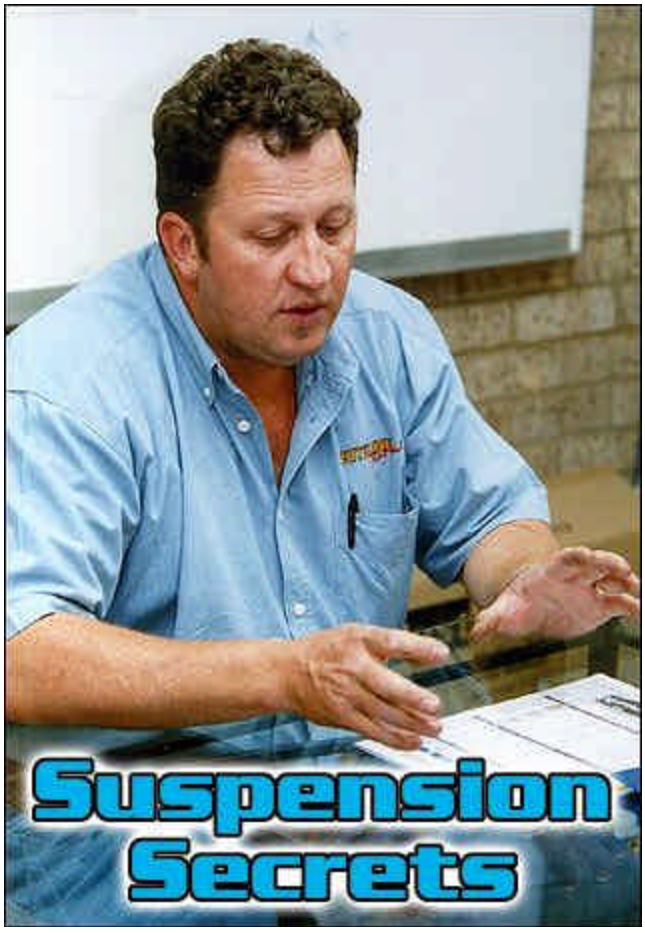

Suspension Secrets - Part 3

We talk to one of Australia's leading suspension gurus regarding rear-wheel-drive vehicles...

By Michael Knowling, Pix by Julian Edgar

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Jim Gurieff of Whiteline is one of Australia's leading aftermarket suspension experts. Here we talk to him regarding factory rear-wheel-drive set-ups and modification...

Describe the handling of a typical rear-wheel-drive vehicle.

It really depends on the weight distribution, but assuming it's reasonable, they'll tend to understeer on turn-in - for the Wally factor. But they're a lot less predictable when it comes to lift-off or mid-corner braking - they require a more diligent driver approach. The advantage over a front-wheel-drive, however, is that tyre loads are more evenly distributed - this allows for a higher ultimate level of handling.

The VT-series Holden Commodore is extremely popular with enthusiasts - what's its standard handling like?

It's a barge - it feels really fat. Look, you can group a Falcon and a Commodore together - these are big cars with a lot of weight.

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When I say they're a barge, I mean there's a lot of weight that has a lot of momentum. A racecar, as we know, is very light - and it's not just because they accelerate faster, it's because they can change directions very quickly. If you're looking at anything other than straight-line drags, a big car is a liability. When all that weight swings it's a lot harder to turn or stop. Weight transfer issues become a problem in their own right.

A VT has also got all these dynamic angle changes in the rear-end, and with the GTS's 300kW it could be a diabolical weapon. An IRS Commodore will toe-out under squat and it goes into massive negative camber - which is exactly what you don't need.

And what about the handling of a lighter rear-wheel-drive car - like a Nissan S15 200SX?

They're a lovely car. One of the major changes between the S14 and S15 is the rear [Torsen] diff - I think people don't give that as much cred as they should. That makes a noticeable improvement in its dynamics - even in a straight line.

[But] we don't like the S-series rear-end much; that passive rear steer system is very doughy. Also, if you lower the height of the rear, it goes into fairly horrible negative camber - so when you apply power, the rear squats, spreads its legs even worse and fries the inside of the tyres. The S15 doesn't do that - its diff is a Godsend.

The new diff lets both wheels share some of the tractive load, instead of one wheel being overwhelmed and losing grip. Imagine the slip curve of any tyre represented by a round pie. Within that pie, there's only a certain amount of grip units that can be divided between lateral and longitudinal load. If you send major power to the tyres of a rear-wheel-drive and you want it to hold a cornering line as well, you're asking a lot. Up to a point we can move that weight down to the back, which helps in theory - but not when the wheels splay out like they do in the 200SX and we're left with a smaller contact patch. All of a sudden there's a heap of negative camber and the tyre's running only on its inside edge. A tyre is rigid only to a point, so it won't maintain the same size contact patch.

What should be the first suspension changes to a VT-series Commodore, given a budget of around $500?

A bigger front swaybar.

Basically, you want to make the front more rigid - to a point, that will increase understeer, but it will also reduce the tendency for the rear to lose traction under transient weight transfer. It'll also make the steering more precise. But - to give you an idea - you don't increase the roll stiffness on the front anywhere near as much as you do on the back of a front-wheel-drive.

In front-wheel-drives, experience has shown that hundreds of percent increases in rear roll stiffness just benefits with transfer to the outside front wheel. If you do those sorts on numbers on the front of a rear-wheel-drive, you'll just plough ahead!

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So - yeah - everything from a HQ Holden onwards, a bigger front bar is the first thing to do.

Front radius rod bushes on a Falcon or Commodore also make a big difference; for the same reason that the rear bush of the lower control arm makes a difference on a front-wheel-drive. It maintains a closer relationship between the static and dynamic wheel angles.

The next thing is control of the rear-end - making it more predictable.

Panhard rod bushes on a non-IRS Commodore make a major improvement. After that, you look at things like upper trailing arm bushes - they wear out relatively quickly and most people don't bother replacing them. With a Ford Falcon, our Handling Pack includes a set of Watts linkage bushes in the rear. The Watts linkage is a much better system than a Panhard rod, but when you've got 5 bushes there's a lot of lost motion. What you want to do is minimise the amount of rear end walk relative to the body.

And how would you apply that same budget to a Nissan 200SX?

On a Nissan 200SX, one of the first things to do are rear camber bushes - the upper control arm bushes. This will help if you want to lower it and to control the rear end. Also front and rear bars - on a 200SX, it pays to have a more balanced approach than, say, a heavier Commodore. The front radius rod castor bushes are also a no-brainer like in the Commodore.

In the rear, though, there are so many bushes. You've got the whole rear sub-frame mounted on these big hydraulic isolation bushes. This is also common to the R32-34 Skyline series, ZXs and SXs. The whole cradle gets a big shimmy-shimmy, it goes this way and that way and it pitches fore and aft.

We've also noticed the front right sub-frame mount degrades due to engine torque and load. These are replaceable but it's a big job. We can cheat, though, and use a sub-frame lock. Apart from the benefit of ruling out the movement of the bush, we can also incline the sub-frame slightly to give it squat. This can make it a drift car or a drag car or whatever.

Of course, reducing the compliance of these bushes will affect NVH. There's also less marshmallow, which mean you have to be more diligent. Compared to a worn standard car, though, it'll probably be more predictable. The benefit is faster out - but you should also get faster in. So long as you get the angles right and the amount of roll right, you should be able to pick up entry speed.

And what should come next with a bigger budget?

The usual story - shocks and springs. But, as I said, major lowering on any of those Nissans is a major no-no. The rear wheels will work through a very ugly range. You can lower them about 40mm, but you need to spend money on the rear bushes and putting camber kits in. If you've got an S14, I'd also suggest putting in an S15 diff - you'll notice a huge difference.

Certainly, this lot of mods will make a dramatically different car.

Wrapping It Up...

Speaking in general, what are some of the best handling standard cars you've come across?

The S15 200SX - thanks to the diff. The exit speed is where it makes up so much time.

A Mazda MX-5 is also great - they'll handle another 30kW without problem. They're so good they'll consistently lap a track about as fast as cars with twice their power. There's no standout weakness in the suspension of an MX-5 - especially with the later ones, where they've increased chassis stiffness and a whole lot of other stuff. They're brilliant.

Finally, what do you see as the areas where there will be a lot of development in the future?

Well, I think the Evo Lancers have demonstrated the benefit of smart diffs.

If anyone were serious about racing something like a WRX or Lancer we would say you've got to do the driveline. Of course, it's nothing to do with the suspension, but if handling is the outcome it's a very important point. Just take a look at the S15 200SX. Nissan has probably made a thousand changes between the S14 and S15, but the biggest difference comes from the diff characteristics. The S15 is much more responsive and has higher exit speeds.

Yes, I think anti-yaw control and smart diffs are it. Also, the use of dynamic suspension will become more common - in addition to reverse ABS technology, like traction control and stability control.

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