

Disk Brake considerations

When I bought my most recent road bike, high on the list of must have was hydraulic disk brakes. I like to ride in the hills, and the idea of sustained and controllable braking without the hand cramps on long descents that come from cable operated rim brakes was appealing. In addition, I had a situation with brake fade from rim brakes a number of years ago that ended up with me in hospital, a situation that I wish not to repeat.

And so I bought the Giant Defy equipped with Shimano RS785 Hydraulic calipers and 140mm floating rotors of a brand I can't identify. While this braking system is fine for general riding, it's a fail for a rider of my mass on big hills (combined bike and rider mass over 100kg). On a recent descent at around 15% contending with traffic and sharp turns, the brakes began to fade in a major way. And so the search was on for a more reliable braking experience. Here's what I learned along the way.

Brake fade – the enemy

I've lifted this information direct off the interwebs, and it's a good description of the situation I am working to avoid.

Brake fade is a term used to describe the temporary reduction or complete loss of braking power of a vehicle's braking system. Brake fade occurs when the brake pad and the brake rotor no longer generate sufficient mutual friction to stop the vehicle at its preferred rate of deceleration. The end result being inconsistent or unexpected braking system behaviour, often resulting in increased stopping distances.

Brake fade is caused by overheating of the brake pad, therefore any vehicle which uses the action of a brake pad rubbing on a brake rotor to convert the vehicle's kinetic energy into heat has the potential to develop brake fade. Because brake fade occurs when the brake pads are overheated, the phenomenon is only temporary and braking performance usually returns once the brakes have cooled down.

In my case, there was a distinct aroma of burning brakes with the bike not slowing and increased lever pressure having no effect on the rate of deceleration. This is not what you want on a steep descent surrounded by cars and hairpin bends.

In addition, Shimano warn of vapor lock owing to heat transfer to the brake fluid:

"Vapor lock occurs when the oil inside the brake system becomes heated, which causes the water or air bubbles inside the brake system to expand.

This can then result in a sudden increase in the brake lever stroke."

So the goal is better heat management to avoid brake fade and vapor lock.

A side note: Shimano mention that turning the bike upside down has the potential to disrupt your hydraulic brakes so if you do this to change a tire for example, best you ensure the brakes are working before setting off down the road.

The braking system

The braking system comprises a number of parts, the levers, calipers, pads and rotors, hoses and fluid. The Shimano system uses mineral oil rather than DOT brake fluid. I'll retain the levers and calipers which leaves me with options for pads and rotors.

Pads

Pads generally come in two flavours, resin (organic), and metal. Resin pads are made up of fibers and organic material that are bonded together with resin. Metal pads are made up of hardened metallic ingredients, which are bound together with pressure and temperature.

Resin pads are considered a better choice for general duties because they have more bite and modulation, but lack the ability to manage heat as effectively as metal pads. Conversely, metal pads have less bite and modulation under normal conditions, but under sustained braking, manage heat better leading to a more consistent braking experience.

The calipers I have use Shimano's Ice-Tech pads (J02A resin/J04C metal) which have a big alloy heatsink attached to aid heat dissipation, further extending the ability to manage heat in theory.

The pads have a modest braking surface of approximately 30mmx10mm on each pad. There are third party options for pads. Previously, brake pad manufacturer SwissStop has recalled their high performance [ExoTherm](#) range of pads owing to the pads disintegrating. So ensure to do your homework if you plan to go third party.

Rotors

Rotors have a number of considerations as well. First the mounting system, six bolt or centre mount depending on your wheel. Then the diameter, 140mm or 160mm for road bikes. Then the type of rotor of which there is a dazzling array to choose from, but limited choice in the six bolt category in the Shimano Ice-Tech range. Six bolt rotors can be converted to center mount, but not the other way around. Larger rotors allow greater leverage from the caliper, and have a greater swept area which permits improved heat dissipation.

Rotors are typically a single piece of stainless steel, or a steel rotor with a riveted alloy hub (floating disk). Shimano's Ice-Tech rotors are a laminated construction, comprising an aluminium core with steel braking surfaces and floating alloy hubs. In the higher end road variants, there are massive additional heatsinks which are intended to maximize heat dissipation. Some suggest Ice-Tech is a marketing thing. Shimano claim their technology can reduce rotor temps from 400 to 300 degrees.

Not all rotors can be used with both resin and metal pads.

Lightweight rotors are known to easily warp and bend and there are reports of Ice-Tech rotors delaminating if the inner core overheats although I am advised that overheated resin pads can give the appearance of a melted rotor.

The upgrade

The steps to improve braking performance is clear; metal pads and a bigger rotor are required in order to provide the stopping power and fade resistance I seek. I have chosen to stick with Shimano products rather than go third party to ensure that everything plays nicely together.

I've selected the 160mm Shimano RT86 Ice-Tech rotor as a replacement for the for existing 140mm front rotor. This is a six-bolt rotor comprising composite construction consisting of a stainless and aluminum laminated braking surface with a floating alloy hub. It is suitable for both resin and metal pads however I will be using Shimano's metal pads to maximize the fade resistance – of the rotor and pads at least.

While installation of the rotor was straightforward, the caliper needed to be moved outward to provide correct alignment with the larger rotor, accomplished with a disk brake mount adapter. This is a standard practice and ensures that a range of disk sizes work with standard fork post spacing. It turns out there are numerous options for adapters, this is an area that should be researched well to ensure you don't get the wrong ones.

With these changes in place the initial road tests bore out the theory. The pads create a slight scratchy noise on the rotors under initial braking. But the additional braking power is evident even on the flat. It's a noticeable improvement. How it fares in the hills remains to be seen, but I feel confident this is the answer.

But wait...

Even though the braking capability was massively improved the front lever was always a little spongy from the when I first took delivery of the bike. It's what led me down the upgrade path. While having the bike serviced, unable to get a firm brake lever, the bike whisperer pulled the front caliper off and discovered the pistons were in pieces. The seal must have still been intact since it never leaked fluid at the caliper.

It turns out the calipers fitted to the bike [had a known defect](#) which caused the caliper to malfunction causing the soft lever. I am thankful the calipers didn't fail completely, especially on a steep descent. Why they were never recalled is a mystery to me. In any case these were replaced with [Clarks M2 calipers](#) and now work confidently with good feel at the levers.

The Clarks calipers are a budget mountain bike favourite and work even better than the broken calipers they replaced which is hardly surprising. They take the same pads as the Shimano calipers and so I might see if the Shimano Ice-Tech metal pads are worth installing at some later stage.

A final word on safety

Braking systems are an important safety component and it is vital that they are always in safe working condition. Although the upgrades I have mentioned are suitable for my situation, always consult with a professional if you are unsure about what might be suitable for you. In particular, don't undertake any work on brakes yourself if you have any doubts about your ability in this respect.

Bonus reading, Orbea on why disks are awesome on road bikes.

<https://www.orbea.com/be-nl/blog/Why-disc-brakes-are-the-best-solution-for-road-cycling>