



### Rex On Rails - Part Five

Installing and testing the fourth (and final) component of Whiteline's Handling Pack - an adjustable rear camber kit...

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Here we are at the fifth - and final - article in our series on improving the handling of a GC8-series Subaru WRX. So far we've fitted a 22mm adjustable rear swaybar, anti-lift kit, 22mm front swaybar and we've also played around finding the optimal tyre pressures and wheel alignment (within the adjustment of the factory suspension hardware). We have to say these mods have absolutely **transformed** the car's handling; we're not talking about barely noticeable subtleties here.

But we haven't quite finished yet. The final component supplied in the Whiteline Handling Pack is an adjustable rear camber kit (which, if you're interested, sells separately for around \$80 and is part number KCA414). The camber kit comprises a replacement pair of eccentric strut bolts with washers and lock nuts; these bolts serve to fasten the top of the wheel hub to the strut body and provide the all-important camber adjustment that's absent in the factory arrangement.

As seen in this photo, the Whiteline camber bolts (on the right) incorporate an eccentric lobe near one end. When the kit is fitted and the bolt head is turned, this lobe pivots the top of the wheel hub inward or outward in relation to the strut - this creates increased negative or positive camber.

So why would you want an adjustable rear camber kit, you ask? Well, as we mentioned in earlier instalments of this series, adding negative camber serves to increase grip during cornering.

This might seem like an unusual mod to the rear of a WRX - which we generally try to make 'active' at the rear - but the primary intention is to allow you to adjust the rear swaybar to its firmest setting. You see - without the camber kit and the rear 'bar set at its firmest - the rear-end can snap oversteer when you back off the throttle suddenly. Adding rear negative camber lessens this tendency and makes the car more forgiving to drive.

So let's fit the new camber bolts, adjust it to suit and hit the road...

## Fitting the Whiteline Camber Kit

Foremost, the adjustable rear camber kit can be *fitted* at home, but it must be *adjusted* on a wheel alignment rig immediately after. Fitment of the kit should take less than an hour - assuming you have tools giving enough leverage - but a professional wheel alignment must follow. Given the short time needed to fit the kit, you may decide to give your wheel aligner the task of fitment as well as adjustment - the extra cost should be fairly minor.

For those that prefer to install the parts themselves, though...

The first step is to loosen the wheel nuts on one of the rear wheels, jack that side of the vehicle and place it securely on chassis stands. Continue to undo the wheel nuts and remove the wheel from the vehicle.

Now grab a pair of 19mm spanners and remove the top strut flange bolt and nut. Note that these are very tight and you'll require a decent length breaker bar to 'crack' them. Don't underestimate the tightness of these bolts; you won't get them undone without some serious tools.

With the original top strut bolt removed we can now slot the new Whiteline camber bolt into position. Note that, unlike many other aftermarket camber kits, there is no drilling required at any stage.

Insert the new camber bolt making sure it's oriented the same way as the original (ie the head of the bolt should face the front of the vehicle). Furthermore, note that the washer sandwiched between the bolt head and the strut flange requires specific alignment; the small inner tab on the washer must align with the bolt lobe as you push it through. This will enable the washer and bolt head to fasten flush against the strut flange.

As mentioned, the adjustable camber kit has the facility to increase either negative or positive camber. In order to

increase negative camber, you must aim the large outer tab on the washer inward (toward the centre of the vehicle). Aim the large tab outward (away from the centre of the vehicle) should you want to add positive camber.

Once the new camber adjustment bolt has been inserted through the strut and set in the appropriate position, fasten it with the new lock nut supplied in the kit. Assuming a wheel alignment will immediately follow, you needn't fully tighten the nut at this stage - tighten it only enough to get the car onto the alignment rig so that the person doing the adjustment won't have to struggle to loosen the nut from beneath the car.

Note that the lower strut flange bolt should also be cracked at this stage - loosening this bolt enables the hub to freely pivot. Again, loosen the lower strut flange bolt only enough so it's easier for the person doing the alignment to make adjustments from beneath the vehicle. Refit the wheel, lower the car to the ground and tighten the wheel nuts.

Repeat the process for the opposite rear wheel.

## Adjusting the Camber Kit

As mentioned the camber kit must be adjusted on a wheel alignment rig. Once we'd fitted our kit, we immediately drove the car a short distance to the nearest wheel aligner.

So how much camber should we ask to have dialled in?

Well, as mentioned in Part One, our preference is for the Touring alignment as suggested by Whiteline; these particular settings improve handling without sacrificing too much tyre life or making daily driven vehicles (such as our WRX) nervous to drive. The Touring specifications suggest 0.75 degrees negative rear camber, while the more extreme Sports and Racing specs call for 1 - 1.25 and 1.5 - 2.5 degrees respectively.

As it turns out, the 0.75 degrees negative rear camber setting suggested in the Touring spec was not to be realised. Curiously, our car's *standard* right rear negative camber was already greater than 0.75 degrees - it was 1.2 degrees to be exact. Hmm. Certainly, we could have reversed the right rear wheel's washer tab in order to reduce the camber angle, but - given there was barely any wear on the inner shoulder of that particular tyre with the existing alignment - we thought that'd be an overall step backward. Jim Gurief from Whiteline also suggested they've seen over 27,000 kilometres from a relatively soft set of tyres on street/circuit WRX that ran Sport alignment settings, so we were prepared to have a go with a more aggressive rear camber setting.

With a baseline negative camber of 1.2 degrees on the right rear wheel, we adjusted the left rear wheel to an identical angle. Our finalised rear camber setting for each of the rear wheels, therefore, was 0.45 degrees greater than the Whiteline Touring spec, but within the range of the Sport spec.

Note that - once the desired camber angle has been set on the alignment rig - the new camber kit lock nut must be fastened to 105Nm.

Another important point is that adjusting camber will simultaneously affect toe angle; our existing 1mm toe-out setting for each rear wheel increased to nearly 3mm toe-out per side once the camber kit was adjusted! A quick adjustment of the rear lateral link brought this back to our original setting.

## On-Road Results

With the camber kit fitted there was more rear-end grip during cornering. Actually, there wasn't any perceptible difference on left hand corners since our right (outside) rear camber angle was already 1.2 degrees to begin with; through right hand corners, however, there was a noticeable difference. An obvious indicator of improved rear-end grip was the car became more difficult to make oversteer.

Note that, although the Whiteline camber bolts are thinner than the originals (as seen here), we have no reason to suspect the bolts are flexing and causing altered mid-corner camber; nothing feels amiss.

### Time to Adjust Tyre Pressures?

In Part One of this series we found that our WRX's best handling came using disproportionately low rear tyre pressures - 37 psi at the front and 32 psi at the rear. These pressures have since provided good handling throughout all previous stages of our suspension upgrade.

With the fitment of the rear camber kit, however, it's only logical to now increase rear tyre pressures; low tyre pressures will only hinder the effect of the increased negative camber setting. As a result, we inflated the rear tyres

to 37 psi - like the fronts.

So what was the difference with higher rear tyre pressure? Well, grip was further enhanced though impact harshness was certainly increased as well. Theoretically, turn-in would also have been affected but we didn't notice any difference in this area.

So now - with increased rear grip through the twisties - we can adjust the rear swaybar to its firmest setting (the holes furthest from the ends of the 'bar). As mentioned, we'd previously found the firmest rear swaybar setting a tad too lift-off oversteer for our tastes.

With the swaybar adjusted, turn-in is sharpened and the approach to the apex is now more controlled; there's simply more of the same benefits we enjoyed when we first bolted on the new 'bar.

Our concerns associated with running the rear swaybar in its firmest setting are now completely answered thanks to the added rear-end grip. We tackled a large, dual lane roundabout at considerably pace (while there were no other cars in the area!) and kept backing off the throttle sharply to try spit the rear-end out; no matter how hard we tried, the rear-end simply refused to step out by any decent amount. At last - we could now tap into the benefits of maximum rear anti-roll without worrying about snap oversteer.

In any case, though, there's no longer any need to ease off the throttle (or apply the brakes) mid corner unless something unforeseen pops up in the middle of the road around the next bend - you don't have to keep modulating the throttle to quell understeer like is necessary in the standard car.

Note, though, the above comments apply only to *dry* road handling - things might be different on greasy, wet bitumen.

## The Wrap Up!

That's it folks - we've finished upgrading the handling of our GC8 Subie WRX! To demonstrate how effective the upgrade has been, we'll wrap up by briefly revisiting some of our comments on throughout they journey...

Comments from Part One of Rex on Rails (standard car); "if you go in too fast or are ham-fisted with the steering input, the car will plough understeer and you'll run wide of the corner apex... throttle and brake modulation is particularly useful in tight, relatively low-speed corners where the WRX tends to overload its outside front tyre and hunt for front-end grip... if you accelerate aggressively while the front wheels are still coping with lots of cornering forces you will encourage power understeer."

Comments from Rex on Rails Part One (after altering tyre pressures); "the increased front pressures improve turn-in sharpness and reduces the amount of understeer - particularly noticeable through tight roundabouts... there is **dramatically** less wear on the outside edge of the front tyres when the car is cornering hard."

And, next, when the wheel alignment was altered (within the limitations of the factory suspension hardware); "most noticeably, the increased negative front camber has improved front-end cornering grip after the early stage of turn-in... wear on the outside edges of the front tyres is also visibly reduced... at the opposite end - the rear - the adoption of toe-out has perhaps slightly improved turn-in but it has certainly created more lift-off oversteer, though not to a dangerous level... overall, though, our fiddling with tyre pressures and the alignment has yielded a bigger improvement than we'd thought possible."

Then - in Part Two of the series where we fitted the 22mm adjustable rear swaybar - we said; "the WRX is now much more obedient during its approach to the apex of a corner - you no longer have to combat understeer and more understeer. The front-end points much closer to the steered angle and the chassis remains more neutral - especially through tight corners that would otherwise have the Rex plough understeering."

In Part Three we installed a Whiteline ALK and concluded; "initial turn-in is noticeably sharper - especially when given a rapid steering input. After this initial turn-in response, the front tyres are then much more resistant to being overloaded. With greater front-end grip, you're able to pour on torque even when there's considerable steering angle applied; the upshot is faster corner exits."

We fitted a 22mm fixed front swaybar in Part Four of Rex on Rails and summarised; "the biggest improvement can be felt during the mid to late stages of a corner. Upon approach to the apex, the front-end now sits flatter and is much more wieldy and accurate. From thereon, the new front swaybar enables better power-out traction since the front tyres are more evenly loaded; you can now begin squeezing the accelerator pedal a little earlier than previously."

And, finally, we've added that the adjustable rear camber kit (with a Sport camber setting dialled in) and commented;

"our concerns associated with running the rear swaybar in its firmest setting are now completely answered thanks to the added rear-end grip. We tackled a large, dual lane roundabout at considerably pace (while there were no other cars in the area!) and kept backing off the throttle sharply to try spit the rear-end out; no matter how hard we tried, the rear-end simply refused to step out by any decent amount. We could now tap into the benefits of maximum rear anti-roll without concerns of snap oversteer."

The only downsides of the overall upgrade has been slightly more nervousness at cruise and marginally increased NVH (not so much through fitment of the low-compliance bushes of the ALK and swaybar D-brackets, but from our relatively high tyre pressures). Oh, and from time to time we also get the sensation there's greater unsprung mass beneath the vehicle - this would make sense given the front and rear swaybars are considerably heavier than the originals.

We expect *overall* tyre wear to be about the same as when the car was standard. With increased negative camber and toe-out, the inside shoulder of the tyres will wear faster in everyday driving conditions. On the other hand - thanks to the increased camber and front castor and the reduced body roll provided by the upgraded swaybars - we are seeing less wear on the outside shoulder of the tyres when being driven hard 'round corners.

We'll give you some longer-term info on tyre wear - as well as wet weather handling, bush noise and more - in an update a few months down the track.

Overall, the Handling Pack offers tremendous positives with barely any negatives - and the \$649 (including GST) retail of the kit makes it within reach of most WRX tinkerers. If you thought a \$1000-odd 3-inch exhaust makes a great bang-for-buck enhancement, you should try this; rarely can spending a few hundred dollars on vehicle modifications yield such massive improvements.

So what potential remains for further handling improvements, you ask?

Well, an aftermarket set of dampers - or complete strut units - remains one area where big gains can be found. These are not cheap but, in any case, the need to replace standard damper units increases as kilometres approach (and exceed) the 80,000 mark. Note that worn dampers not only limit outright handling, but - depending on how bad they are - can be dangerous in everyday driving situations.

With increased spring and damper rates the fitment of chassis bracing becomes increasingly important. Front and rear strut braces and sub-frame braces all serve to help maintain static alignment angles during hard cornering. The greater the cornering forces your WRX generates the more effective chassis braces are.

Depending on your application and choice of tyres, you may also decide to step up to even stiffer front and/or rear swaybars. Note, however, the 22mm front and 22mm adjustable rear swaybars are generally ample for street/circuit use.

Interestingly, though, there are a couple of durability issues that should be addressed when using massive swaybar rates - the plastic front and rear swaybar end links can snap and the rear swaybar mounts have also been known to break. Whiteline sells heavy-duty rear swaybar mounts (which we've already fitted in Part Two) as well as heavy-duty swaybar links that, in addition to increasing durability, provide faster swaybar response during transients.

Although separate from suspension and handling hardware it is important to choose the appropriate tyres and, to a lesser extent, rims...

Street legal semi-slicks are simply dynamite for streetcars driven in a predominantly dry environment - they offer unbelievable amounts of accelerative, braking and handling grip. More practical (and safer overall), however, are mainstream high performance road tyres such as Yokohama A539s and others; these offer good dry and wet weather grip plus decent life.

When it comes to rims the general rule is bigger is better. Large diameter rims necessitate low profile tyres in order to maintain the correct rolling diameter and - again, as a rule - low profile tyres equate to reduced sidewall deflection; this improves handling and steering response.

The widest possible rims are also preferable because there's further reduced tyre squirm through corners.

When all of these changes have been made, the next step for a WRX should be to explore different front, centre and rear diffs. These can make a tremendous difference to handling - just ask the WRC teams!

**Footnote** - The Whiteline rear camber kit was supplied to AutoSpeed for this test at no cost.

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