ANTI-ROLL BARS

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'ROLY-POLY MANTULA'

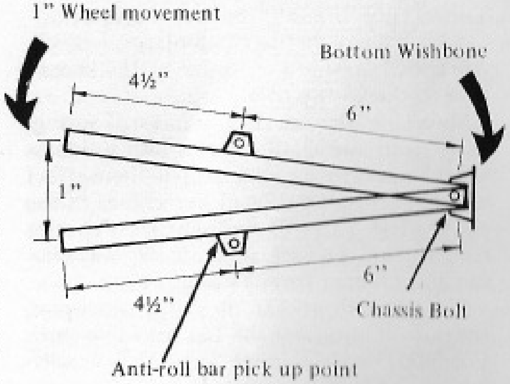
If you're the sort of person who hasn't discovered what that middle pedal's for yet - this is for you!! Anti-roll bars are what I'm talking about - front and rear. Whilst it's true to say that due to its light weight, low centre of gravity and strong spring rates, the Marcos needs them less than other, heavier, more lazily sprung sports cars; it is also true to say that the only vehicle that wouldn't benefit from the fitment of anti-roll bars either travels totally flush to the road surface or never goes round corners!

Anti-roll bars are a much underestimated commodity - they can exert three or four times the resistance of coil springs to roll in a corner and unlike coil springs, affect no other aspect of suspension function other than that for which they were designed.

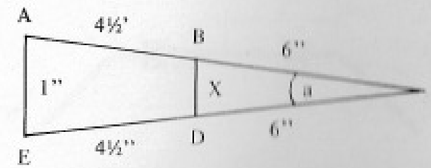
As anybody will tell you, when it comes to anti-roll bars and the like there is plenty of 'try it and see' involved - as the mounting mechanism, leverage, bushes used, and some would say conjunction of the planets can alter the effective stiffness to a considerable degree!!

The first thing to do is to calculate the movement at the anti-roll bar mounting point for a unit movement at the wheel. Call me old fashioned (people do you know!) but I prefer to work in inches - so my 'unit movement' was chosen as one inch.

I decided to adopt the standard Triumph geometry at the front as this fits the car extremely well, simplifies installation and most importantly gives me a choice of four different thicknesses of bar that can be interchanged without much trouble. The standard geometry provides the following results:-



BECOMES



For Δ ACE

$$\cos a = \frac{10\tfrac{1}{2}^2 + 10\tfrac{1}{2}^2 - 1^2}{2 \times 10\tfrac{1}{2} \times 10\tfrac{1}{2}}$$

a = 5.46° for 1 inch wheel movement

For Δ BCD

$$\frac{X}{\sin 5.46} = \frac{6}{\sin 87.27}$$

X = 0.57" for 1 inch wheel movement

To the best of my knowledge, there are four different thicknesses of anti-roll bars available to fit the standard Triumph geometry:-

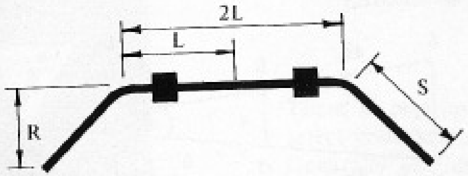
Source	Part No.	Fitted To
Aust/Rover	207093	Herald/Vittese/Spitfire I,II,III & GT6 I, II, III.
Aust/Rover	Not/Kn	Spitfire IV (1500) & GT6 III from KE2001
Aust/Rover	217033	Late model Spitfire IV (1500) from KE20000
Trium/Tune	TT3485	Imported from America of all places.

All above arranged in order of thickness - thin to thick - top to bottom.

Since the Marcos already has stiff springs (my front are 250lbs), the anti-roll bars would need to be very still if their effect was to form a significant percentage of the car's total anti-roll equipment. For this reason, the thickest anti-roll bar was chosen and ordered from Triumph Tune.

With the front bar now decided upon, the information can be fed into Pilbeam's Formula for calculating anti-roll bar stiffness:-

Pilbeam's Formula:-



T= Track (Ins)
D=Diameter of Bar (Ins)
L=Length of Torqued Bar (Ins)
S=Actual Arm Length (Ins)
Q=Stiffness in lb/ins per degree
R=Effective Arm Length (Ins)
K=Fractional Lever Arm Ratio

$$K = \frac{\text{Movement at Anti-Roll Bar Pick Up}}{\text{Movement at Wheel}}$$

$$Q = \frac{10^4 \times T^2 \times K^2 \times D^4}{R^2 \times L}$$

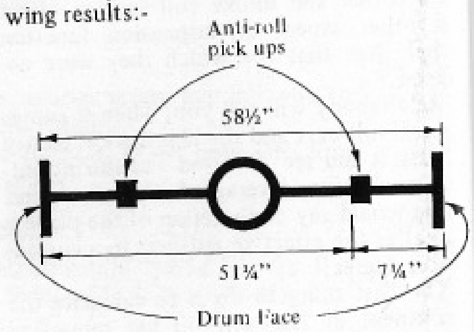
Applying Pilbeam's Formula to the standard Triumph geometry give the following results:-

T = 42.75"
K = 0.57"
D = 1"
R = 10"
L = 11.125"
S = 10 5/8"

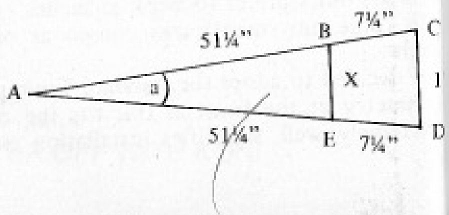
$$Q = \frac{10^4 \times 42.75^2 \times 0.57^2 \times 1^4}{10^2 \times 11.125}$$

$$\underline{Q = 5337 \text{ LB/INS Per Degree}}$$

All that now remains is to match the anti-roll bar stiffness at the rear with that at the front. Before this can be achieved, certain dimensions of the rear installation need to be decided upon. These are arrived at by studying the geography of that area of the car. An anti-roll bar fitted behind the rear axle would foul on the four leading arms. One fitted in front would have to have a linkage that would take account of the fact that the rear axle and anti-roll bar would be moving against each other as the suspension rises and falls. The solution I adopted can be seen from the photographs - I think it is the neatest, needs minimal bracketry and doesn't foul on anything (yet!). With the dimensions of the rear bar decided upon, we now need to calculate the movement at the rear anti-roll bar take-off point for a one inch movement at the wheel. My dimensions produced the following results:-



When one wheel moves 1" this becomes:-



For $\triangle$ ACD

$$\text{Cos a} = \frac{58½^2\ 58½^2 - 1^2}{2 \times 58½ \times 58½}$$

a = 0.9794° For 1" wheel movement

For $\triangle$ ABE

$$\frac{X}{\text{Sin } 0.9794} = \frac{51¼}{\text{Sin } 89.51}$$

$$\underline{X = 0.8761\text{" For 1" wheel movement}}$$

This information together with the dimensions decided upon earlier and the anti-roll stiffness calculated for the front can now be fed into Pilbeam's Formula again - to give us the thickness (diameter) of the rear bar:-

$$5337 = \frac{10^4 \times 58½^2 \times 0.8761^2 \times D^4}{5\ 7/8^2 \times 20¼}$$

$$\underline{D = 0.614\text{" Diameter}}$$

Choose a thinner bar to add understeer
Choose a thicker bar to add oversteer

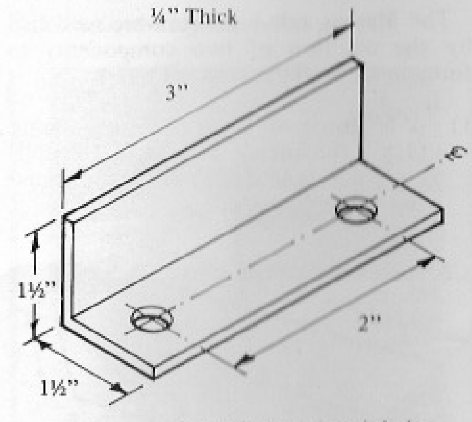
I don't like the idea of manufacturing my own anti-roll bar(s) - as the amount of heat applied is critical if softening of the bar or making it too brittle is to be avoided. I deliberately kept the dimensions of my rear anti–roll bar as simple as possible (just two ninety degree bends) so that if I had to have it made it wouldn't cost an arm and a leg. (I've already used up both arms and legs paying for the rest of the car!)

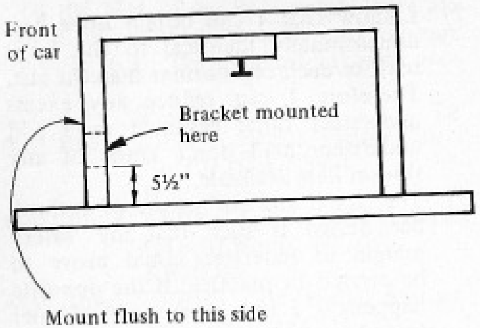
Before having a bar made up, I embarked on a search to see if there is a commercial bar available to meet my requirements. It is worth saying at this stage that I decided to build in understeer to the anti-roll equipment for the following reasons:-

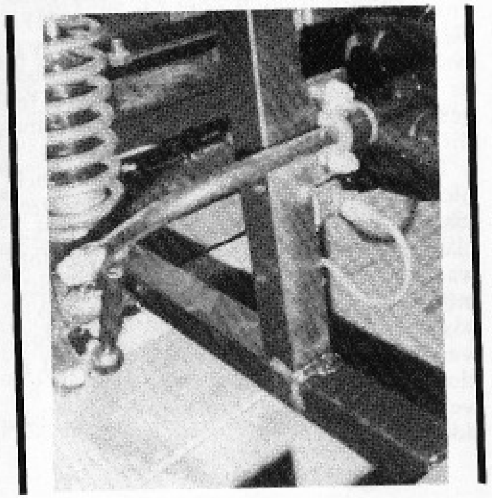
1) 265bhp even with the limited slip differential would unstick the rear rubber - understeer should help in 'power on' corners.
2) I know that I can obtain three bars dimensionally identical to the front bar but each one thinner than the last. Therefore I can reduce any excess understeer quite easily. I can't add understeer as I don't know of any thicker bars available.
3) The 'try it and see' nature of anti-roll bar design is such that my 'safety margin' of understeer could prove to be eroded in practice. If the opposite happens - I can always add thinner front bars again.

The bar that fitted almost perfectly came from (shh! don't let anyone hear you!) a Reliant Robin three-wheeler! (Obviously it was fitted to the back wheels on the Robin as well!) A new one was obtained - together with mounting clamps, rubbers and drop hangers.

Two brackets were made from ¼ inch ninety degree angle iron the hole centres matching those of the Reliant's mounting clamps. These were mounted to the forward uprights of the 'picture frame' chassis members through which the rear axle passes so that they are flush with the forward side of the uprights (the side that is close to the seat backs). These need to be welded in place and the welds on the flush side ground flat:-

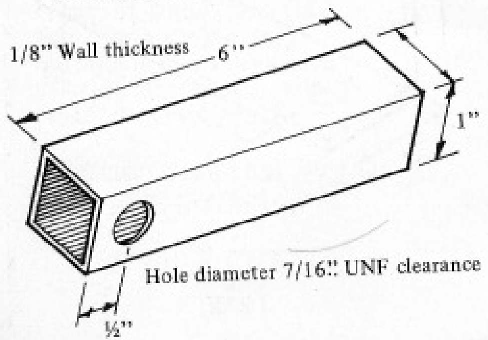




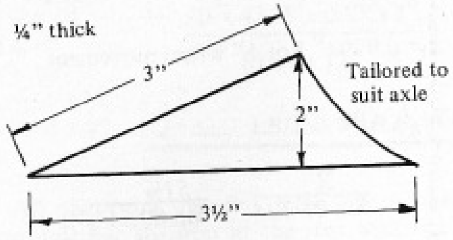


The Marcos axle brackets were modified by the addition of two components to form an anti-roll bar take off point:-

1) A 6" piece of 1" square steel tubing (1/8" thickness) with a 7/16"UNF clearance hole drilled ½" in from one end through one side:-

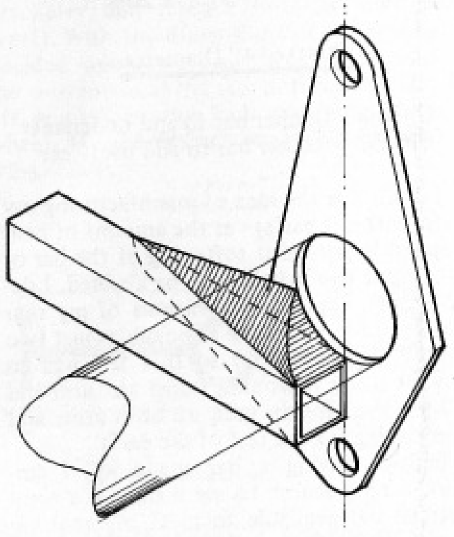


2) A gusset piece made from ¼" steel plate. (NB - these gusset pieces are handed and are NOT interchangeable):



Whilst the above drawing represents the final shape of my gussets, I suggest that you arrive at your shape by the following method:-

1) Weld tubing so that the drilled hole faces INWARDS, and so that the hole is at the non axle end. The axle end of the tubing should form as near a perfect tangent with the axle as is possible whilst the other end should pass over the point at the end of the Marcos brackets:-

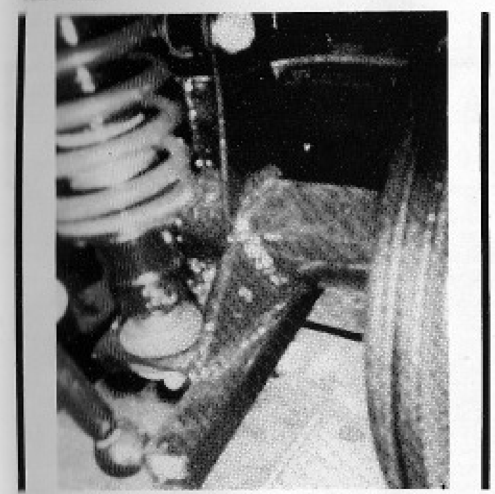


2) Whilst the assembly is still warm from the welding (NOT HOT), apply a generous coating of copper grease (the stuff you spread all over your brake mechanisms etc. - and the wife too if you're that way inclined!!)

3) Still with the assembly warm, fill the cavity that the gusset will eventually cover with body filler. The warmth of the surrounding metal means that the filler should take no time at all to set.
4) When set remove the filler. The copper grease should now prove what poor adhesion it offers to isopon filler and with a bit of care you should be able to get it all out in one piece.
5) Use the flat side of the filler (the side that faced outwards when it was still in the axle) as a template for your gusset piece.

All three sides of the gusset need to be tapered in order to accommodate the angle at which it must sit and it is these tapered edges that make the two gussets handed.

The finished axle bracket should look like this:-



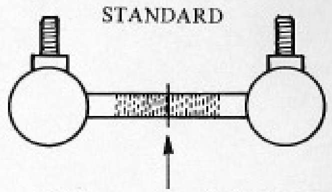
The drop hangers in standard form will not fit. These were sawn in half and a 3/8" UNF thread applied to each half (the shaft is in fact a fraction over 3/8" diameter, but a good stock and die will do the trick).

Two hexagonal section steel rods of 3" length were obtained and drilled in a centre lathe to accept a 3/8" UNF thread. These were tapped accordingly. Two locknuts were run up the (now threaded) halves of the drop hanger and both halves screwed into the hexagonal section bar. The ball joints were adjusted in-situ to obtain the correct angles, then the locknuts tightened.

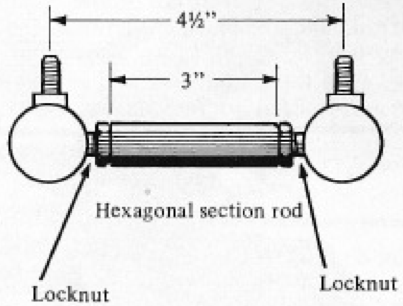
Apart from a neat finished product, this method is better than welding as there is no heat involved to burn out the rubber ball joints and to a small extent, the hangers are adjustable for length.

Drop hanger details:-

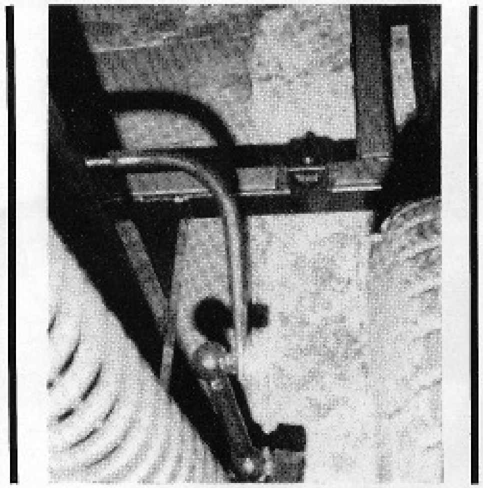
STANDARD



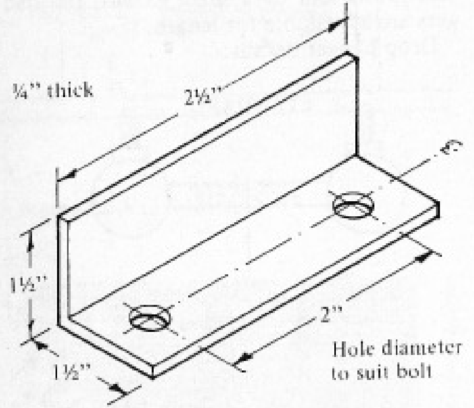
FINISHED



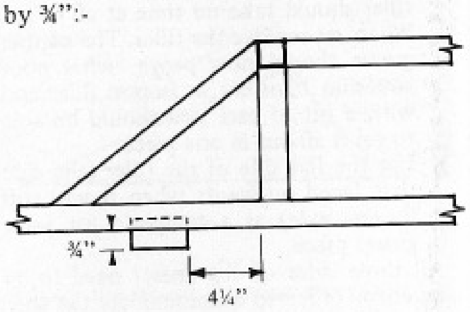
The finished drop hanger in place:-



The front installation is much simpler. Two brackets 2½" long were made up from the same angle iron as that used at the rear

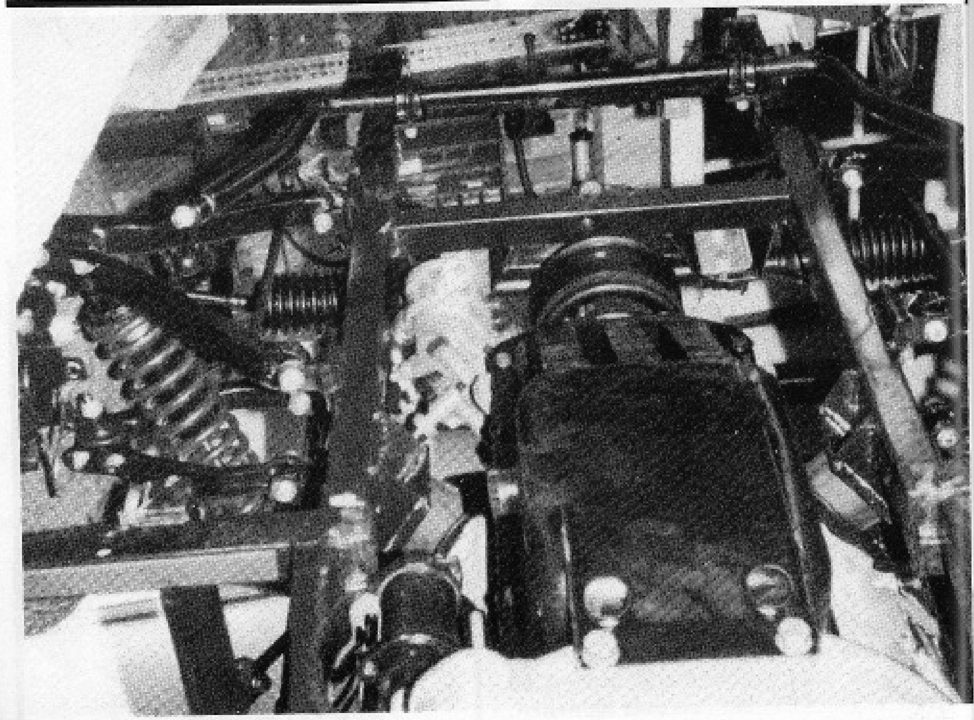


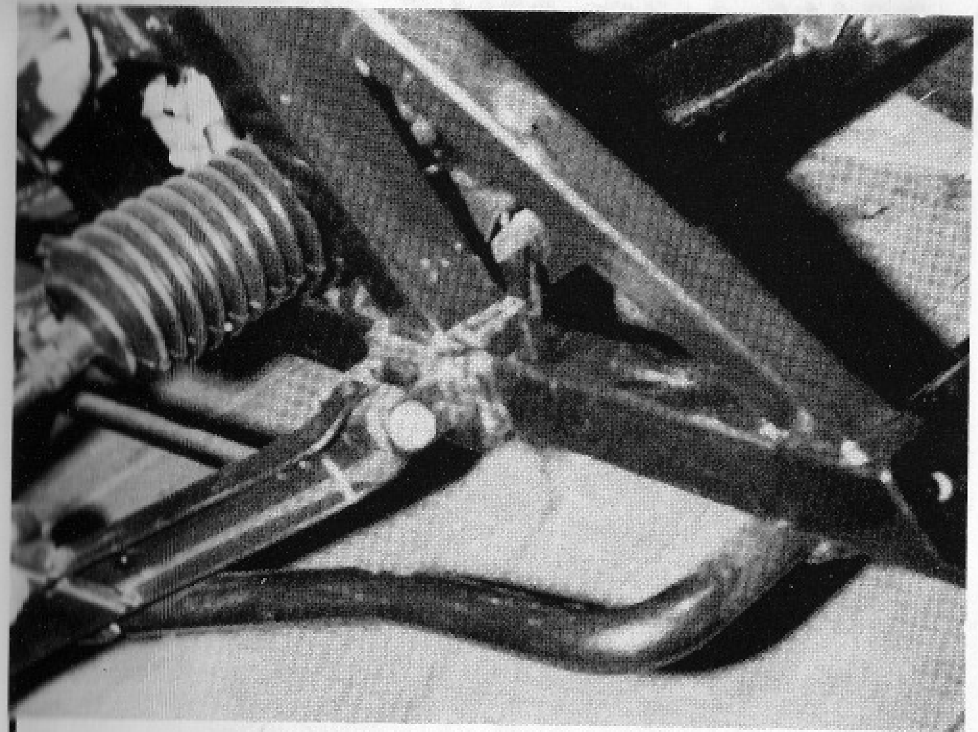
These were welded into position so that they were 4¼" in front of the foremost vertical upright on the Mantula chassis. They were not welded on flush as at the rear, as in this case this would have caused the anti-roll bar to foul on the underside of the lower wishbone when the suspension was on full compression. Instead, they were welded in place so that they hang below the afore mentioned chassis member by ¾":-



The anti-roll bar is connected to the front suspension by means of the standard bracket on the lower wishbone via the standard Triumph drop-links (part nos. 125481 & 125482 - they are handed).

A general view (from underneath) of the front anti-roll bar assembly in place :- Note also the sump modification.





A close up showing the front anti-roll bar mounting details

The car is a long way from being ready to take to the road yet (you know the feeling I'm sure!) - so I haven't been able to try the handling out yet. When I do, fine tuning will be possible by:-

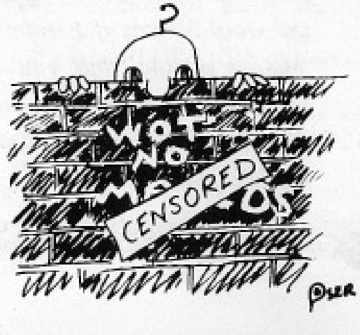
1) Swopping the front anti -roll bar for a variety of thinner ones.
2) Adjusting the length of the rear drop hangers.
3) Replacing the mounting rubbers with harder (less compliant) ones.
(Hard rubber increases effective stiffness by up to 15%; solid nylon by up to 25%).

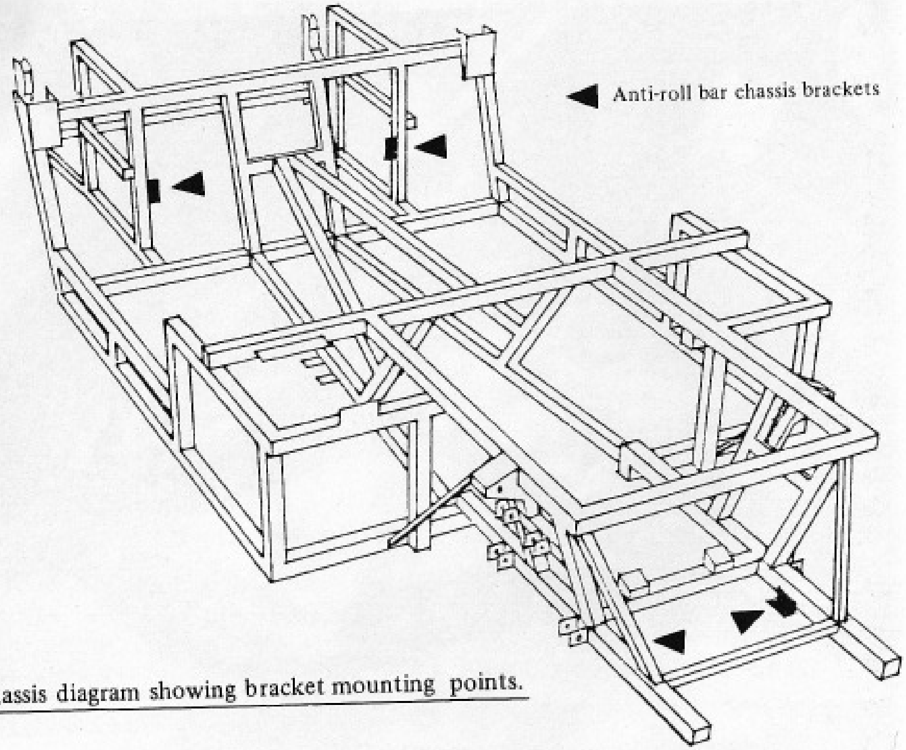
As the optimum settings are neared, a small adjustment produces a big difference in handling and vice-versa.

I'll let you know the results. In the meantime, if anyone is interested or just curious 'phone me on (062981) 2149 after 7.00pm

PLEASE NOTE

Please forgive the absence of the logo & name Marcos but ***Jem Marsh*** *has banned us from using them in any of our publications............*





Chassis diagram showing bracket mounting points.

ATTENTION CONTRIBUTORS

If you are writing anything for our magazine,please note that Jem Marsh has forbidden you to use the word Marcos.You can only use the word Marcos if it refers to a car. This means that you can't say 'Marcos rebuild', but you can say 'my Marcos rebuild';you mustn't say 'Marcos racing', but you can say 'racing a Marcos'. If in doubt, don't worry, as we will edit the article to conform to Mr Marsh's legal demands.

THE LIFE AND TIMES OF A MARC.S >>>>>>>> MANIAC <<<<<<<<

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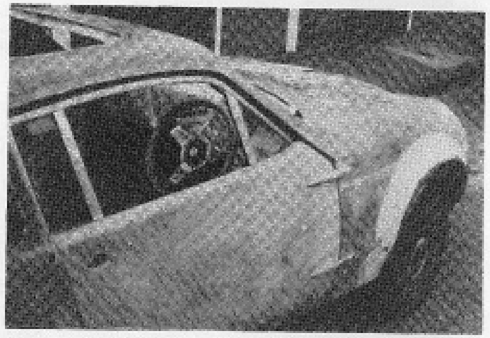

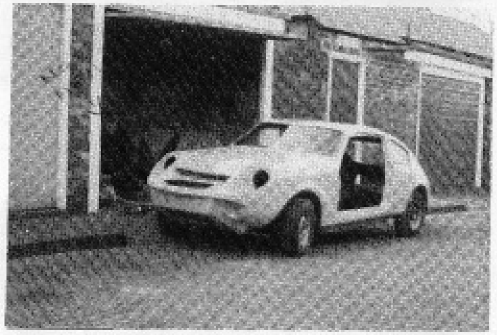

Bodywork before and after a lot of work

Dear Colin,

Maybe I should start with a bit of history behind LUP 310J, my Mk3 Mini Marcos. A friend of mine first bought the car back in 1983 with a jet black livery. Over the next few years it received a number of modifications, such as Fiat/Ferrari rear lights, a removable sunroof, more reliable electrics and so on.

Unfortunately, due to his occupation my friend had to buy a more practical car, therefore it was garaged.

When I purchased it in March '86 it had already been half stripped with a view to a complete rebuild. After obtaining an MOT, (first failure just on front bearings!) I partially rebuilt the mechanics and gave the car a couple of coats of Tanke Yellow paint.

As you can see in the photos the finished shell looked quite presentable. (Please note the 'stripped' photos were not taken at the same time!!)

After driving the Marcos for about six months the more 'common' problems with a Mini Marcos started. First of all the bonnet went west after a hundred mile an hour chase with a 911 Targa. And just when I was catching him... Then the door hinges fell apart and the door was deposited onto my girlfriends toes, highly embarrassing outside the Odeon, with the queue a mile long, all eyeing this little yellow go kart!!

Over the following months, various other bits failed or dropped off. Really after inspecting the parts and their positioning I would like to think the blame could lie with the original assembly. Never mind I had the opportunity to remedy this.

First of all the suspension was tackled. The cones had already been shortened, so spax adjustables replaced the existing units which were frankly at the end of their life.

After a couple of weeks my girlfriend was still receiving large lumps on her head after being bounced against the sunroof. After drilling the cones life was a bit more bearable. I'm still not satisfied with the ride, so a beam axle is in the making. I've still got to make the spacers, so the old cones will have to stay for the time being.

Next on the list was new wellies for each corner. The addition of 6x10 Mamba's shod with Admiral P7 treads have done nothing but extend LUP 310J's remarkable cornering powers.

I have heard much about wide tyres leading to aqua-planing in the rain, but apart from a couple of over-the-top spins on a local renowned roundabout, I personally think it is worth the transition as the response in the dry more than makes up for the diminitive lack of grip in the wet.