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Suspension Intervention

The path one man took to make his constant all-wheel-drive Nissan GTi-R handle like a car possessed. And you might be surprised to learn about the problems he encountered along the way...

By Michael Knowling.
Photos by Julian Edgar and Michael Knowling

Andrew Moyle purchased this Nissan N14 Pulsar (Sunny) GTi-R about two years ago expecting it to be the awesome handling all-wheel-drive monster it's cracked it up to be. Having stepped up from a modified front wheel drive N13 Pulsar he was familiar with the handling traits of these smaller high-powered Nissans. But it wasn't until he took his new GTi-R for a fast drive along Victoria's Great Ocean Road that he realised that the GTi-R was a terminal understeerer - certainly more so than the rival Subaru WRX.

To remedy the situation, the suspension system immediately entered the first stage of its development. The aim was to make the GTi-R handle similarly to the racing kart Andrew regularly pilots - so the standard was set pretty high...

Phase One of Development

Out of the box, the Nissan Pulsar GTi-R sports MacPherson strut suspension all round with a 22mm front and 16mm rear swaybar. When Andrew bought the car it was standard. Accordingly, Andrew had the standard struts fitted with what were later discovered to be only 175 lb/inch linear rate springs at the front combined with 150 lb/inch variable rate rears. At the time, they were simply labelled as sports springs so he didn't know they were so light. Inserted into the strut centres were high quality adjustable Koni dampers, that Andrew says are "wound all the way up" to maintain maximum stiffness and spring control. At the rear, an aftermarket 18mm swaybar was also fitted to aid in reducing understeer.

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The stock 15-inch rims and tyres were discarded in favour for a set of hot-looking Viper A2 17x7s wearing Kelly Charger 215/40 rubbers. This particular choice of tyre was necessary because of financial limitations at the time, and their treadwear rating of 320 really is too high for this application. But Andrew plans to replace these with stickier tyres once the car is absolutely perfectly set up - if they ever wear out, that is! Interestingly, the front to rear tyre pressure balance is massively biased to the front. Around 44 psi goes into the front tyres while 30 psi goes into the rears - that's nearly 50% more at the rear. The aim of this is to further encourage the rear end to move slightly laterally through corners (reducing understeer).

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To ensure the suspension - not the body shell - is doing all the movement, GAB front and rear strut braces tie the strut towers together for maximum body rigidity.

To attain the amount of camber that was desired all round, an aftermarket camber kit was purchased for the front and rear. This gave around 3 degrees of negative camber at the front and 1 degree at the rear when measured on the workshop floor - however, it was soon discovered that things changed dramatically once the car hit the road...

Big Problems

Fitted with these goodies, you'd expect an all-wheel-drive GTi-R to handle very capably - and so did Andrew. Unfortunately, the upgrade proved disastrous. Turn-in was fine while driving at low speeds, but as soon as Andrew attempted to throw it through a corner at high-speed it really became dangerous. The front end would seem to suddenly reach a transitional point where it would launch into full "plough" understeer. We're talking major understeer here, and Andrew can recall having to wind on more and more steering lock and keep adjusting the throttle input just to keep it on the bitumen!

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The problem was also causing massive wear on the outside shoulder of the tyres, as you can see.

Phase Two of Development

Looking around the car's suspension system, two other areas looked to be a little under-developed. These were the other wheel alignment angles and the bushes. So the factory fitted rubber bushes came out (looking suspiciously like they had never been replaced), and were upgraded to firmer Nolathane items.

Every rubber part that ever existed underneath was replaced, in order to eliminate the factory squish.

A high-performance wheel alignment set the front wheel toe to zero, and the rear to 3mm toe-out (this also promotes rear end movement). Castor remained at the factory setting, which is 1.2 degrees.

But back out on the road the problem was just as chronic as before. So the car then entered stage three...

Stage Three of Development

The standard strut units were next modified to full adjustable platform specifications. It wasn't until the sports front springs were bench tested that it was realised they were only 150 lb/inch rated. To beef things up significantly, Pedders in Adelaide put heavy-duty 400 lb/inch linear rate King springs in at the front along with 150 lb/inch variable rate rears. This bias to the front might seem a little excessive, but Andrew says that's a similar spec to what Nizmo ran on their GTi-R tarmac rally cars, and the majority of the car's weight is up forward anyhow. The car now sits around 2-3 centimetres lower than stock.

Turn in was further improved and understeer reduced by replacing the previous 18mm diameter rear swaybar with a solid KMAC part that measures 22mm. That means there are now 22mm swaybars fitted to the front and rear.

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After all this, the results once again proved just as bad! It wasn't until one afternoon Andrew got wind of the situation. He measured up the alignment angles at home, went for a fast drive until the problem reared its head and then returned home to re-measure the settings. Low and behold, the alignment had changed. Not just slightly, the front toe had changed by a total of around 2 centimeters! Andrew then suspected the cause of the problem ware the aftermarket camber pins, and he was quickly back inside his house booking them in for removal.

Bastard Problem Solved

As the GTi-Rs camber bolts were being pulled out, the answer to the massive understeering problem suddenly smacked everyone watching in the face. Comparing the aftermarket top through-bolt to the factory through-bolt, it appeared the "high-performance" part was about half as thick!

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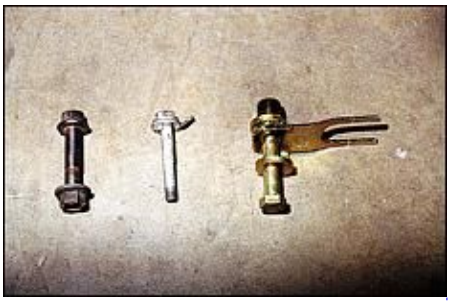
These weak top bolts must have been flexing as soon as there was any real cornering load applied on the front wheels, thus causing the varying alignment angles.

A pair of quality K-MAC camber kits was subsequently purchased (part number 120116), and their packaging label confirmed Andrew's suspicions of the previous kit. They read "Safest to fit, no weakened crank bolts used, aircraft bolts used..." It certainly seems K-MAC had also become aware of some of the other low-quality aftermarket kits on the market!

When flanked by the standard Nissan and K-MAC bolts, the small diameter of the Brand X item was plainly obvious. The probable reason the bolt diameter was so small, was to give the necessary adjustment in the top bolt hole, without needing to enlarge it with a drill. But not only was it much leaner, it also appeared to be manufactured from significantly lower grade material.



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So out came the defective parts and in went the new K-MAC items. Bill Keen at ATS was entrusted with the task, and we went along to get some step-by-step photos of the event:

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Firstly, the car was jacked off the ground.

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With the wheels removed, the culprit camber bolts were removed from each corner using spanners. As they were being slipped out of their hole, the aftermarket bolt had a large amount of clearance between itself and the inside of the hole. A sure sign the bolt was too flimsy for the job.

The standard lower hub bracket bolt was retained as no modification was required in this area.

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To fit the K-MAC camber kit, the top hole of the hub bracket was enlarged by a few millimetres using an electric drill. Bill of ATS made the point that when doing this, it is a good idea to lay out newspaper underneath to protect ABS sensors and driveshaft boots from the filings. The rough edges of the hole were then cleaned up.

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Before the new K-MAC camber kit could be fitted, the small extension pieces located on the mounting plate had to be cut off to give enough clearance for the driveshaft boot below.

The reason these extensions are there in the first place is because this K-MAC part number suits other types of cars as well. Installation of the new kit was simple and took only about five to ten minutes for each corner.

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