Part 2 - Improvements
Edition 3
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BRAKE UPGRADES FOR ROAD SPEC BRAKING SYSTEMS

RACE BRAKES
0800 BRAKES

Pad Life

One of the most commonly asked questions is….

“How long are my race pads going to last under road conditions?”

Sadly, there is no simple answer.

While we cannot guarantee the accumulated mileage on a set of race pads, we can give you some indication as to what to expect.

As a general rule 500 racing kilometres is considered good mileage from a set of race pads.

However that only works if you are comparing apples with apples. If you were only going to get 500 road ks out of your $200 race pads, this would not be considered a good investment.
If we use 40,000km as an average mileage for a set of road pads under normal road conditions and we fit our race pads and drive the car exactly the same way as we did on the road pads, we would expect to get higher mileage from them as they are of a denser material composition.

What we find in reality however, is something different.

The race pads are fitted and the car is now driven in an entirely different manner than it was before. The braking points become later, the pedal pressure is applied more vigorously, and the car is taken to track days.

And that different driving style changes the overall data. Given that heat is one of the big killers of pad life this usually results in the vehicle getting less mileage (say 20-30,000km) on the race pads.

De-Gassing

What is it and how will it benefit me?

By Steve Borg, Disc Brakes Australia DBA.

As we know normal brake rotors have a smooth, flat surface. Having holes and slots in the face of the disc provides a number of benefits.

Firstly, removing gasses from the face of the disc.

These gasses greatly reduce the coefficient of friction. Disc pads, when hot, expel gasses. These gasses form a cushion between the face of the disc and the pad.

It takes a tenth of a second to squeeze these gasses out on normal rotors. Now this does not sound like a very long time, but consider this. When a vehicle is travelling at 100km/h, it is moving at a rate of 30 metres per second, so a tenth of a second is three metres.

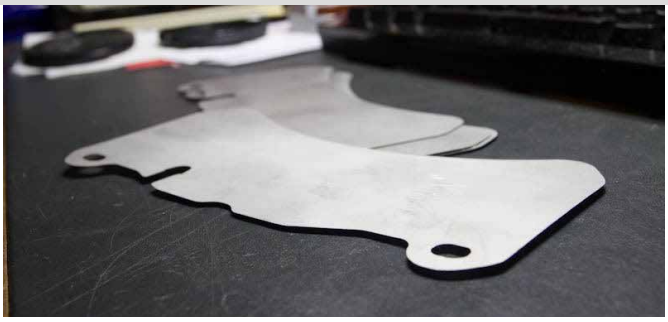
So in essence, when the brakes are applied, the vehicle travels for three metres squeezing out gasses and not creating friction to slow the vehicle.

(*Race Brakes comment*: This is probably not a big issue at city speeds but consider the lap time savings of a 300 km/h race car with 6 braking points per lap. As an example, this could add up to a saving of half a second per lap which could mean the difference between 1st or 14th in an Aussie V8 Supercar grid.)

Another problem that occurs when the buildup of gasses is not released, is that the pad material becomes hardened and glazed, greatly reducing the grip between the pad and disc.

Cross drilling and slotting allow these gasses to be removed immediately, helps to deglaze the pads, increase the grip between the pad and disc, and shorten the braking distance.
Also, cross drilling and slotting makes the disc surface uneven so water and dust cannot develop into a thin layer that becomes a smooth, glass like surface which can greatly reduce the coefficient of friction. Cross drilling and slotting works effectively to reduce the main problems that occur in brake systems.

But there are some tradeoffs, such as a shorter pad life of approximately 10% so if you're getting 40,000km from a set of pads this can be reduced to 36,000km, a small price to pay for better braking performance.
However, the cross drilled rotors are more prone to cracking under extreme conditions, such as racing.



Both the cross drilled and slotted and just slotted discs have the same performance qualities.

So the question is, do you fit cross drilled and slotted or just slotted discs?

The question has to be asked of the driver, in regards to its main purpose.

What is the main use of the vehicle?

Is the vehicle used for racing, or driven extremely hard?

Does the vehicle go off road?

If the answer is yes to any of these questions, slotted only discs should be recommended.

Back to Steve Currie from Race Brakes.

Most race pad manufacturers do not produce pads for road calipers.

But Race Brakes are able to custom manufacture these for you. It will take approximately 3 – 4 working days to produce your new pads.

We create templates to manufacture them from other pads which costs on average $20 - $30 per axle set.

Alternatively, we can build them using your old disc pads which will save you this outlay.

Bedding

In the road pad world, bedding-in of new pads is done very slowly and carefully along with new rotors or freshly machined ones.

Race pads however are a different kettle of fish. Official bedding-in (conditioning) procedures for race componentry advises bedding-in (conditioning) of new pads on old rotors, and bedding-in (conditioning) new rotors with old pads.

This ensures that the high temperatures involved in bedding-in race pads doesn't hurt the "green" (non-work hardened) new rotors.

Most people cannot afford the luxury of fitting a set of pads, bedding them in and then pulling the car apart again to fit the new rotors.

What we advise in road car instances is to fit the new rotors and pads at the same time and drive the car normally for about a week thus getting some non-severe heat cycles through your new non-work hardened rotors.

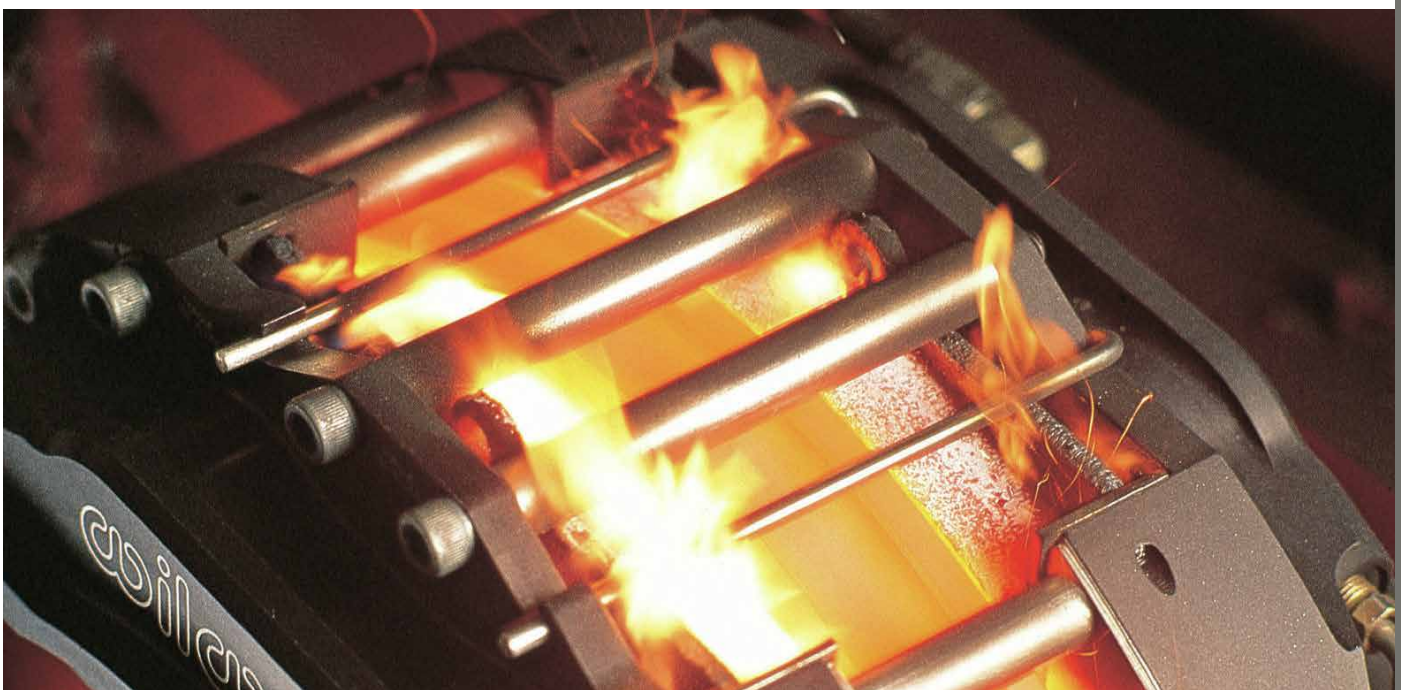
Once this is achieved, it will then be appropriate to do the high heat cycling conditioning procedures necessary to bleed the gasses and resins out of your new race pads.

This will cause an initial pre-fade as it happens but once it is out of the way, fade will not re-appear. Performance and longetivity will also be enhanced.

Be aware, most race pads will fade the first time that they get up to racing temperatures as the conditioning process takes place.

We advise doing this pre-fade/ conditioning/bedding-in procedure (call it what you will) in a controlled environment.

Make sure that you get a set of bedding-in instructions for your particular brew of race pads when you receive them.



Braided Hose

The short answers on braided hoses:

Yes, they are legal for road use as long as they meet a required standard.

Yes, we can build them for you if you provide us a sample hose or a very, very clear set of instructions.

No, you won't need to certify the car.

For a long time, virtually any type of braided brake hose was O.K, but they needed to be signed off by a low volume vehicle certifier, which meant that the car had to have a low volume certificate. Now the LTSA requires the braided hose itself to meet an approved standard, which is marked on the hose so the testing station guys can pass them, and does away with the need to certify the vehicle.

So now, the only disadvantage over rubber hoses is the extra cost of the hose – typically around $50 a piece more expensive.

The advantages though, may make this extra investment well worthwhile.

For starters, braided hoses don't swell and expand like rubber can, greatly improving pedal feel and response.

They are less prone to exterior damage, very important in gravel events, and are less likely to suffer internal wall collapse which can act as a check valve and hold your brakes on – not a good look as far as heat build up and pad wear are concerned.

A collapsed inner wall on a brake hose can also be very tricky to diagnose and is generally only thought of after the pads have been blamed as a bad batch and wearing out too fast, along with the calipers having been overhauled in case they were sticking.

Possibly a lot of needless expense. Braided hoses also weigh less than rubber lines – not by a lot, but it does all add up and it is unsprung weight as well.

Predominantly, there are 3 types of braided hose.

The first is a properly swaged type like Goodridge, the acknowledged Rolls-Royce of braided brake hoses. These are manufactured like a rubber hose with proper braided hose swaged fittings at each end, i.e. a minimum amount of joins which translates into lighter weight and less chance of having any connection problems.

The second is of a type which has fittings screwed into swaged ends. Not ideal, because of the extra connections involved, but certainly a better option than the third type…..

Which is the Brakequip style that uses large diameter rubber hose fittings swaged onto small diameter braided hose.

To overcome the diameter differences, a packer is used between the hose and the fittings.

A quote from Brake Quip in the February 2007 issue of Undercar Review states:

"It is important to note that these hoses are not designed for race/competition use".

Below is a Q&A between a modifier and Tony Johnson from the Low Volume Vehicle Technical Association.

Q. I am in the middle of turbocharging my Honda Civic and have a question regarding brake upgrades. Basically, is there a point where they must be upgraded, or does it just come down to them being tested when I do the cert?

The car was originally a Vti model before I put the B16A DOHC VTEC engine in, so it only comes with the disc brake on the front and drums on the rear.
From previous experience though, I have found that upgrading the front pads to something half decent usually makes a pretty good difference, but I'm wondering if that will be enough in my case?
I don't really want to go to the hassle of doing a rear disc conversion, as I don't think it will make that much difference to the cars stopping power. I'm aiming for around 250hp, which is almost double the 120hp the Vti came with. Kind Regards, Michael.

A. Good question.

No, there isn't a cut-off point that says bigger brakes have to be fitted.
As you can imagine the number of potential vehicles/conversions is almost infinite, so it would be near impossible to regulate.

Add to that the fact that some cars come out from the factory with useless brakes (VN Commodore for example), while others have such awesome braking systems you can throw gobs more power at them and they're still just fine (Honda VtiR/SiRs etc).

As you rightly mention, decent performance brake pads on the front can make a huge difference (cures the Commodores). Likewise, direct brake rotor replacements from an after market supplier like DBA can give a great improvement (through better material composition).

Neither of these two mods require an LVV cert. So to answer your question, whether or not your brakes are man enough for their new job is a decision for the LVV certifier as part of his inspection process.

In the case of a power upgrade, he doesn't carry out just a one-off performance test, but a cyclic brake-resistance fade test. This slows the car from 100kph to 0kph several times in immediate succession, ensuring that after repeated applications (simulating a hard twisty and hilly road work-out) you're not going to run out of stoppers.

The LVV certifiers often find that brakes are good once, maybe twice, but often on the third or fourth application the pedal's gone rock hard and car just keeps going.

The best advice for those of you doing an engine upgrade or conversion and wanting to retain the standard brakes is before you take your car in for its cert, make sure the brakes are all in good condition (fresh, good quality fluid etc), and secondly, exactly what Michael suggests – talk to a specialist and fit a good quality set of aftermarket pads to the front.

A final word of caution here; don't go too wild on the pads. The pads serious race cars use require a lot of heat to build them up to a point where they work properly (some pads will need one or two hard-out laps around Pukekohe before they're fully in business).
These are not suitable for road going performance cars, they can be dangerous...

Now for those that choose to ignore all of the previous and insist on grafting larger brakes on to your vehicle for increased cooling, which will decrease the wear rate of your consumables, and/or to fill up the wheels, keep in mind that you will still have to do the friction materials and fluid even on your bigger brakes.

Since a well set up small brake system will run rings around a standard spec big brake system, a properly set up big brake system will obviously be better than a well set up small one.

There are two ways of fitting bigger brakes to a car. The least common route for most people is the fitment of proper aftermarket race calipers and two-piece race rotors.

This way, while generally being the most expensive option because of the necessity of making 'hats' to get the rotor to fit the car, ensures that you get the maximum brake size inside your given wheel diameter.

The most popular way for us Kiwi's to fit a larger brake to our cars is to graft something on from a larger donor car, usually (but not exclusively so) from the same family of manufacturer.

Examples of this would be Skyline 4 pot calipers onto Pulsars or VT Commodore parts onto VB – VS.

One other point: It is O.K to use a mix of componentry.

The Dark Arts

One of the most annoying aspects of a car is brake squeal. And the solutions to it are wide and varying. Here's some information that may help.

Brake squeal is irrelevant on a race car, but nonetheless it is still frustrating and very difficult to solve.

Often the friction materials are not the cause of brake squeal, but by changing them, sometimes the noise goes away which causes the uninformed to refer to the previous squealing set as 'faulty'.

However, brake squeal is caused predominantly by a harmonic frequency, which is the frequency at which something vibrates, found in the relation between the steering/braking/suspension systems of most cars to one degree or another.

In simple terms, think of a bell. When you hit it, it vibrates and makes a noise. If you were to put your hand over the outside of it and hold it tight, then throw the little inner ball against the inside of it, you would only get a thunking sound, not the usual ding.

This is because you have eliminated the bell's vibrations and changed the frequency.

This vibration elimination is also what we need to achieve with your car to get rid of the squeal/ringing sounds - by changing/eliminating the pitch/frequency of the vibration through a damping effect.

You will probably have noticed that brake squeal is predominant under light check braking and goes away when you give the brakes a good workout.

This is because you are putting a lot of pressure on the pad/caliper combination under hard use which is stopping things from vibrating, moving and chattering. It will in all likelihood also be de-glazing disc pads which, in some instances, can be another contributor to brake squeal.

Soft standard cardboard pads are generally a lot more forgiving to vehicle harmonics than the race compounds as they will absorb and dampen the vibration instead of "chattering" like the denser race pads.

To prove that it isn't pad compounds causing the squeal, one only needs to look at cars with standard pads that are also squealing to realise that there is more to it than just disc pad compounds.

Admittedly, now that we understand why, it is easy to see how changing friction materials can sometimes get rid of the noise, but it doesn't necessarily get rid of the harmonic vibrations. But as these harmonic vibrations aren't a safety issue, just getting rid of the noise is all we care about.

So how do we get rid of the vibrations from our race pads, because we don't really want to put standard road pads back in?

Since most vibrations come from the disc pad contact areas in the caliper, we need to make sure that we have some good aftermarket anti-squeal shims fitted between the caliper pistons and the back of the pad.

Yes, those steel shims that you threw away, were factory fitted anti-squeal shims. These were O.K for soft forgiving standard pads, but not really that absorbent as they were made of steel, and usually had to last through a number of pad changes because most people don't buy O:E pads with new shim kits.

The aftermarket anti squeal shims are a bit like a gasket material with a sticky backing on one side which you attach to the back of the pad. The piston goes up against it and the shim absorbs any vibration.

These aftermarket shims are around $15 for an axle set. You can also get spray on anti-squeal compounds for the back of the disc pad, but these tend to be less permanent than the shim arrangement.

You will also need to make sure that any areas on the side of the pad that come in contact with the caliper are coated with copper grease or something similar. This is to eliminate the pad "hanging up" and vibrating on the caliper body.

Don't ignore pins and slides where appropriate for the same reasons and never put oil or grease onto the friction material surface of the pad. If your caliper slides are seized and gunked up, this can also cause noise. Make sure that they are serviced and slide freely using rubber grease, not a copper grease.

For the record, the larger the brake diameter, the more prone it is to harmonic frequency. This is why vehicles such as Evo's, with 320mm diameter Brembo brakes on the front of them etc, have more squealing issues then Grandma's Corolla with the smaller diameter brakes .

If the generally effective and cheap fixes listed above don't work, you may need to look at rotor compositions. Not a common problem, and not guaranteed to cure the problem if you change them, but an incompatible rotor/ pad combination is known to be an issue in some instances.

Obviously you would not start to cure brake squeal by changing disc rotors as your fist option in the "process of elimination" should always start with the cheap cures.

If you find yourself getting down to some of the old timers remedies of pad chamfering and slotting, we would suggest that you are probably on a hiding to nowhere.

And yes, we do know of cars that could never get rid of squealing problems, so the owner got rid of the car.....