



THE
ENGINE
ROOM

CAR CLINIC

XE POWERED MINI

LEE BUTCHER'S BUILT A POWERFUL AND BEAUTIFUL LOOKING XE-POWERED MINI. BUT WHY DOES IT DRIVE SO BADLY? TROY ROBINSON ATTEMPTS TO FIND OUT



CAR CLINIC

In Car Clinic we take a PPC reader's modified car and assess it in the workshop and on the track to see how it could be improved. Want to see your car here? E-mail kev@ppcmag.co.uk

→ This year is the 50th anniversary of the all conquering Mini and there have been all sorts of events going on around the country to celebrate this British world beater. So when Lee Butcher contacted PPC to see if we would like to put his Mini through the Clinic it seemed rude not to say yes.

Love it or hate it you can't argue that the Mini wasn't cutting edge when it was conceived by Alec Issigonis. Could he possibly have foreseen that his design would be capable of beating much bigger opposition both in racing and rallying and would be so heavily modified over the years and still have a massive following 50 years on?

Enthusiastic owners have been tuning the A-series engine for years with some amazing results but the cheap and readily available power that came with Vauxhall's bread and butter XE engine meant that it was only a matter of time before someone stuffed one in the front of a Mini. We know Lee's not the first person to do this but he has tackled the majority of the fabrication work from scratch so it was definitely worth a look.

Lee's owned his Mini since 2006 and like so many cars it was bought as the basis for a simple restoration and modification project into which he planned to fit a Metro Turbo unit. Unfortunately the shell turned out to need lots of metalwork due to the voracious British tin worm. And most insurance companies seemed to suffer sudden communications failure after hearing the words Mini, Turbo, and 19-year-old.

As Lee was going to have to do a lot of metalwork and the insurance wasn't going to be cheap he decided on the XE route. Lee's a fabricator by trade and a mate had a very cheap Vauxhall lump for sale so mating the two seemed a perfect solution.

CHASSIS

To save money Lee decided to make his own front subframe. By leaving the original suspension towers in place he was able to use the existing subframe as a template to ensure the front suspension pick up points remained in the right place. He then cut away the unwanted portions of the original sub frame leaving his own fabricated frame in place. This was then further braced and strengthened and all the engine mounts added.

By converting the front end to the square Clubman shape and doing away with the original inner wings the engine bay has a surprising amount of space.

The back of the Mini hasn't escaped Lee's angle grinder either and the standard subframe's gone in favour of a homemade item to save weight. While he was at it Lee decided to make the inner mounts adjustable to give some scope for optimising camber and toe settings. The dampers and springs have also been changed from the original rubber cone type to a more flexible coil-overs using Gaz adjustable dampers.

One of the problems Lee's encountered since getting the car on the road was a severe lack of grip and serious torque steer. We're not talking the usual powerful

front driver type torque steer, we mean 'drive straight to the scene of the accident' torque steer so Lee and I were both keen to get the car on the alignment gear to try and get to the bottom of the problem.

Without driver the car weighed in at an impressive 677kg which is on a par with a Caterham or Westfield so all Lee's work with the cutting disc has certainly paid off. With Lee on board another look at the individual weights began to unravel part of the cause of the lack of grip.

The left front was 220kg right front 272kg left rear 130kg and right rear 127kg. This gave a cross weight of

46% with the LF and RR diagonal being the lightest. The problem here is that the left front wheel has 52 kilos less weight than the right front and as a result will always break traction first, even when accelerating in a straight line.

We decided the jack some weight onto the left front by raising and lowering the opposing spring platforms to even out the weight distribution. This eventually reduced the discrepancy across the front axle to 7.5 kilos but it did increase the rear axle discrepancy to 30 kilos, the cross weight however was now balanced at 50%.

Most cars require a compromise to some degree, and it's almost impossible to get the weight distribution spot on in a saloon or sports car without careful placing of movable components to offset the driver's weight. Here it was better to compromise across the rear axle than the front especially with a lot of power on tap.

The front of the car also sits up very high and gives the car a nose up stance. In the future it would be beneficial to replace the front damper units to allow the car to sit lower at the front without running out of bump travel or adjustment on the spring platforms.

After the scales it was on with the alignment gear to see where the wheels were pointing. Considering the scope to get it wrong Lee has done a pretty fair job with just a tape measure and eyeball. The right rear camber was out of spec as it was showing 18 minutes of positive camber and it also had a zero toe figure. I had hoped to use Lee's adjustable inner mounts to correct this but they were already on the maximum adjustment that the slotted holes would allow so these will need to be further modified before the rear alignment can be corrected. At the front the right wheel also had positive

camber but this was easily corrected with the adjustable lower arms fitted to the car.

We also made some small tweaks were to the castor and toe to try and improve the car's behaviour.

ON THE DYNO

There is not a lot that hasn't already been written about the Vauxhall XE engine or red top as it's often called. Basically it's a gem of an engine with a strong bottom end and a cracking 16v head originally designed by Cosworth. We've run hundreds of them on the rollers over the years and in standard trim they would always give the book figure of 150bhp and on a no expense spared build will push on towards the 300bhp mark in normally aspirated trim.

Lee's engine though was just as Vauxhall intended and even came complete with its original injection, loom and ECU. Lee considered running the engine in this spec but a set of R1 bike carbs came along at a very reasonable £85 and together with the inlet manifold the whole intake system cost less than £300. The first power run showed a slightly disappointing 140bhp and 130 ft/lbs of torque, and the fuelling was very rich. The filter socks crammed tightly over the end of the bike carbs looked like the likely culprit and they were quickly removed and another run carried out. This time the power figures were similar but the fuelling was now way too lean which illustrates just how sensitive bike carbs are to minor changes in airflow. After a bit of fiddling with fuel jets and needle height we got a reasonable compromise on the fuelling which gave a final power figure of 155bhp@6750 rpm and 138ft/lbs of torque@5032.

The plots were now much smoother and the torque curve much flatter without the rapid drop off that was evident on the first runs. Although this is a bit low for an XE on carbs the engine was a bit tired when it was installed and was only intended to get the car up and running while something a bit fresher was prepared. Also minor things like the ports on the head being smaller than the inlet manifold and the heavily cut and shut standard exhaust manifold can easily rob a few horses here and there.



Socks on carbs were robbing power so we took them off.



Rear coil-overs instead of rubber.

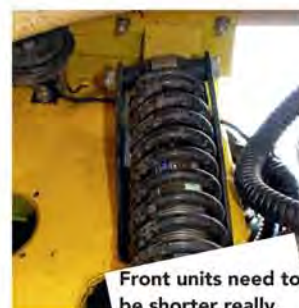


Front units need to be shorter really.



Vauxhall XE twin cam with Yamaha bike carburetors.

FINAL SET UP			
	-1.33 14 mins toe in	+ 18 mins 0 mins toe in	
FRONT	-1.45 14 mins toe in	-27 mins 18 mins toe in	



Shell built to very high standard.



Standard Vauxhall ignition coil.

ON THE ROAD

As we pulled away from the workshop Lee was nervously reminding me about the lack of grip and torque steer and I was reassuring him that the changes we had made to the set up and my extensive driving talent would render the beast harmless and docile. Ohhh how wrong could I be?

Even when pointing absolutely straight ahead anything more than a tentative prod on the accelerator resulted in instant wheel spin. Thank God the sun was shining. As the wheels broke traction the car would begin to randomly pull to whichever side had marginally more traction than the other. Cat's eye's road markings, freshly repaired tarmac, all wanted their say as to which direction the car should take. Trying the same level of acceleration through a bend was really not much fun at all as the unloaded inside wheel instantly lit up and the car began to understeer wide. Rather than gently tightening its line when easing off the gas car would instantly snatch in the opposite direction bringing us closer to the scenery than was really comfortable on a couple of occasions.

When there was traction the engine pulled strongly and with just 677kg to haul the car was definitely quick but I was sure we had missed something on the alignment that could give a clue as to the cars poor stability so we headed back to the workshop to have another look.

With the car back on the stands it dawned on me that the offset on the wheels looked very shallow and was almost certainly affecting the scrub radius of the car.

In the diagram you can see the line drawn through the top and bottom ball joints which extends down to a theoretical point where it meets the road, this is the

steering axis. If you now draw another line through the centre of the tyre and extend this downwards to the road surface you can calculate the distance between the two lines. If the lines meet at the road surface this would be zero scrub radius. If they intersect below the road surface this is positive scrub and above the road surface would indicate negative scrub.

This dimension can have a huge effect on steering feedback both while accelerating and braking. With large positive scrub, brake failure on one wheel or hitting a large pot hole can literally rip the wheel

from your hands as there's significant leverage exerted from the contact patch of the tyre on the steering axis. When the forces across the front wheels are in perfect balance then no steering feedback would be evident but that rarely happens in practice as the contact patch at each tyre is a dynamic thing that's constantly moving depending on the forces applied to the suspension as the car accelerates, brakes and corners.

The effect of scrub radius on handling is a subject in its own right but suffice to say that small scrub radius values reduce torque steer and adverse feedback.

Normally this dimension doesn't change unless you have drastically moved the pick up points on your suspension or have the wrong wheels fitted. So make sure to check the offset when fitting your latest Carlos Fandango super wide wheels; they may look good but could ruin the car's handling.

Lee has got some wheels with less offset that he's going to experiment with and hopefully this will cure most of the car's dodgy handling. Lee's brother is an automotive painter and is responsible for the immaculate paint job; it really would be a shame to have to repaint it!

