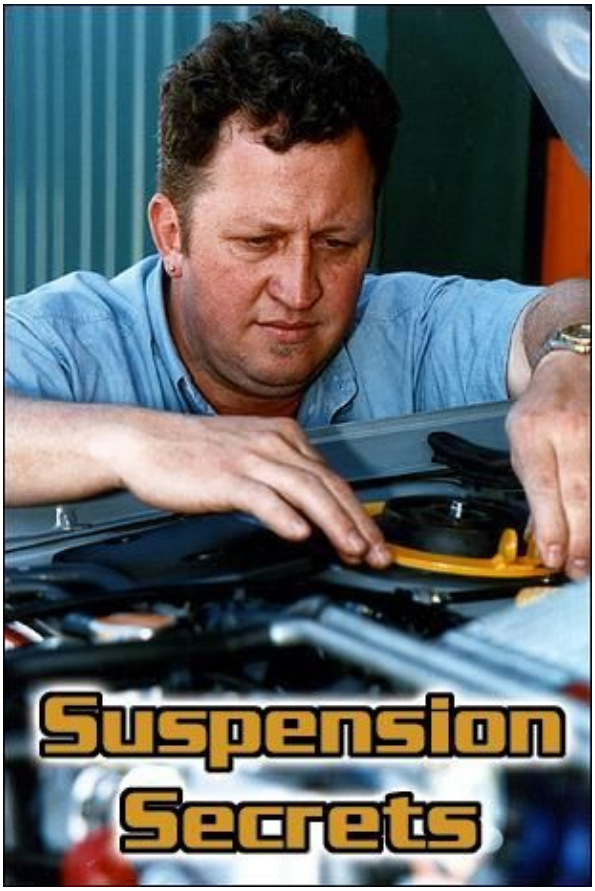

Suspension Secrets - Part 2

We talk to one of Australia's leading suspension gurus about the handling of constant all-wheel-drive vehicles...

By Michael Knowling, Pix by Julian Edgar

Jim Gurief of Whiteline is one of Australia's leading aftermarket suspension experts. Here we talk to him about factory constant all-wheel-drive set-ups and modification...

Describe the handling of an unmodified constant all-wheel-drive vehicle - such as the Subaru Impreza WRX or Mitsubishi Lancer GSR.

It's important to clarify here that we're talking about front-wheel-drive cars with torque trimmed to the rear - not the other way around like in the Nissan Skyline GT-R. This really does make a big difference to handling.

With standard diffs, you'll find a constant AWD generally behaves like it would without the rear drive - it tends to understeer. However, turn-in at the limit is better - it has to be because there's torque going to the rear. The big thing, though, is the performance envelope is more open, because you've got additional drive.

Power understeer is the name of the game in a WRX. The newer model (MY01) is much better than the old one because Subaru raised the rear roll centre, making it more neutral. It also has a 25mm wider front track - which makes a hell of a difference.

That was one of the greatest weaknesses of the earlier WRXs - the Lancer GSR always had the goods over it in the front track.

It's the 'praying mantis' scrabbling of the front tyres on corner exit that's the trademark of a WRX. A stock Lancer GSR (non Evolution model) doesn't really do that, though. It comes out of a corner much flatter because it doesn't really have the power. I think a standard GSR is a nicer car than a Rex. It turns-in better because of the wider front track, plus it doesn't lift and squat at the back as much as the WRX. Of course, increase the power and it will, though.

There's no question that - for the average punter - any all-wheel-drive system is a great thing. It flatters. I mean, ham-fisted people - like me - can get away with blue murder and still come out smiling. In front or rear-wheel-drive cars you need to be much more precise - but if you're having a bad day behind the wheel, you're going to have a **real** bad day.

Some AWD vehicles - such as the Mitsubishi Galant VR4 - also feature rear-wheel-steering. How does this affect handling?

The VR4's active rear steer is a nightmare. It transitions from understeer to oversteer very abruptly mid-corner. It says, "You're pushing the front, [so] I'll start steering from the back to make it more neutral." At that stage you're about to get on the power and full boost - so the next thing you know, the tail's hanging out. Then you go to correct it and it says, "Oh you're turning the front wheels back," and you can end up in this terrible fishtail cycle.

We don't like active rear steer at all - in any car. Front, rear or all-wheel-drive. It just adds an element of unpredictability.

So why would the factory chose to install it?

Because it makes it more foolproof for the average person.

Why wouldn't they simply improve geometry or alter part of the driveline to reduce understeer?

Well, I answer that by saying Porsche, BMW and Mercedes - none of them have rear-wheel-steer. The cars that do are all Japanese - and they're full of trinkets. They love acronyms.

On the street, four-wheel-steer does have its place - particularly with the big power Nissan Skylines. You only need to take one down to our roundabout near here, have a spirited turn in one direction and the other. If you're a ham-fisted Wally it'll save you - especially if it's wet. So on the street it'll save you, but on the track - if you're confident what you're doing - it won't be any faster.

We actually did a test of a R33 Skyline GTS25T at Oran Park with and without HICAS turned on - with a professional driver, it was half a second faster with it off.

If you had around $500 to spend on improving handling, what should be the first changes to - say - an Impreza WRX?

An anti-lift kit and an adjustable rear bar - definitely.

We also sell swaybar links that make the swaybar work more directly. They don't increase the swaybar rate - contrary to what people think - it just works sooner. It reaches zero compliance faster.

Does the rear bar really have to be adjustable to suit your particular diving style?

We prefer an adjustable rear bar because WRXs are generally modified as part of an overall journey. An adjustable bar is great for that, because you have scope of keeping pace with other mods down the track.

And what effect will an anti-lift kit and rear swaybar have?

Well, they'll greatly reduce the understeer - particularly on exit. Turn-in can be worse, because if you come in too hot it could understeer more. So you may have slightly slower entry speed - but, with all honesty, it's immeasurable.

What should come next?

Some decent alignment specs - when I say an alignment, I also mean things like rear camber pins, if needed.

Look, we have a new MY01 WRX as our project car. We grabbed it from the dealer and drove it straight onto our wheel aligner - and it was all over the place. And that's not just common to Subarus - it's just that factory tolerances are different to our performance expectations.

After an alignment would come shocks then springs.

Ideally, you replace the shocks and springs together, but if you had to separate them I'd put shocks before springs. That'd give you much better control - it'd be more appropriate for what the expectation is. However, if you're going to do [track] super sprints, a set of lowered springs will give a good outcome **if** the standard shocks are still in good condition. Remember - as far as the shock's concerned - when you put a bigger bar on, you have the effect of slaving one side to the other. It has to work harder. Straight away that puts OE shocks under stress so they'll wear out sooner.

Nissan's Pulsar GTi-R needs shocks badly. Their weight distribution is horrendous - it's the worst. You really benefit from better front shocks to control the front end from oscillating, maintaining contact between the tyres on the road.

Many people invest in big wheels and their rubber is considered secondary - what are your comments on this?

We generally suggest that people buy their tyres first and their wheels second. In other words, there's more benefit to be had in a better quality tyre than in a bigger wheel. There are so many factors - such as offset and the shape of the footprint depending on tyre width - that'll affect how the car behaves. A wheel alignment becomes very important, because - if you've got this great wide thing cambered over on edge - it would be better to have something 80 percent as wide but which sits squarer.

Get the best tyre you can afford and then buy the wheel for it. If you have to put a piece of crap on there to afford the 18-inch rims, don't do it - unless cosmetics are all you're after.

When purchasing suspension gear, is it best to pick and chose individual components or buy a kit?

That's the hardest thing to try and convince people of - the value of a tuned package.

Australia is one of the few places in the word that has a mentality that the informed consumer somehow knows better than the tuner. For example, everywhere else in the world people sell kits of 4 springs - they don't even sell pairs. In Australia we have this preoccupation with being able to buy pairs.

Joe Bloggs knows that Monroe make the best front shocks for his HQ - but when it comes to the rear, somebody else does. Which is total crap. I mean, Monroe don't know the springs that he's got in there - which is the first failing. The shocker is there simply to control the spring, the swaybar and all the oscillation rates of the effective springing.

I'll be buggered if I know that shock goes with every spring in every case either, but at least we test and try them.

Your company sells shock and spring packages - how do you match them?

A lot of it is seat of the pants. We go to the racetrack for testing and do laps, measure tyre temps, watch tyre wear and get driver feedback and so on. We also analyse MoTeC data logging results to see what maximum and constant lateral Gs we can generate. That's what we do.

Even a simple drive around the block helps. You can go around a roundabout at 50 or 60 km/h and get a pretty good idea of how things are interacting with each other.

Is there a scientific way of doing it?

Well there is if you have a 7-post chassis rig like they do in Formula 1.

We can measure each spring individually and simulate its rate curve. We can do the same thing with a shock. Then we can work out what the swaybar is doing relative to the standard one. That's all fine, but the problem is when you join everything together. That's when you come down to a 7-post rig or your backside and some data from testing.

What are your opinions on Japanese suspension kits?

Generally, in our experience, the Japanese sourced [aftermarket] stuff is way too hard for Australia. I mean, they are probably a very good shock - but they're failing is their appropriateness. They give skittish, unpredictable handling on Australian roads - they might be fine on the racetrack.

And - look - just because you've got a $5000 spring and shock set, that doesn't mean it's the end of the story. People see these set-ups as a panacea for curing all suspension problems - it's not. It's only one part of a whole package.

DMS [Drummond Motor Sport] we find are great. They're Australian made, excellent value for money and more appropriate as well. In our kits, we actually stipulate to Jamie Drummond our chosen spring rates.

How do insurance companies view suspension modifications?

That's a difficult one. Technically, everything that people like ourselves, Pedders and all the rest of us do is illegal. When people ask if a mod legal, I have to say 'no'. The reality is, though, everybody's been doing it forever and a day.

There are some common sense things that we follow that we know are non-threatening or challenging - for example, how much to lower a car. But, you see, it all turns to shit when you look at ADRs and it specifies a certain height from the ground to the headlight - minimum clearance. A brand new Honda Integra, straight out of the box, is illegal according to ADRs. The previous version Civic is the same, the XR Falcons when they came out - they all contravened ADRs.

Then there's the rule that you can't reduce bump clearance by more than a third. Well, most modern cars have full contact bump stops at normal ride height - there's no bump clearance. So they contravene ADRs too.

But, really, the Number One golden rule is a minimum of 100mm clearance between the road and the lowest point of the car. A sensible amount of lowering that leaves enough bump travel and shouldn't have the car leaving the road whenever it hits a bump.

The number one mistake people make with their suspension is they lower it too much. They want that chic look.

What sort of wear does over-lowering cause?

CV joints or universals, shocks, ball joints - especially with wheels that have the wrong offset. But the one people hear after a while is a body rattle - they literally pound the chassis into submission. Ultimately, there's a price to be paid for the fact that you don't have any suspension compliance left. Monocoque chassis are not as strong as a railway track - they're designed to flex to a point, in conjunction with the compliance in the bushing and so on. If you remove that suspension compliance, it's all down to the body and - after a year or so - you hear these body creaks.

Excessively low springs will also deteriorate because they'll be overstressed and/or there are that many stacked coils hitting each other. They'll wear out and sag. Spring coils don't like hitting each other - that's one of the factors that effect spring longevity.

Speaking of spring longevity, how essential is the shot-peening process?

Shot-peening is a stress relief process that is good for both hot- and cold-wound springs. It really is essential for any decent spring.

Lack of shot-peening - in some situations - is enough to cause a spring to eventually fail. We have a life cycle simulation on our computer, and when you put in a whole bunch of factors - size, rate, cycles and so on - the available cycles before failure is determined by a coefficient that includes shot-peening. Remove that coefficient and a spring that would last for 100,000-200,000 kilometres might only last for 5,000 kilometres.

These days - where manufacturers are looking for weight reduction - we find that springs are getting smaller and lighter. That means they're more highly stressed, so it's harder for people like us to find a spring to fit in the hole that will do the job and last. So - yes - shot-peening really has become essential.

How do you test the durability of the springs you supply? We've got a simulator for springs. It's a computer model where we put in a whole bunch of factors and it says how many cycles it'll endure before it collapses. We look at that a whole variety of factors - like, whether or not it'll be acting with the bump stop. We often talk up to about 10 million cycles at any sort of velocity.

And how do you test bush longevity?

That's something we leave to the factory that makes them for us.

We pretty much use exclusively the Fulcrum factory. That's their expertise. If we design something new, we simply give them the outcome we want - like the angle of change or NVH change - and they work out the solution. And they've got static and dynamic test rigs.

In the final part of our interview we'll be talking to Jim about constant rear-wheel-drive handling and suspension set-ups...

Contact:

Whiteline Suspension
+61 2 9603 0111

www.whiteline.com.au