


# Brake Check

13 road calipers tested

by Matt Pacocha | photos by Don Karle



When it comes to brakes, shaving weight is only a good thing if performance is upheld. Here we examine 13 brakesets to determine which are powerful, which are light, and which best meld these two seemingly opposing attributes.

We tested brakes ranging from the industry's benchmark Shimano Dura-Ace 7800 to one of the lightest, the ax-lightness Orion. We used real world protocols — panic-stop trials and mountain descending — to reach our conclusions.

Much of the testing took place on the 2,100-vertical-foot Flagstaff climb in Boulder, Colorado (the same climb used for last summer's climbing wheel test in Issue 14). All 13 brakes were tested on the full descent, which includes pitches that exceed 25-percent in gradient. Descending such sections pushes brakes and pads to their limits, and quickly demonstrates their quality.

While mountain descending gives a good feel, it's hard to quantify. For that, we used a panic stop — measuring how quickly each brake could decelerate from 40km/hr to 0km/hr. This test was performed on a flat, windless road. For each brake, the rider accelerated to 40km/hr then grabbed the brakes — hard — on a pre-determined mark and recorded stopping distance. This test was performed 10 times for each brake, and the stopping distances were averaged.

Some of the brake pads produced a burnt smell after hard stops. Many of the test brakes — and, in every instance, the test bike's fork — would visibly load up and bend only to unload once the levers were released, post stop.

Remember, power is only one attribute of a good brake and the “most powerful” doesn't necessarily translate to “best.” Good modulation, durability and predictability are also desirable. The brakes' power and modulation are rated on a subjective 1-10 scale where a score of 10 represents the best performance.

## AX-LIGHTNESS ORION RACING BRAKES

\$1,290 » 150 grams



**BRAKE DESIGN:** Single pivot

**PANIC STOP DISTANCE:** 10.02 meters

**PANIC STOP DECELERATION:** 6.16 m/s<sup>2</sup>

**POWER FEEL:** 3

**MODULATION FEEL:** 4

From the motherland of gram geekdom, Germany, ax-lightness is a leader in the lightweight carbon category. Consider its 48-gram saddle. Its Orion brakes are by far the lightest in this test. Excluding pads and pad holders, the carbon calipers with titanium hardware weigh less than 100 grams.

**LIKES:** The engineers did their homework here. The light but ultra-stiff structure doesn't grossly flex under hard braking and it provides a consistent feel and decent modulation. We tested this brake with a high-end SwissStop pad. To illustrate the carbon engineering in this brake, look to the barrel adjuster as it threads directly into the carbon arm.

**DISLIKES:** The Orion was the only brake in this test that relied solely on its geometry to create its power, and it showed. Its relative lack of power requires the rider to alter his or her braking habits. And, ahem, the price.

## BONTRAGER SPEED LIMIT XXX

\$400 » 233 grams



**BRAKE DESIGN:** Cam actuated single pivot

**PANIC STOP DISTANCE:** 8.7 meters

**PANIC STOP DECELERATION:** 7.09 m/s<sup>2</sup>

**POWER FEEL:** 6

**MODULATION FEEL:** 5

High-compression-molded carbon arms use a single, linkage-actuated pivot that increases the leverage ratio and thus power. Bontrager calls this linkage "PowerAmp." The pad holders are machined aluminum, as are the pad fixing bolts and mounting nuts. A stainless steel bolt anchors the cable.

**LIKES:** The Speed Limit XXX is a steal compared to some other carbon fiber brakes. It is possibly the best performing single-pivot brake in the test. Stopping power is less than the Ciamillo's Negative G, but the Speed Limit accepts both wide and narrow rims. The Speed Limit provides even power with good lever feel. Modulation is good; it never felt grabby or faded even after bouts of extended hard braking. The quick release design is sharp, and the 5-year warranty adds confidence.

**DISLIKES:** The Speed Limit lacks power in comparison to dual-pivot designs, most notably during long, steep descents. It requires more day-to-day centering adjustment than a dual pivot brake. The cable adjusters are harder to use than those on standard racing brakes. Plus, the linkage doesn't move straight when it pulls cable, which causes the cable to kink.

## CAMPAGNOLO SUPER RECORD D SKELETON BRAKES

\$405 » 275 GRAMS



**BRAKE DESIGN:** Dual pivot front; single pivot rear

**PANIC STOP DISTANCE:** 8.11 meters

**PANIC STOP DECELERATION:** 7.6 m/s<sup>2</sup>

**POWER FEEL:** 6

**MODULATION FEEL:** 8

Campagnolo pairs a dual-pivot front with a single-pivot rear, which puts power where it's needed up front and saves weight in the rear (pictured). The "skeleton" arms are hollow and rotate on bearings. The cable fixing bolt and the main bolt are titanium, while the pad fixing bolts and main nut are Torx fitted alloy nuts.

**LIKES:** The dual-pivot front and single-pivot rear make perfect sense. On a bicycle, the majority of your braking power comes from the front brake; the rear brake provides control. In fact, a weaker rear brake actually helps prevent you from locking the rear wheel. The Super Record brakes provided a firmer feel at the lever, but didn't produce any sort of fatigue. The brakes didn't fade, either. The pads sit a good distance from the rim, which we like, and the brake's barrel adjuster is easy to use.

**DISLIKES:** The brake lacks all-out stopping power compared to some of the others. This might be as simple as a refinement to the pad compound. Campagnolo's use of aluminum Torx nuts in this brake means you need to plan on having a multi-tool with at least a T-25 driver for on the road adjustment. This brake doesn't have any sort of quick-release, as Campagnolo provides that at its lever.

## CIAMILLO TECH NEGATIVE G TI

**\$400; \$525 FOR CUSTOM COLORS  
AND LASER ETCHING » 223 grams**



**BRAKE DESIGN:** Cam actuated single pivot  
**PANIC STOP DISTANCE:** 7.24 meters  
**PANIC STOP DECELERATION:** 8.52 m/s<sup>2</sup>  
**POWER FEEL:** 7  
**MODULATION FEEL:** 5

The Negative G has beefier 7075 alloy arms and its cam ramps up the brake's leverage quicker than the company's lighter Zero G, providing more power earlier in the brake's travel. Our sample came equipped with a titanium center bolt, pad hardware and cable-fixing bolt. Ciamillo also offers a stainless steel hardware version for \$319.

**LIKES:** The brake works well enough to descend as quickly as your skills — and guts — will allow. Along with the supplied SwissStop pads, the brake offers a good, firm beginning feel and adequate power for high-speed corrections. It's modulation shined in the mid-range. One distinct benefit it has over most of the competition is its low profile, which helps the caliper fit on tight aero frames and small frames. For the fashionistas, Ciamillo offers one of seven color options plus laser etching for \$125.

**DISLIKES:** The Negative G has a progressive leverage ratio, meaning ratio increases through its travel, so the brake's power is dependent on its position. This design did not interface well with wider rims. The brake never reached a position of maximal power and therefore required a lot of force for panic stops. This made for tired hands and a feeling of power loss during long, steep descents. Ciamillo is addressing the issue and hopes to have a solution this season. Other gripes include a finicky quick release, and barrel adjuster and alloy fixing nuts that strip easily. It's harder to keep this brake centered and aftermarket knurled washers don't mesh well with the design.

## EEBRAKE

**\$543 » 186 grams**



**BRAKE DESIGN:** Linkage activated dual pivot  
**PANIC STOP DISTANCE:** 7.1 meters  
**PANIC STOP DECELERATION:** 8.69 m/s<sup>2</sup>  
**POWER FEEL:** 8  
**MODULATION FEEL:** 8

Craig Edwards, the engineer who brought Sweet Wings titanium cranks to the industry in the '90s, considered nearly every design issue that plagues conventional brake calipers when he created the ee-brake. The dual-pivot brake has wide, 7075-T6 machined arms for rigidity and its eccentric mounting bolt allows for optimal placement of the dual pivots. Even the brakes' alloy pad holders have a crafty design that allows for quick, no-tool pad changes. The ee-brake is finished with titanium hardware.

**LIKES:** With a huge amount of adjustability, the ee-brake allows you to decide how you want it to perform. Its power rivals the best in the test — it came second in the panic stop and displayed a smoothness and modulation that sets it apart from all but the top brake during the mountain descending. It has more than enough power to confidently descend. It does all this while posting the third-lightest weight. It's so easy to change pads that swapping alloy pads for carbon pads for race wheels on the weekend is a no brainer.

**DISLIKES:** ee-brake ships with easy to follow installation instructions that should be used to achieve their optimal operation. It's not as simple as bolting the brake on and adjusting the pads. The two biggest issues with the brake are that the barrel adjuster is hard to use while riding and the quick-release renders the brake unusable when open. Finally, you can't ignore that the brake is the second most expensive in the test. The consolation for the price, however, is that the brake works well.

## FEATHER 199

**\$400 » 194 grams**



**BRAKE DESIGN:** Cam actuated single pivot, with interchangeable cam ratios  
**PANIC STOP DISTANCE:** 10.18 meters  
**PANIC STOP DECELERATION:** 6.06 m/s<sup>2</sup>  
**POWER FEEL:** 5  
**MODULATION FEEL:** 6

Machined out of 6066-T6, the Feather 199 has excellent, tight tolerances and a high quality finish. The cam uses a roller bearing for very smooth actuation. The main titanium bolt is paired to an aluminum nut. The pad mounting bolts are also titanium. In addition to the 199's stock configuration, Feather offers an aftermarket cam kit that raises the leverage ratios of the brakes. The black brake arms come with a choice of four colors for their complementing components.

**LIKES:** There is no slop in the main pivot or the cam, yet its exact tolerances do not produce any binding or tightness through the travel. With the higher power cams installed, the brake seemed to produce good clamping force. The power of the brake comes on very smoothly and does not fade. It produced good feel at the lever and the firm retraction springs give the brakes a snappy response.

**DISLIKES:** Even with its high-power cams, the Feather lacked power. We tested all brakes in this test with the pads available from the manufacturer; this hurt a few of the brakes including Feather. The stock pads are very hard, and while this wards off any fade, it also detracts from everyday stopping performance. With a different pad this brake's performance may be very different. Finally, the cable clamp is very hard on the cable, and can only be used a few times before a new cable is needed.

## FSA K-FORCE

\$320 » 267 grams



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 7.58 meters  
**PANIC STOP DECELERATION:** 8.14 m/s<sup>2</sup>  
**POWER FEEL:** 8  
**MODULATION FEEL:** 4

FSA forges the arms of its K-Force brake from 6061-T6 aluminum. Its front arm has an I-beam forging to increase the stiffness of the long lever arm. The two pivots of the caliper rotate using thrust bearings, which offer stiffness to the structure. The brake's pad holders are carbon fiber. The brake has 6/4 titanium hardware throughout.

**LIKES:** Stiff, smooth pivots and a long leverage arm make K-Force a powerful brake. It feels powerful in its clamping force, observed by its slightly spongy feel. It displays power when descending in the mountains. It affords the rider a light touch at the lever and one-finger use. FSA includes all of the "must have" features for a racing brake, including an easy-to-use quick release and barrel adjuster, and its geometry allows for ample pad-to-rim clearance.

**DISLIKES:** The K-Force suffered fade on long, fast descents. It also felt a bit grabby in slow-speed use. The root of both problems can be found in the pads, a dual-compound model from Kool-Stop that showed signs of excessive wear during our test. The problem with the K-Force is, while it has plenty of power, it's hard to harness. At slower speeds the grabbiness is an issue, and at high speeds or under hard braking, there is fade. With a different pad, the K-Force's power may be more usable.

## KCNC CB1

\$330 » 165 grams



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 11.03 meters  
**PANIC STOP DECELERATION:** 5.59 m/s<sup>2</sup>  
**POWER FEEL:** 2  
**MODULATION FEEL:** 4

Machined from 7075-T7 alloy, this dual-pivot caliper rotates on alloy bushings. The two arms interlock above the main pivot. This "channel guided" design ensures both arms move toward the rim at the same rate. All of the fittings are alloy or titanium. The brake is available in four colors and comes with both alloy and carbon pads made by Ashima.

**LIKES:** The CB1 is very light; it rivals the lightest brake in this test, which costs four times as much. It sets up easily and it has an indexed quick release that can be used as a large cable adjuster. And it does stop a bike.

**DISLIKES:** The CB1 will stop a bike, but it forced us to grossly adjust our braking technique. It was the only brake in this test where we had a true, "I don't think, I'm going to be able to stop," close call. There is noticeable flex in the arms of this brake. It feels underpowered to begin with, yet it still fades dramatically. KCNC currently has new pads in development, which should be available in May and will hopefully better the brake's performance.

## SAMPSON STRATICS SL

\$280 » 244 grams



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 8.36 meters  
**PANIC STOP DECELERATION:** 7.38 m/s<sup>2</sup>  
**POWER FEEL:** 6  
**MODULATION FEEL:** 7

Sampson's brake arms are cold forged from 6066 series alloy then post machined to further shave material. The caliper's post and the cable fixing bolt are steel. The SwissStop brake pads are held by carbon-molded holders, which are fixed with alloy Torx bolts. The mounting bolt also relies on an alloy Torx bolt. The brakes are hand-polished in either anodized red or gloss black. Sampson includes carbon-specific pads with the caliper set as well.

**LIKES:** Sampson's brake works well, posting power scores that are very close to Campagnolo Super Record, yet at an even lighter weight. We found it to be well mannered and very usable. After having previous experience with Sampson's Stratic brake, which was outfitted with a harder, no-name pad, we can say the manufacturer's recent investment in SwissStop pads is worth it. The SL caliper is outfitted with an easy-to-use barrel adjuster and an indexed quick-release.

**DISLIKES:** Performance-wise, the Stratics SL performed solidly in our test, but there are a few minor issues. The caliper arms pivot on bushings rather than bearings, which gives it a bit of a rougher action. We also found the alloy Torx fittings, specifically on the brake's pad holders to be very soft, so extreme care is needed and it does seem like only a matter of time before they strip. Also, make sure your mini-tool has a Torx driver.

## SHIMANO 7800

\$320 » 315 grams



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 6.44 meters  
**PANIC STOP DECELERATION:** 9.58 m/s<sup>2</sup>  
**POWER FEEL:** 9  
**MODULATION FEEL:** 9

Shimano introduced the Dura-Ace 7800 group in 2003. Since then these brakes have been established as the industry's benchmark. The dual-pivot brake arms are cold-forged alloy and pivot on a thrust bearing. The brakes' racing amenities include simple barrel adjusters and quick release levers, which make for both quick wheel changes and usability in the event of a crash and bent rim.

**LIKES:** This brake inspires confidence. Shimano's performance bar has yet to be surpassed. It has an unrivaled blend of power and modulation, achieved with little hand force, which is comfortable to maintain on long descents. It posted the shortest stopping average and also proved very easy to use no matter the situation from all-out panic stops to high-speed corrections on descents. Shimano claims much of the new 7900 brake's power comes from a new pad compound, which makes us wonder what that pad would do for this brake.

**DISLIKES:** While the 7800 brake is at the very top of the pile in terms of performance, it is also the heaviest in this test. Every fastener is steel and while this makes for a durable brake, it gives the brake considerable heft. How much weight could a titanium bolt kit drop, and at what price? The brake's larger profile can create a compatibility issue with some frames, and Shimano used this feedback when it designed its 7900 brake.

## SHIMANO 7900

\$440 » 295 grams



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 7.18 meters  
**PANIC STOP DECELERATION:** 8.59 m/s<sup>2</sup>  
**POWER FEEL:** 10  
**MODULATION FEEL:** 7

The cold-forged caliper is supposed to have a more linear response than the 7800. Shimano touts this brake's new pad compound to offer 50 percent better durability and 20 percent more dry weather stopping performance than its previous Dura-Ace brake. Shimano also shaved weight with a slimmer profile and titanium center bolt.

**LIKES:** The true stopping potential requires practice to fully implement. Hard descending in mountainous terrain rarely requires its full power and a rider must quickly learn that a light touch of the lever means serious business at the caliper. This makes for incredible braking performance with minimal effort from the rider. If you use this brake properly it can save energy in the form of hand and arm fatigue. And knowing its power gives you confidence to go faster.

**DISLIKES:** This bad boy is like a sharp knife — it is ultra precise and efficient, but it can be intimidating. We had trouble harnessing the power of this brake in every situation, specifically our panic stop test. While able to produce two of the shortest stopping distances in the entire test, we also found ourselves in a few tense nose wheelies that threw its average score. Its shortest stopping distance produced an uncanny deceleration of 10.35 m/s<sup>2</sup>, that's over 1 G (as in g-force). The only other issue is the design of its barrel adjuster. The adjuster is fixed in the brake arm with a plastic bushing, which stripped out, rendering the adjuster inoperable while riding.

## SRAM RED

\$290 » 277 grams



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 7.71 meters  
**PANIC STOP DECELERATION:** 8 m/s<sup>2</sup>  
**POWER FEEL:** 7  
**MODULATION FEEL:** 7

The drivers of SRAM's top level Red brake are its cold forged arms, which feature a refined design from the original SRAM road component group, Force. The calipers have titanium mounting bolts and alloy pivot bolts. The arms pivot on bearings and the brake is finished with titanium hardware. The brake pads are SRAM's own compound, produced by SwissStop.

**LIKES:** SRAM created a solid brake for Red, and seeing how widely accepted the components are in the professional ranks, it's a good thing these calipers work well. SRAM's brake has plenty of power and the modulation to keep up with that power. The brake did well in our panic stop test and performed without drama during our mountain descents. Like all of the professional level brakes in this test, SRAM's Red brake has easy-to-use barrel adjusters and an indexed quick-release. Finally, the Red brake is a good value.

**DISLIKES:** We had no issues with SRAM's Red brake. But we did observe the undersized titanium front mounting bolt sports only eight threads before it steps down to a narrower diameter, which then lets the front section of the brake and its knurled washer jiggle around before it's clamped down. SRAM engineers consider this a non-issue, but it seems like SRAM could have kept a standard sized bolt for the few grams it might have cost.



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**TRP R960**  
**\$410 » 249 GRAMS**



**BRAKE DESIGN:** Dual pivot  
**PANIC STOP DISTANCE:** 7.9 meters  
**PANIC STOP DECELERATION:** -7.81 m/s<sup>2</sup>  
**POWER FEEL:** 6  
**MODULATION FEEL:** 7

TRP's 960 dual pivot caliper is forged from 6061 alloy then post machined to shave even more material. It features a hidden Slyde quick release. The brake features titanium hardware and comes standard with SwissStop pads. The 960 comes in red and black.

**LIKES:** The 960 does its job well. It's better than the single-pivot brakes, but does fall short in power when compared to the best in this test. That said, it's a good, usable brake. It offers moderate power and good modulation. It also has good lever feel; it's on the firm side, but doesn't cause fatigue. We were able to descend as quickly as we wanted, though a little more power up front would have been appreciated.

**DISLIKES:** There were no major issues, but there are a few minor ones. It has a low amount of clearance, especially when paired with larger tires; you won't fit anything larger than a 25mm tire with this brake. Its barrel adjuster is harder to use than the major manufacturers. The brake's quick release is also more complicated and harder to use than a more standard design.



## THE BUCK STOPS HERE

Even considering how unbelievably light the ax-lightness Orion is, we weren't able to actually feel a weight reduction while riding a bike equipped with them. This observation speaks to questions of where one should shave weight on a bike. Lose 165 grams from a wheel, and most riders will notice. Take the same amount of weight from a brakeset, and it isn't nearly as impressive on the road.

Any of the brakes in this test with a deceleration number of more than 7 m/s<sup>2</sup> didn't force a huge compromise when descending. Keep in mind the panic stop distances and decelerations were measured with a 150-pound rider. A heavier rider would probably increase stopping distances and push the deceleration numbers down.

Another conclusion from our test impressions: Brake pads matter — in a huge way. Shimano attributes most of its claimed 20-percent power increase from the 7800 to 7900 brakes to the pads' performance. A few of the brakes suffered unduly for the pads they came with.

For those who like to go fast and take chances when descending, or are heavier than 150-pounds, better brakes will most certainly give you more confidence to push your limits. We want the best braking performance possible and because of this we prefer the higher powered brakes regardless of their weight. Further, although we appreciate a light bike as much as the next rider, we were never able to actually feel a difference in the weight of the bike as we swapped brakes.

For performance, **Shimano's Dura-Ace 7800** brake did the best job of melding power and modulation. The **ebbrake** clearly wins the battle of balancing power, modulation and weight, while **Shimano's 7900** brake has the most raw stopping power, hands down.

Of note: Each of these brakes was ridden with either Shimano Dura-Ace 7800 or 7900, SRAM Force or 2009 Campagnolo Centaur brake levers. The panic stops were performed using Dura-Ace 7900 levers. Braking feel did vary between the levers, but in a similar manner.