determine ‘twitchy’ or ‘stable,’ look to a bike’s trail number. 🚴

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LOOKS THAT THRILL

California's Squid Bikes has carved out a niche with flashy paint and eye-catching design

BY FRED DREIER



COURTESY SQUID BIKES

Squid's bikes are easy to spot in a crowd.





Co-founder Emily Kachorek still paints many of Squid's bikes by hand.

It's easy to spot Sammi Runnels at the U.S. National Cyclocross Championships—just look for the rider with the shining metallic bicycle adorned with pink graffiti graphics. Runnels is the star rider for Squid Bikes, the California brand that paints bicycles to resemble skateboard graphics, urban graffiti, and other radical designs.

Over the past five seasons Squid has become one of the most visible brands on the U.S. cyclocross circuit, and it's done so without the aid of elite national championship titles. Instead, Squid has used its catchy kit designs and radical paint jobs to bring attention to its pro riders Runnels and Anthony Clark, both of whom have equally colorful personalities.

"Pink is one of my favorite colors so I was super excited to have a high-lighter-pink bike," Runnels said in a recent interview about her bike. "It's one of my favorite paint jobs so far."

The brand is the brainchild of Emily Kachorek and Chris Namba, who co-founded Squid in 2014. At the

time, Kachorek was an elite cyclocross racer on the national circuit after years spent racing on the road. She felt that kit and bike designs on the U.S. national circuit had become homogenous and boring.

Kachorek was fast, yet not fast enough to win major national-level events, and she sought a way to attract more eyeballs to her racing squad. Kachorek saw an opportunity with her jersey design. Starting in 2012 she designed a kit that had loud colors and design elements that pulled from skateboarding, surfing, and retro-1980s style. She looked unlike any other rider in the field.

"It was important that, aesthetically, I had an image that would be eye-catching and memorable and say something different," Kachorek said. "I wanted people to buy the kits too."

Kachorek's endorsement with her apparel manufacturer paid her a percentage from every kit she sold, and the radical designs quickly sold through, helping pay her way to and from races. She wondered if the same

model would work for a bike frame. She obtained a custom aluminum frame from a local frame builder, and set to work painting it herself to match the aesthetic of her jersey.

"I went to the hobby store and got these big sheets of neon vinyl and just did this 'Saved by the Bell' neon vomit paint job all over the frame," Kachorek said. "I had this feeling of like, am I going to be super embarrassed when I'm at a UCI race and I don't look like anybody?"

As it turned out, the custom 1980s retro paint job connected with fans, and Kachorek and Namba received inquiries from other racers about where they could buy the bikes. Thus, Kachorek and Namba got an idea: Why not launch a bike company around the hand-painted designs?

The two live in Sacramento, California, and approached Sherwood Gibson, the longtime frame builder and co-founder of Ventana Mountain Bikes, to build for them. After some convincing, Gibson agreed to weld



Kachorek (left) and Chris Namba show off Squid's colorful frames.

their frames, and built an aluminum cyclocross frame for their new company. Squid started with just one model, a cyclocross bike, available with either cantilever or disc brakes.

"We didn't have the funding to make a mold in China," Kachorek said. "It was important for us to do small-batch stuff at first."

Kachorek raced on the bikes, and she brought on Clark as the first sponsored athlete from outside the company's family. A development rider through the Massachusetts-based JAM Fund program, Clark is well-known for his numerous tattoos, long hair, and colorful backstory. Prior to becoming a professional cyclist, Clark was in and out of jail.

"He looks different than any other cyclocross racer out there," Kachorek said. "He's not the top-tier racer but in that level just below. He was a perfect fit."

Kachorek told Clark about the new program and the fact that Squid would custom-paint his cyclocross bike. Clark said he wanted a wide

variety of graphics on his bicycle: An El Camino, a checkerboard, flames, and mermaids, among other designs. Kachorek took notes, and painted Clark the unorthodox and radical bicycle he desired.

After that first season Squid blossomed into a bona fide bike brand, with its cyclocross bikes appearing in magazines and even getting featured at the North American Handmade Bicycle Show. In subsequent years, Squid added more models to its array, including a BMX bike with 26-inch wheels, a hardtail 29er mountain bike, and a singlespeed road bike for skidding that Kachorek calls a "tracklocross" frame.

All of the frames are handmade in Sacramento, and Squid still relies on lightweight aluminum as its material of choice. While the performance cycling world has entirely moved to carbon-fiber, Kachorek said Squid will remain true to aluminum for the time being.

That's because performance is only one component of the Squid brand. The lion's share of the company's fame

still comes from those flashy paint jobs. These days Kachorek hires out local artisans and graffiti artists to paint special editions of the bicycles. She and Namba still paint most of the frames themselves, by hand, at the company's headquarters. The two apply tape and use spray paint to achieve the patterns and designs. Customers can choose one of four different types of paint design: torn tape, drip, freestyle, or stencil. Then, they spray, stencil, or drip the paint on the frame by hand.

"Your bike is a badass metal bike built by this guy who's been making bikes his entire life," Kachorek says. "You tell us the colors you want, send us some photos, and we paint it."

The colorful bicycles are hot items, and several of the company's models are already sold out. In fact, Kachorek says the brand has never paid for any type of marketing, aside from the race team. In truth, Kachorek's commitment to radical designs and unorthodox colors, amid a sea of homogenous looks, paid off. 



A NEW STANDARD

Ben Farver created the T47 bottom bracket standard in hopes of making BBs boring again

BY FRED DREIER

Ben Farver wanted to make the bottom bracket boring again. It was early 2015 and Farver, the founder of the Bend, Oregon-based custom bicycle brand Argonaut Cycles, had just received an email from a customer in Europe. The message addressed an annoying occurrence that has plagued cyclists for generations: a noisy bottom bracket. The customer wondered why the expensive bicycle now creaked like an antique wood floor.

At the time, Farver was preparing to ship another bicycle to a customer in Asia, and he envisioned the future

email that was bound to appear about bottom bracket creaks.

"Here I was about to send this bicycle 6,000 miles in the other direction and I know I'm going to be dealing with the same situation," Farver said. "It was like, 'This is so annoying. It's unsustainable. We cannot keep doing this.'"

Farver's annoyance centered on a piece of engineering that revolutionized bicycle designs during the last decade: the oversized PressFit bottom bracket. A decade ago the bicycle industry fell in love with 30-millimeter (or bigger) bottom brackets that could

be pressed directly into the bottom bracket shell. The new PF30 standard added stiffness and worked with the wider and stiffer crank spindles. Plus, the PressFit design eliminated the chance of catastrophic damage to internal threads. Over the course of a few years the big brands adopted the standard for metal and carbon-fiber racing bicycles, which entrenched the technology across the industry.

But the PF30 standard had one very fatal flaw. Manufacturers struggled to build bottom bracket shells that matched the exact dimensions of the press-in shape. This minor

COURTESY ARGONAUT (2)

*Chris King's threaded
T47 bottom brackets.*

inconvenience, over time, transformed into a major headache. Even if the bottom bracket shell was off by fractions of a percent, the abnormality would eventually create a loud creaking noise. Readers have undoubtedly heard these creaks on group rides and in races—it's not a broken part or a cracked frame, but rather a bottom bracket shell that is off by a few degrees.

Across the bike industry, builders and mechanics learned quickly that almost every single bike frame had an imperfect bottom bracket shell.

"Frame tolerances are all over the place," said Jay Sycip of Chris King. "It's hard to make it perfect, because a [shape] from one manufacturer to another manufacturer, and from one material to another material, is impossible to hold."

Cyclists, manufacturers, and mechanics learned to live with the PF30 annoyance, opting to treat the creak with grease, sandpaper, or a warranty return. Customers became accustomed to bringing their bicycles in for regular bottom-bracket service, or pulling out the press-fit cups themselves.

But on that day in 2015 Farver was fed up with the creaking, and he decided it was time to start a movement against PF30. Farver longed for the time before 2010 when the lion's share of bottom brackets were threaded BSA designs that had to be physically screwed into the frame. The design was old and unglamorous, but amazingly simple.

"I reminisced for the days of BSA bottom brackets because of how dumb and easy they were—you set it and forget it," Farver said. "As soon as we adopted [PressFit] bottom brackets, everybody knew what was in their bike because they had to fiddle with it two times a year."

Farver had a simple solution: a threaded, screw-in design. Bottom brackets that are screwed into a frame will rarely creak, since the threads secure the machinery in place. So, why not create a threaded design that could screw into a PF30's 46-millimeter bottom bracket shell hole?

Farver called his contacts at Chris



King and discussed the idea. He knew that creating an entirely new part, no matter how small, would require the creation of a new tool to cut threads into a metal bottom bracket shell, as well as the bottom bracket cups themselves.

As it turns out, other independent frame builders had expressed similar complaints to the component manufacturer. Independent component brand White Industries and small builder Engin Cycles, among others, had approached Chris King about building a threaded bottom bracket that would fit into the large-diameter shells.

"As it turns out, nobody wants to buy a \$6,000 bicycle that creaks," Sycip said. "And the only way to stop it is threads."

But Farver wasn't inquiring about the part, he was demanding it. So determined was he to pursue the project that he promised to buy all of the new bottom brackets in the first order, simply to justify Chris King building the new part.

"I'll create the demand to get this off the ground," Farver said. "If the industry adopts it, great, and if I'm the only one threading these things into my frames, that's fine too."

Engineers at Chris King took the concept and ran with it. Farver wanted a 1-inch thread pitch to mimic that of the original BSA bottom bracket. But Chris King engineers believed a steeper pitch of 1.5 would be needed to keep the bigger bottom bracket tight in place. Eventually, Chris King moved forward with the 1.5.

The company worked with long-time partner Paragon Machine Works

to produce a prototype, and within a few weeks, Farver had a shipment of the new parts. The new bottom bracket screwed into a threaded shell and worked perfectly, spinning quietly without so much as a squeak. By November of 2015 Farver held an official launch.

"It was a really collaborative effort—it felt like there was something in the atmosphere that people wanted to solve this problem," Farver said. "I think we wanted to simplify things rather than be a punchline in the joke that is the dysfunctional bike industry."

Farver and Chris King decided to leave the design unpatented, meaning any manufacturer or builder could adopt it. At first, only small-batch builders adopted the new technology. But as more time went by, even mainstream brands picked up on the T47 standard. The biggest nod came in early 2019 when Trek produced its Crockett cyclocross bike with a T47 standard. Then, in July, Trek revealed that the new Domane carbon-fiber bicycle would also adopt T47. The adoption meant that T47 had finally hit the bigtime.

Five years after his big idea, Farver sees the entire T47 project as exemplifying what can happen when independent manufacturers band together to solve an engineering flaw. Sycip agrees.

"Small builders can do something like this because they don't have massive production schedules that are booked years out or tools that would need to be redone," Sycip said. "It took a builder to come up with this and launch this idea." 

ROAD

No matter your budget, here's how to spend wisely on your road setup.



LEZYNE POCKET DRIVE PUMP \$30

Sure, it's nice to have a small pump. It's better to have a small pump that actually works. The durable body is CNC machined aluminum, and the stowable hose connects easily to your valve. It will pump to 160psi and weighs just 79 grams.

WOLFPACK RACE COTTON TIRE \$90

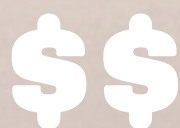
From Wolfgang Arenz, one of the legendary designers who created some of the fastest tires on the market for brands like Continental and Specialized, comes a tire brand all his own. The cotton casing makes for a supple ride, and the tire is aerodynamically optimized for speed.

TUBOLITO TUBO ROAD TUBE \$35

It packs up small and weighs next to nothing at just 38 grams. That means you can stow an extra CO2 in your seat pack rather than sacrificing to the bulk of a butyl tube. And Tubolito says its tube is twice as puncture-resistant as a standard tube.

GIRO AGILIS MIPS \$90

It's super affordable and looks like a top of the line lid. More importantly, it's MIPS-equipped to help counter rotational forces should you crash. 32 vents make this an ideal summer lid, and with Giro's Roc Loc 5.5 fit system, it stays firmly in place, even on gravel.



SHIMANO RC5 SHOES **\$160**

These sleek shoes weigh 500 grams (size 42) and wrap around your foot comfortably, thanks to a combination of the seamless midsole, Boa L6 fit system, and velcro strap over the forefoot. They're ready for the race or the training ride, with a comfortable fit combined with exceptional power transfer.

CERAMICSPEED T47 SRAM DUB BOTTOM BRACKET

\$359 | **\$459** *coated bearings*

If you already know about T47 bottom brackets, then you're ready to upgrade to CeramicSpeed's version of this relatively new threaded system. (If you don't already know about it, turn to page 45 and read all about it.) Save precious watts with CeramicSpeed bearings and upgrade to coated bearings to get even longer life in the roughest riding conditions.

FIZIK VENTO ARGO R1 SADDLE **\$225**

The short nose design keeps the rider planted in a power position and prevents excess body shifting. And the proprietary foam has a springy feel to it, meaning it's comfy while maintaining support. A generous cutout keeps pressure off sensitive tissue. And it's light at just 179 grams (size 140mm).



ROAD *cont.*

\$\$\$

REYNOLDS AR80X DB WHEELS \$1,549

Go deep-section without going deep into your wallet. These 80mm-deep wheels are designed for aero advantage, but they're also tubeless-ready and feature a 19mm inner rim width to take full advantage of your tire's grip and lower pressures for improved rolling resistance. Despite appearances, the AR80X wheels are quite stable in light crosswinds too.

CANE CREEK EEWINGS ALLROAD CRANKSET \$1,000

These titanium beauties look burly but weigh just 395 grams, which is on par with leading carbon cranks. Cane Creek says they're stiffer, too. And these flashy titanium cranks are sure to catch an eye or two on the group ride. More importantly, they're rugged enough for your gravel bike, so feel free to go get dirty!



GRAVEL

No matter your budget, here's how to spend wisely on your gravel setup.



PRO DISCOVER BOTTLE BAG \$35

Put your food where you can reach it quickly. The Bottle Bag is an ideal place to stow a water bottle or snacks for quick access. It mounts easily using velcro straps and cinches shut so you don't lose your goodies over rough roads.

STAN'S DART TUBELESS REPAIR \$25

The Dart plugs big holes by filling the void and creating a chemical reaction with Stan's Sealant. The Dart insert will wear off cleanly, and you'll never feel it — even on road tires. At just 15 grams, this is the lightest peace of mind you can take on your next ride.

BONTRAGER UNIVERSAL FENDER SET \$60

These light and simple fenders fit anything from 700x23 up to 29x2.8. They're quick and easy to install and just as easy to remove or swap from bike to bike. The clamp design allows for use on oddly-shaped seatposts too.

SCHWALBE G-ONE ALL-AROUND GRAVEL TIRES WITH ADDIX COMPOUND \$56

A perennial favorite, the G-One tires now come in a cool skinwall that indicates the tire is made with Schwalbe's Addix compound. The All-Around tires work wonderfully if you want to go fast, but if you feel like you need a bit more grip, try the G-One Bite or Ultra-Bite tires, which feature larger lugs.



BRAD KAMINSKI (2)

GRAVEL *cont.*

\$\$

WAHOO ELEMNT BOLT \$250

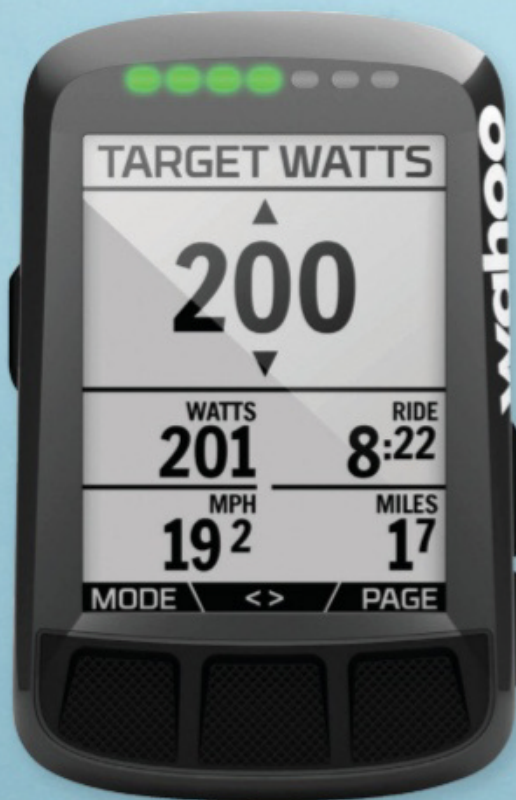
We've tested a lot of GPS units and this is a *VeloNews* favorite. It's compact, intuitive, and easy to read. The navigation features are everything you need for the road, trail, and gravel in between. The screens are easily customizable so you see just what you need, when you need it. And it touts up to 15 hours of battery life.

CANE CREEK EESILK SEATPOST \$289

When you need just a bit of cushion, the 295-gram eeSilk gives you 20mm of compliance to keep you fresh. Choose from five elastomers to control the spring rate. The eeSilk supports riders up to 330 pounds and adds just a bit of smoothness to your gravel bike.

SPURCYCLE HIP PACK \$135

Hip packs are a dime a dozen. Hip packs made from Dyneema fabric for the ultimate in durability that weigh just 250 grams are far less common. Spurcycle's Hip Pack offers plenty of storage space and is made in the USA.





\$\$\$

CERAMICSPEED OSPW X FOR SRAM EAGLE ETAP AXS

\$549 | \$649 *for coated bearings*

Gravel has grown from misfit segment to racer's delight. You can tell because CeramicSpeed now has an oversize pulley wheel system for SRAM's Eagle eTap AXS system. It reduces drive-train friction so you can keep up with the fast crew at your next gravel race. The narrow-wide tooth profiles also help improve chain retention.

EVIL BIKES CHAMOIS HAGAR **\$5,800**

The Chamois Hagar takes the rock n' roll attitude from the mountain bike world and combines it with the speed and pedaling position of an aggressive road bike. The result? A unique ride that's a whole lot of fun. A slack 66.67-degree head tube angle makes for a super-stable ride at high speeds. Throw in a dropper post for a low center of gravity and you'll be rocketing descents faster than ever before.



BRAD KAMINSKI (2)

MTB \$

No matter your budget, here's how to spend wisely on your mountain bike.



ASS SAVERS MUDDER FENDER \$11

Attach this light and unobtrusive fender to your fork with the included zip ties and you'll keep trail mud from becoming a mid-ride snack.

GRANITE STASH MULTITOOL \$55

Utilize dead space on your bike. The Stash fits solidly within your steerer using Granite's unique clamping system. When you need tools, just slide out the multitool from within the steerer and use any of the 8 included tools. It weighs just 145 grams.

VOILE STRAP \$4-\$10

What can you do with these straps? What can't you do with them? Secure a spare tube to your frame, or stash a tool kit under your saddle. Wrap one around your rain jacket to pack it up tightly in your pocket. These versatile straps are inexpensive, durable, light, and endlessly useful.

VITTORIA AGARRO TRAIL TIRES \$70

Vittoria's Agarro tires are less aggressive than the popular Martello tires, so you get more speed when you need it. Leading steps on the lugs reduce rolling resistance while maintaining excellent grip for climbing. These 850-gram tires also feature Vittoria's Graphene 2.0 compound for added durability.

TIMBER BELL \$25

Chime only when you need to. The Timber bell features a locking mechanism that silences the bell, and when you release the lever, the passive ringer chimes as you encounter bumps on the trail. It's easy to swap between bikes with the QR model, or keep it solidly in place with the Bolt-On version.





\$\$

ONEUP V2 DROPPER POST \$209

Drop further. The V2 has the shortest stack height and shortest length on the market to get your saddle lower. Options range from 120mm to 210mm of drop, and the V2 is a real value at just over \$200. There's a two-year warranty, too.

WTB VOLT TI SADDLE \$130

Just the right amount of padding makes for a comfy perch, and a slight upward flare at the back keeps you in an optimal pedaling position. Not sure if this is the right fit for you? Use WTB's Fit Right System on the website to make sure. It's been spot-on for us every time.

GARMIN EDGE 130 \$200

This diminutive computer packs a punch. It fits nicely on your stem and touts a 15-hour battery life. If you just want the basics out in the forest, the Edge 130 delivers navigation and data tracking. If you want more fun — like jump distance and hang time — upgrade to the Edge 530 for an extra \$100.



MTB *cont.*

\$\$\$

DIRT COMPONENTS ROUGH COUNTRY WHEELS \$1,850

Sure, these carbon hoops are pricey, but not nearly as pricey as carbon wheels made by other brands. They're rugged, affordable, and they feature Industry Nine's Hydra Hubs for best-in-class engagement. The Rough Country wheels are stiff to track well in corners and light enough to keep your burden low.

SAGE POWERLINE TI MOUNTAIN BIKE \$3,100 - \$7,261

Trail riding continues to evolve as mountain bikes become more capable, and Sage has taken a simple approach to tackling it all. This titanium beauty is dropper-post ready, and it features a middle-ground 67.5-degree head tube angle ideal for climbing, all-day grinding, and descending confidently. It's 1X-drivetrain-specific, designed for a 130mm fork, and comes with Boost spacing, so all the modern touches add up to a true everyday bike that's ready for racing or adventuring.



GARAGE

No matter your budget, here's how to get the most bang for your buck when mapping out a bike garage.



KUAT RACKDOCK \$68

Don't hang your rack precariously off a hook, or take up valuable floor space with it. The RackDock provides a stable and secure wall mounting option to hold your rack when it's not in use. It makes the swap over to the car easy too. It holds up to a 4-bike rack.

PRESTACYCLE PRESTAFLATOR \$50

This garage must-have is ideal for seating tubeless tires, or for inflating your clinchers before a ride. The urethane elastomer head is soft and strong, and it gives a solid seal around your presta valves. Squeeze the lever lightly for a little bit of air, or hold it all the way down for a lot. Simple and indispensable.

GRANITE DESIGN HEX STAND \$80

If you own a hollow axle crankset, the light and compact Hex Stand is ideal for garage storage or supporting your bike pre-race in the parking lot. It folds up super small and is height-adjustable to accommodate just about any bike.

GARAGE *cont.*

\$\$

MUC-OFF PRESSURE WASHER **\$175**

Designed specifically for bicycles and motorcycles, the pressure washer won't damage bearings and frame surfaces. Use the various lances to adjust pressure for your cleaning needs, and even use the special snow foam lance to get a thick lather for a deep clean. It comes in a waterproof bag if you want to take it on the road.

PARK TOOL THT-1 SLIDING T-HANDLE TORX WRENCH SET **\$110**

The most common Torx sizes are all here, in steel, with a Speed Spinner that makes it easy to fasten long bolts quickly. The sliding T-handles adjust for the best leverage position, and it all comes with a handy tool holder to mount it all to your wall.

FEEDBACK SPORTS PRO TRUING STAND **\$100**

Use the Pro Truing Stand on a table-top or mount it to any of Feedback Sports's wash-and-repair stands for the ultimate in portability and integration. The adapters accommodate all the common wheel sizes and hub types. There's an integrated rotor truing slot too.



\$\$\$

ENVE AIR PRESSURE STATION \$750

This one's only for the most discerning PSI aficionados. The Pressure Station connects to your compressor and automatically inflates your tires to your indicated pressure within .5 percent psi or bar. You can set three pressure presets, or use the override feature to seat tubeless tires. Not sure what pressure to use? Just use your phone to scan the NFC tag on the side that directs you to Enve's pressure charts.

ABBEY BIKE TOOLS TEAM ISSUE TOOL BOX \$1,350

Abbey did all the hard work for you, choosing the best tools and populating its rugged Pelican case with them. Each tool gets its own home in Kaizen foam so you always know where things belong. You even get a custom engraved name tag in Abbey Green to let the world know whose box is boss.



BRAD KAMINSKI (2)

HOW TO INSTALL AND ADJUST PEDAL CLEATS

Prevent injury with proper positioning. **BY LENNARD ZINN**



A cleat connects the pedal to the shoe, and it determines the fore-and-aft, lateral, and rotational position of the foot. If a cleat isn't properly oriented, the misalignment between the pedal and the leg's physiology could eventually cause hip, knee, or ankle problems.

Follow these steps to ensure you get the proper cleat position on road or mountain bike shoe and pedal systems.

1. PUT THE SHOE ON AND MARK

the position of the ball of the foot (the bump behind the big toe) on the outside of the shoe. Take the shoe off and continue the line straight across the shoe sole. If you are replacing existing cleats of the same type, simply trace around the old cleat with a pen, set your new cleat there, and tighten it down. Voila! You can skip the rest of this.

2. GREASE THE THREADS

of the cleat screws and screw the cleat onto the shoe. This usually requires a 4mm hex key. If the cleats come with adhesive-backed sandpaper cut to the shape of the cleat, adhere it to the bottom of the cleat.

Point the front of the cleat forward. It may be obvious, or an arrow may indicate forward; otherwise, the cleat instructions will specify orientation, and in some cases, on which shoe each cleat should be mounted.

3. POSITION THE CLEAT.

With the cleat in the middle of its lateral- and rotational-adjustment range, set its fore-and-aft position so that the pedal spindle will be under or just behind the ball of the foot. Cleats may have a mark on the side indicating the spindle position or may be symmetrical about the center of the pedal. Line up the mark or the center of the cleat 0–1cm behind the line you drew in step 1 across the shoe sole.

When the shoe is level, the ball of the foot should be between zero and 1cm forward of the pedal spindle. A further-forward foot may help develop power, while high-cadence spinning is usually enhanced with the foot farther back. A gear-masher will like the cleat farther back than will a spinner. Very small feet some-

times do better with the cleat farther forward on the shoe. Riders with large feet (size 46 or greater) often prefer the cleat all the way back to reduce the calf's work in controlling that long lever. And pedaling force from a large rider, concentrated on the same-size cleat as for a small rider, is better distributed over the shoe if the cleat is located behind the ball of the foot, which reduces pressure under the metatarsals. Mountain-bike shoes and cleats offer more rearward positioning than road pedals other than Speed-play, which offers a cleat extender base plate kit to offset the cleats 14mm further rearward than the standard plastic base plates.

4. SNUG THE SCREWS DOWN.

5. PUT THE SHOES ON, SIT ON

the bike, and clip into the pedals. Ride around, noticing the position of your feet.

6. SET THE LATERAL CLEAT

position. Generally, the closer your feet are to the plane of the bike, the more efficient your pedaling will be, but if your ankles bump the cranks or if your knees are wider than your feet, you will need to re-adjust. Take the shoes off and adjust the cleats laterally, if necessary.

7. SET THE ROTATIONAL CLEAT

position. You may feel pressure on one side of your heel from the shoe. If so, remove your shoes and rotate the cleat slightly in the direction that relieves that pressure.

Most pedals offer free-float, allowing the foot to rotate freely for a few degrees before releasing, making precise rotational cleat adjustment less critical. Start with

the greatest amount of free-float the system allows. You can reduce the float later if you desire, either by an adjustment on the cleat or pedal, interchanging the left and right cleats, or by getting different cleats with reduced float range.

8. ONCE YOUR CLEAT POSITION

feels right, trace the cleats with a pen or a marker. That way, you can tell if the cleat stays put over time.

9. WHILE HOLDING THE CLEAT

in place, tighten the bolts down firmly. If you have a small torque wrench, tighten the cleat screws to 35–43 in-lbs (4–5 Nm). Otherwise, hold the hex key close to the bend to minimize your leverage so that you do not over-torque and strip the bolts. While there is little danger of overtightening with a screwdriver, take care that the blade (or Phillips tip) fits well in the screw slot (or Phillips cross) and push down firmly while tightening.

10. CHECK THE SCREW LENGTH.

Remove the insole and feel around inside to ensure that the screws are not pushing up into the sole. Get shorter screws if necessary.

11. CARRY CLEAT-TIGHTENING

tools the first few rides. You may want to fine-tune the cleat adjustment over the course of a few rides.

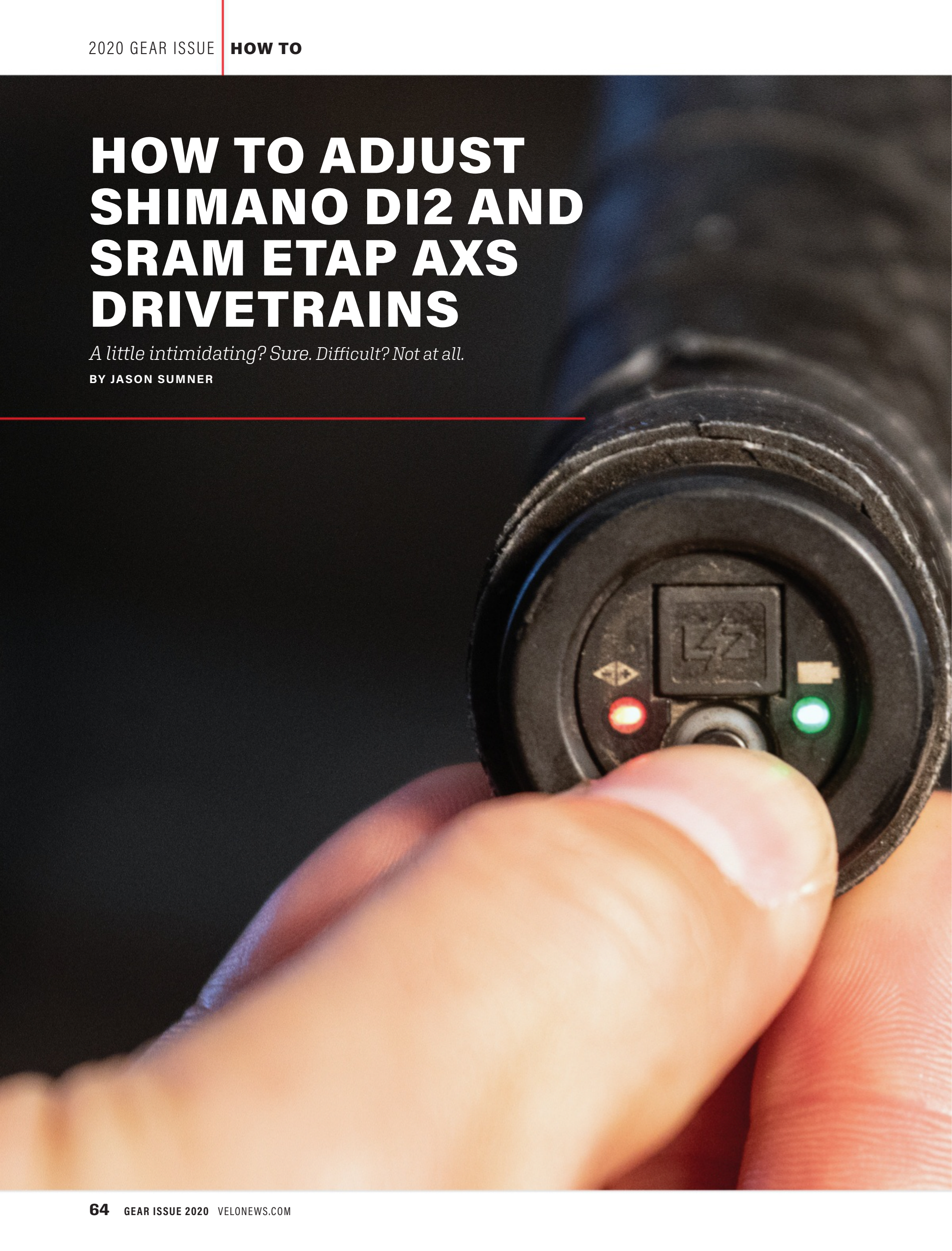
12. RETIGHTEN THE CLEAT

bolts after every ride for the first few rides. After that, the cleat will have pushed itself into the shoe sole as far as it can go. This is particularly important with a mountain bike shoe, where the metal cleat is hard and the outsole is soft. This is the key to keeping the cleat bolts from falling out as well as preventing the cleats from slipping. Threadlock compound on the bolts also can help. Once the bolts stop turning at the same torque setting, you can stop doing this daily. 

HOW TO ADJUST SHIMANO DI2 AND SRAM ETAP AXS DRIVETRAINS

A little intimidating? Sure. Difficult? Not at all.

BY JASON SUMNER





The modern bike maintenance checklist goes something like this: check tire pressure, lube chain, charge batteries. Indeed, the advent of electronic shifting drivetrains has forever changed the way we maintain our most precious two-wheeled possessions. So, what are the keys to keeping your Shimano Di2 or SRAM eTap AXS systems properly adjusted?

If your Di2 rear derailleur is out of whack, typically indicated by rasping or chain skip, start by shifting your chain into one of the middle cogs. Then, enter Di2 adjustment mode by pressing and holding the button on your junction box until a red light comes on. By pressing your shift buttons, you can micro-adjust the trim of your rear derailleur by 0.2mm at a time inboard or outboard, until the issue is resolved. Double check your work by pressing the function button again to exit adjust mode, and then run through your gears.

It's also worth noting that just like on a Shimano mechanical drivetrains, you must assure that high and low limit screws are adjusted correctly, lest you shift your chain into your wheel or frame.

If your Di2 front derailleur is misbehaving, shift into the little ring, and then make sure the gap between your big ring and derailleur cage is between 1mm-3mm and that the cage is parallel with the big ring. If it's not, make the appropriate positioning changes. Just as with a mechanical set-up, double check your high and low limit settings, making sure your chain doesn't rub when you're in your easiest and hardest gears.

The rules of thumb are similar for SRAM eTap AXS systems. In the rear, start by shifting into the second largest cog. The pulley wheel should be aligned with the center of that cog. If it's not, use the system's micro-adjust feature, which is done by pressing and holding the appropriate shifter AXS button located on the inside of the shift paddle, while also pressing the shift paddle itself.

The right shifter will adjust the derailleur outboard in 0.25mm increments. The left shifter will adjust the derailleur inboard 0.25mm. The derailleur may not appear to move, so watch for the derailleur LED to flash to confirm the command was executed.

To adjust the limit screws, start by shifting the rear derailleur to the largest cog. Then adjust the low limit screw (marked with an L) so that it lightly contacts the inner link of the rear derailleur. Next, shift the rear derailleur to the smallest cog and adjust the high limit screw (H) until it lightly touches the inner link of the rear derailleur.

If you're still having issues, check the B gap, which is done by installing a chain gap adjustment gauge to the upper pulley wheel, and then using a 2.5mm hex wrench, turn the B adjust screw until the tallest teeth of the largest cog line up with the outline on the gauge that matches your cassette size.

If your eTap front derailleur is malfunctioning, start by checking the height. This is done by aligning the tip of the tallest chainring tooth with the set-up line on the inside of the inner derailleur plate. Also assure that the cage is rotated so that the guide marks are aligned with the large chainring.

Then, check that your limit screws are properly set-up. Start by shifting the rear derailleur to the smallest cog and the front derailleur to the outboard position. Now turn the front derailleur high limit screw clockwise to move it inboard or counterclockwise to move it outboard, aiming for 0.5mm to 1mm of space between the inside of the outer derailleur plate and the outside of the chain.

Now shift the chainring to the smallest chainring and the largest rear cog, and turn the low limit screw clockwise to move it outboard or counterclockwise to move it inboard. Again, the goal is to have 0.5-1mm of space between the inside of the inner derailleur plate and the chain.

And no matter which system you're running, always make sure your batteries are charged. Otherwise none of these adjustments will matter. 



PEDALING TO PARADISE

When I told people that I was going to bike tour around the island of Molokai, there were two general responses.

“Don’t get leprosy!”

And then, the less histrionic: “Are you bringing a bike?”

Although I have plenty of bikes and the requisite gear to take them on multi-day adventures, the thought of lugging all that stuff to an island that doesn’t even have a traffic light hadn’t crossed my mind. When you fly to Molokai, they ask you how much you weigh — not how much your bike weighs.

I had my fingers crossed that “Phillip” at “Molokai Bicycle” was a real person who would reply to my

inquiry about renting bikes and a trailer, but I was skeptical. When he wrote back, offering airport pick-up and a room to rent in addition to the bikes and trailer, I was thrilled.

For some people, this “fly by the seat of your rental bike” approach might not work, but for me, it’s the only one that does. The southern coast of Molokai is buffered from the sea by dozens of ancient fishponds. Whizzing by on a new bike, you’d never glimpse the stone and coral walls that enclose the ponds, and then you wouldn’t be able to spend the next 20 miles wondering if the concept still worked, if the little fish still swam in from the sea, only to become bigger fish when they

On Molokai, everyone knows Phillip, who’s also the high school counselor, and our bikes were synonymous with his shop. That earned us more respect than any brand name.

became trapped in the pond.

If you carried all of your food in plush frame bags, then you wouldn’t need to stop at Mana’e Goods & Grindz for a Mahi burger, and you wouldn’t meet the guy at the table next to you who tells you that, no, the fish ponds aren’t used much commercially anymore but rather just for feeding the familial ‘ohana’.

And if you brought your own bike, you might be afraid to leave it by the side of the road when you spotted the most perfect swimming beach, or up against a gate where you knew there was a waterfall a half mile’s hike in. On Molokai, everyone knows Phillip, who’s also the high school counselor, and our bikes were synonymous with his shop. That earned us more respect than any brand name.

On one particularly tough climb from the coast to the upcountry, my riding partner asked me to tow him, as well as the Burley trailer containing 40 pounds of stuff. I thought he was kidding until he handed me my jump rope. I tied one end around my seatpost and gone were the carefree miles of watching for whales out at sea. Then, someone drove up and stuck an iPhone out of their car window, capturing my misery. It was Phillip, who’d just returned from Maui on a Costco run. “How’s it going?” he called out to us. “Is everything okay?”

We slowed down to tell him how much fun we were having, how beautiful the island was, and how great the bikes had been. I don’t think he even noticed the jump rope. 

ILLUSTRATION BY DAVID BRINTON

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RIDE THE
REVOLUTION