



Revl Road Components, by The Hive

The Revl brand is road components designed and developed by The Hive. Revl components are distinguished by class leading performance, and uncompromised finish and function. Revl products are engineered from the ground up by The Hive to look good, work well, and last a lifetime.

Revl Carbon Road Brake Genesis

The Revl Carbon Road Brake is the culmination of thousands of hours of design, engineering, analysis and development over several years. The end product is a brake that provides class leading performance, coupled with a progressive, timeless design.

This document will attempt to explain some of the engineering considerations that go into designing a world class brake, as well as explain some of the most important features of the Revl Carbon Road Brake.

Brake Design Theory

How should a great brake function? First, the brake should always have some additional force in reserve –hopefully braking should always be limited by tire traction. It should provide braking force proportionate to hand input at the lever, and should provide a relatively linear response to hand force. This is often referred to as modulation. In conjunction with this, the brake should provide a satisfying response to lever inputs – feel solid while providing excellent braking. The brake should deal well with varying temperature demands under wet and dry operating conditions. And lastly the brake should prove durable and simple to maintain over its lifetime.

Bicycle rim brakes are fundamentally simple – a mechanism which takes tension in a brake cable, and converts it to force applied to two brake pads which are pressed against the rim. This force generates a tangential friction force at the rim which slows the wheel. So what are the forces in play, and how can we manage them to create an excellent brake?

The first aspect of the brake system is cable tension and movement. Cable tension and movement are provided by the rider's actuation of the brake hand lever. As the rider applies force to the lever, tension is generated in the cable, which can then be used to apply force to the pads. Upon more thorough consideration of the lever/cable assembly, it becomes apparent that **lever movement** and **cable tension** are inversely related by the mechanical leverage provided by the lever. That is a complicated way of saying that more lever travel has the

potential of providing higher cable tension, and therefore more braking force. Let's assume for a minute that maximum braking force was our goal, we could achieve very high cable tension by having the lever travel almost to the bar while pulling very little cable. In practice, there are many practical considerations that make this undesirable: Pads wear, so excess lever travel must be provided to allow the brakes to work even when pads are worn. Cable housing flexes proportionately to cable tension, so extreme cable tension will cause more flex in the overall system, etc.

Brake lever mechanical advantage is out of our hands- it is set by the shifter/brake lever manufacturer. Every manufacturer uses a slightly different lever pull, and in the case of Shimano, more than one in their own product line! The Revl Carbon Road brake is designed to be modular with respect to cable pull. We allow the replacement of the cam mechanism to accommodate different levers and provide the same force response at the brake pads. The two available cams cover the spectrum of lever pulls out there, and allow modification of lever feel based on rider preference.

Braking force is directly proportionate to the force applied to the pads, so in order to create a powerful brake, why not just crank up the mechanical advantage in the caliper? There are several practical reasons, the first of which we have already mentioned – increasing mechanical advantage at the caliper requires pulling more cable at the lever, and there is only so much lever travel to go around. We have to allot some of that travel to allow for pad wear, and also to allow for quick release function. Who hasn't been on a rain ride when you wear through an entire set of pads? Under those circumstances, it's critically important that the brakes still function, and for safety's sake, even with the quick release opened. The cable, housing, lever and caliper all flex, and some cable pull must be budgeted for these effects.

So we can't just arbitrarily crank up the leverage ratio to increase braking. Another perhaps equally important consideration is the feel of the brakes under operation. In our experience, riders feel more confident about a brake that provides a firm lever feel. Unfortunately, "firm lever" and "ultimate braking force" are on opposite ends of a continuum. All other things being equal, a low mechanical advantage brake provides an extremely firm lever, right up until you blow a corner and ride into the ditch. A high leverage brake will lock the wheel up while providing little sensation at the lever, perhaps with equally disastrous results. So mechanical advantage has to be a compromise between these two extremes. We have spent a lot of time testing various brake configurations to come up with a leverage ratio that we think works and feels great.

So if leverage ratio is a compromise, what can we do to improve braking feel once we've chosen that ratio? There are three areas we can work on to improve braking performance and feel: optimizing spring tension, reducing friction, and increasing brake stiffness.

The spring on a road brake needs to be strong enough to overcome cable friction and internal friction in the caliper, while not fighting the user. The spring on the Revl Carbon road brake has been refined over years of development to meet those criteria.

Friction in a road brake comes primarily from the pivots. The Revl Carbon Road Brake uses engineered bearings from IGUS to provide exceptionally low friction, low wear and resistance to contamination. These bearings will provide years of slop-free service, and require no lubrication. Stiffness in the brake comes from two main sources, arm flex and pad deformation. The Revl Carbon road brake uses monolithic full carbon arms optimized for stiffness to provide flex free operation. On the pad front, we spec pads which provide not only exceptional stopping performance, but also less flex than some other popular pads. Pad flex is an often overlooked key to firm lever feel on road brakes.

On pads: not all pads are created equal, and we have tested a lot of pads! No matter how wonderful your brake mechanism, its ultimate goal is to press those pads against the rim, so the pad winds up as the ultimate arbiter of braking force and feel. Pads need to work well at all different temperatures, under varying weather conditions, and against varying rim surfaces. We have specified pads which we feel provide the best compromise in performance across the gamut of conditions in which we ride. You may find that your local conditions or personal preference for feel are better served by a different brand of pad, and we encourage you to experiment!

A certain well known veloped news organization published an interesting but ultimately futile brake shootout in the last year, where they rounded up many different brands of brakes, and performed a stopping distance test with each to gauge performance. They did a good job of comparing braking distance between different brakes, *with the stock brake pads*. Unfortunately they did not perform the same test suite using a standard pad in all brakes. This would have allowed them to eliminate pad performance as an indicator of brake performance, and compare the brakes themselves. The unfortunate outcome of all this is that a perfectly serviceable brake with a pad that performs poorly under their specific testing conditions would be unfairly penalized in their ratings, and a brake could be set up with pads that are a total ringer for the test, but are deficient in some other area, and the brake might come out on top.. So take your magazine tests with a grain of salt, no matter how scientific they seem.

Summary

Here at The Hive, we take the time to design things the right way, or we don't do it at all. The Revl Carbon Road has been developed over several years to provide excellent braking, light weight and striking good looks at a competitive price.