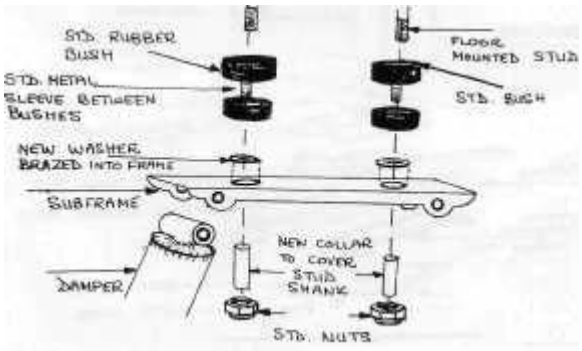
5.0 Rear Suspension

5.1. POSITIVE AXLE LOCATION

The first consideration when doing anything to the rear suspension is to stop unwanted movement, and get the axle travelling as much as possible in a straight up and down plane. Because of the way most live axles are located on production cars, the axle does, in fact, move in an arc.

5. 2. MODS FOR EARLY ESCORTS

To stop the axle moving from left to right on corners, a lot of the rubber must be thrown away. On Escorts with the rear cross-brace (ie 45 inclination) damper mounting, this means throwing out the rubber spacers between the damper mounts and floor pan. The brace then mounts directly onto the floor. A flat washer, filed to size, should then be brazed or welded into the cross member to provide positive location using the standard body welded bolts. A spacer must then be placed over the shank of the projecting bolt, between the cross brace and securing nut. This ensures the cross member is securely pressed against the body, and production damper travel is retained.

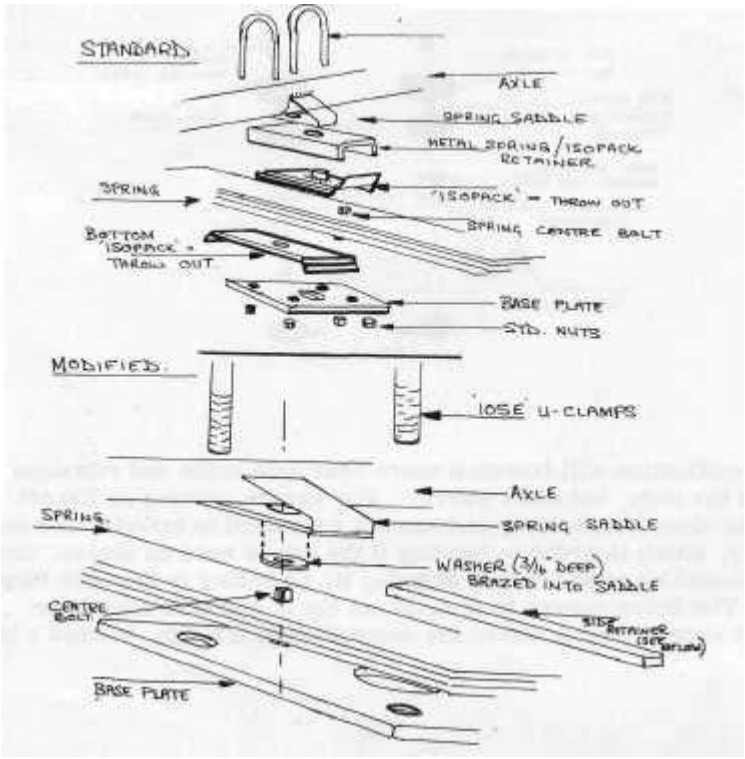


This modification will transmit more rear axle noise and vibration through the body, but don't worry. For anyone running an Escort with this older suspension, and has not converted to turrets, the cross member, which is prone to bending if the car is used on stages, can be strengthened by either double skinning it, or boxing in the open fourth side. The latter course is strictly not Gp 1, and still allows the weakest area, directly where the dampers bolt through, to bend a bit.

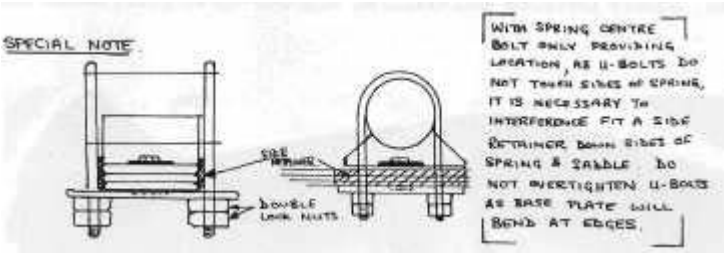
RS Parts did produce a kit, with a modified section of floor pan, to update this earlier set-up to Mk II spec of 15 degrees inclination but this is no longer available.

The next move, no matter what rear damper arrangement there is on your car, is to positively locate the axle on the spring and stop unwanted sideways axle movement. This lateral movement is inbuilt in the standard car for comfort and is caused by a rubber 'Isopack' block between axle and spring. This has to come out, and can be hurled in the nearest dustbin. To do this, undo the 'U' bolts on both sides, remove the actual 'U' clamps and jack up the axle a few inches. This will enable you to just lift out the 'Isopack' blocks. From the 'Isopack' shape you will see it incorporates a central, circular inbuilt metal protrusion, which locates in the axle saddle, and removal of the block means that the spring can move inside the oversize saddle hole.

To prevent this, a large 3/16" deep washer, (finis code 905 1310) with central hole large enough to accommodate the bolt on the spring top, should be brazed into the axle saddle. See sketch. The spring and axle can now be brought directly together. Because of the space vacated by the 'Isopack' the standard 'U' clamps will be too long, and should be replaced by 105E 'U' clamps and plates for retaining 'U' clamps. Don't attempt to increase the thread on the 'U' clamps, it's not worth the bother and can weaken them. Remember to cut off any unnecessary length on the 'U' clamps that projects down and can catch on rocks, etc, and bend the clamps. Some people fit a double nut here to ensure easy removal.



The end result of this exercise will be a positive gain in handling and an increase in rear ground clearance of approx 3/4".



5.3. AXLE RADIUS ARMS

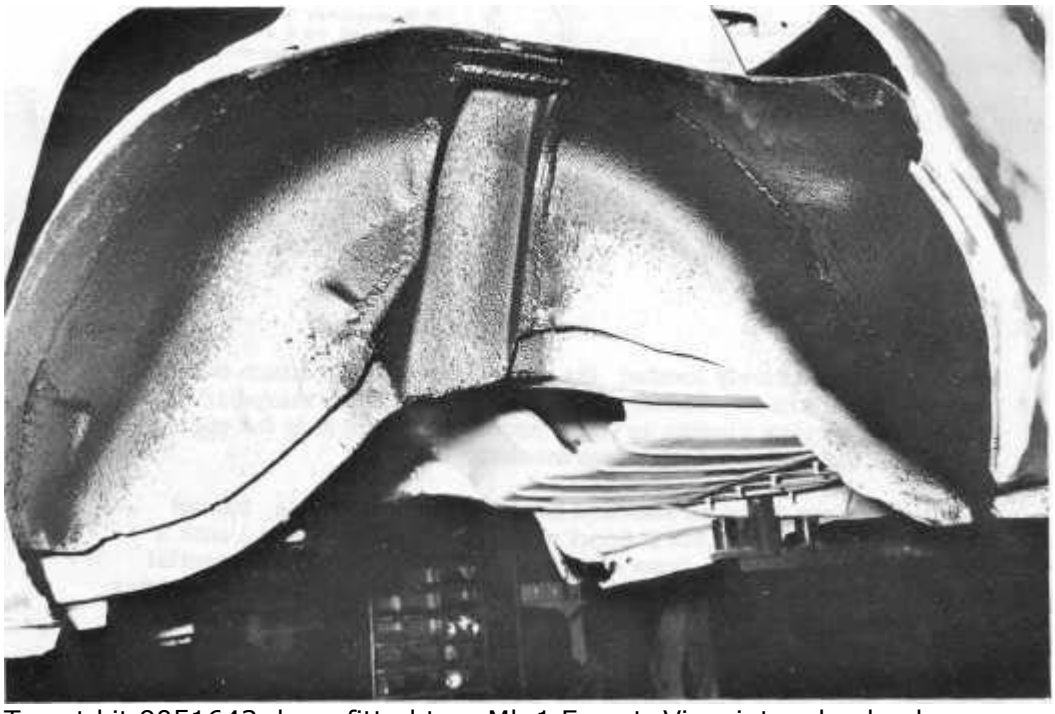
With the axle positively located, the next essential is to attach it to the body by radius arms. These - sometimes called anti-tramp bars -prevent the springs winding up under acceleration and help the springs just get on with being a suspension medium. Radius arms are fitted as standard to all RS Escort models, but not Mk I 1300GT, nor Mk I/Mk II Sport models. If going Group 1 with a Sport derivative, radius arms cannot be fitted, but would be essential for Gp 2 or 4. RS Parts market a radius arm kit (905 2143) comprising arms, body mounts, axle mounts, bushes and eye bolts. In the case of Post 11/73 Escorts (ie upright or pull ahead dampers as they are called), you will have to purchase some different radius arms (finis code 905 2566 RH, 905 2567 LH). For competition use it's worth fitting h/d bushes to the radius arms for more positive location - front 905 3167, rear 905 3168.

5. 4. TURRET KIT

To have the rear suspension working efficiently, the dampers really have to be mounted in an upright position.

The simple way out is to fit an AVO turret kit, available under finis code 905 1643. This gives a box section mounted vertically in the rear inner wing, with the damper passing through to its top mount. Fitting the actual turret is a precise job, and it's worth taking the car to an RS dealer or specialist; they have a special tool (jig no P5522) which mounts in the front spring eye on the body, and arcs up into the shell so that the cutting marks can be accurately scribed on the inner wing. This kit is designed for use with the AVO shockers finis code 905 1492, although accurate positioning of the axle bracket is essential to avoid bottoming of the dampers.

At Boreham a special turret derived from the standard Capri unit is used, which although giving near ultimate damping, is a more complex job. Again, Safety Devices and Gartrac are set-up to graft these on.



Turret kit 9051643, here fitted to a Mk 1 Escort. View into wheelarch.

5. 5. WORKS DAMPER POSITIONING

The RS Parts turret kit, when fitted to either Mk I or Mk II Escorts, with damper 905 3385, gives you a turret above and just behind the axle vertical line viewed from the side. This is an easy location, as only the inner wheel arch behind the bulkhead has to be cut, making fitting simpler. The damper is mounted in front of the axle, which gives the damper a rearward tilt at the top, when viewed from the side.

On the works cars, the damper is mounted directly on top of the axle, giving direct downward pressure, and keeping it out of the way of boulders thrown up from the front wheels. In doing this though, the turret must be exactly above the damper/axle mount in the standard ride height position, which means locating the turret in the bulkhead plane, as shown. The axle mount has to be very carefully fabricated, since the outer 'U' bolt must pass through its base, when located correctly.

As a half-way between the RS Parts and current works spec set-up, there was an additional complication when Boreham used two damper settings. Measured from the top seat to a line extending along the side rails, these were either 10½" or 12½", with the difference arrived at by a longer damper and welding in the turret at a different height.

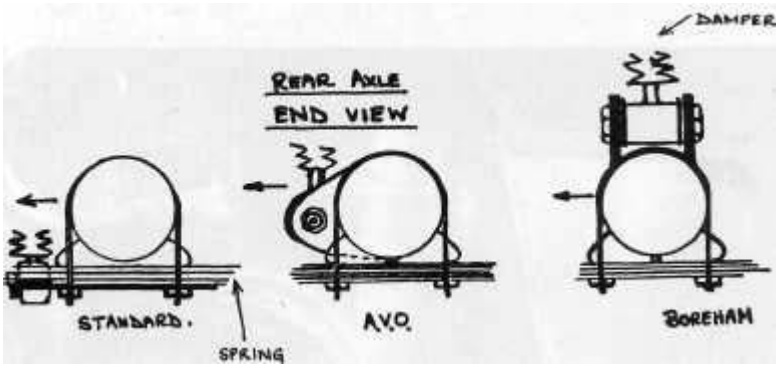
Works turret viewed from inside boot. Damper top nut access is from inside cockpit.

It's a good idea to use a 105E bump stop located as normal under the axle 'U' bolts. , If you cut about 3/4" off the domed top, which is quite soft, the remaining part will allow that extra bit of travel before the stop comes into action. Check, of course, that your dampers are not fully compressing before the rubber stop hits the chassis rail.

5.6. WORKS DAMPER TO AXLE MOUNTING

Boreham used to locate the bottom shock absorber mount in front of the axle casing to help prevent axle wind-up under acceleration, but when the length of the radius arms was increased, thereby restricting wind-up, they were able to alter the turreting arrangement for optimum damping.

The dampers are now mounted on top of the rear axle, giving them a greater inclination outwards of the damper. To do this, the turret must either be made longer or placed a corresponding distance higher in the wheel arch than previously, and the top cut off and re-welded so that the damper sits with an inclination from the vertical of 8°, not 4° as before, the base of the damper being nearer each wheel vertical line, than the top. Another advantage with the new position is to prevent occasional damage to the bottom bush and to stop it from getting knocked out of its housing.



5. 7. REAR SPRINGS

Model Unit	Finis Code	Rate (lb/in)	Front Bush	Rear Ride Ht Bush in ins	Application
Mk I CD6	9051305	85	9051311	1710123 Std	All round 4 leaf spring. Bush for pre '68 Escorts.
			9051890	" "	Bush for post '68 Escorts
Mk I CD8	9051307	115	9051564	9051311 +1"	Only for post '68 Escorts as special bushes needed. Very hard spring designed for full load in boot (big tank etc)
Mk I RS 3100 Mk II	9051947	112	9051564 9053169	9051564 - 1"	Single leaf. Ideal for Gp 1. Use 105E shackles
Mk I/II	9053604	145	none	1710123 -	Slipper spring as used on 4 link Gp 4 rear axle (5 leaf)

5.8. NOTES ON REAR SPRINGS

The prefix CD is derived from Competitions Developed, ie, it originated from Boreham testing.

All the ride height figures quoted have taken into account the removal of the rubber sandwich plates beforehand. All springs, except the RS3100, and the slipper springs, are four leaf - standard on Escorts is 3 leaf.

When changing rear springs, especially when converting a non original RS h/d shell, watch for different size rear bushes. In some cases, depending on shell age, 105E rear spring hangers will have to be fitted. For most special stage events, stick with the CD6 as the best all rounder.

If fitting the RS3100 single leaf spring take special care to check homologation within event regs.

Standard Mk II springs are 1" wider than Mk I.

5. 9. WORKS 5 LINK REAR SUSPENSION

To make the most of power outputs of 200 bhp plus, one needs a highly effective rear axle set up. In the Escort, this is satisfied by the use of a fully floating rear axle located by a 5 link zero steer rear system, which involves extensive modifications to both axle and bodyshell, (the 5th link being the transverse panhard rod).

The axle itself is based on the Capri 3-litre unit, and should be built up from scratch, starting with a bare differential housing, available from RS Parts (finis code 905 3330) and assembled using all the relevant fully floating components, which we shall list further on.

This is no mean job, and the experts to contact are Safety Devices (Cambridge), Gartrac (Godalming) or Gomm Metal Developments (Old Woking) - although the latter are reluctant to work on one-off jobs.

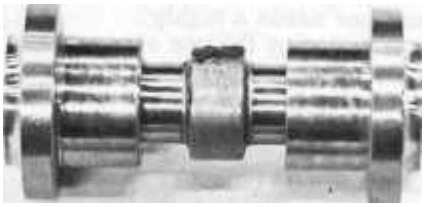
To return to the rear suspension: Basically, it consists of an outboard turret assembly based on the standard Capri turrets, sliding roller (commonly called "slipper") rear springs and Bilstein rear shock absorbers.

To achieve zero steer rear suspension, there must be no interference with the straight up and down movement of the axle, so both spring ends must be free moving. This is achieved by using a slipper arrangement at the front of the spring, instead of the usual bush. Using the standard bracket widths, a hardened steel roller for the spring to sit on is inserted, and a phosphor-bronze bush above the spring, on another roller, to keep it seated on the lower one.

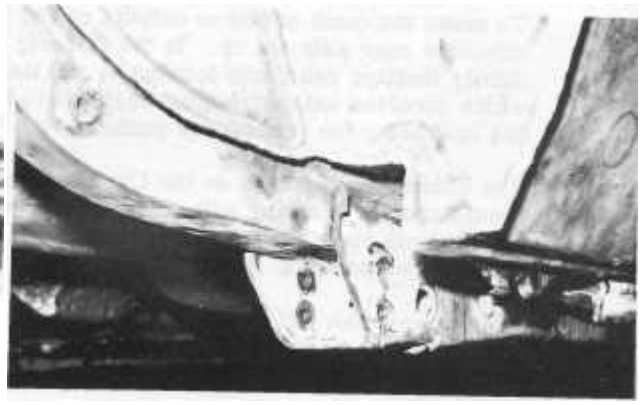
This kit is available from RS Parts, the relevant finis codes being as follows:

Roller - upper (2 off)	905 3602
Roller - lower (2 off)	905 3601
Bush - bronze - spring roller (4 off)	905 3603
Grease nipple (2 off)	176 1997

Components of slipper-roller kit,

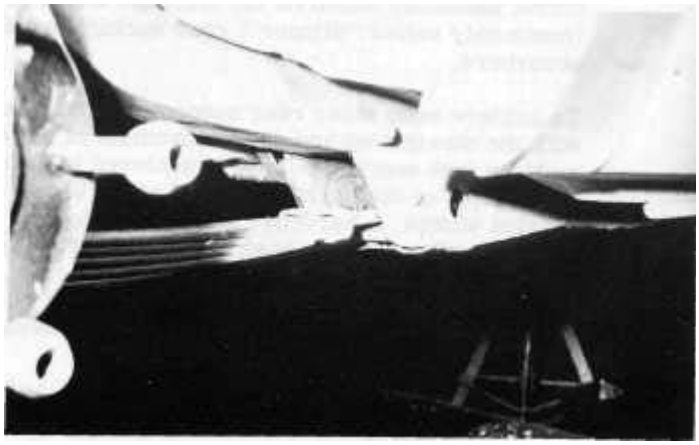


Roller built up.



Modified front spring hanger.

Spring hanger without



and with spring.

The rear springs themselves are standard units of whatever specification, with the front eye cut off. When sawing off the eye, cut as far forward on the flat of the spring as possible, to give the maximum feed between rollers. Grease liberally with graphite grease.

Incidentally, many privateers and semi-professional teams fit a similar kit which uses PTFE bushes and is marketed by F English's Ltd in Bournemouth. It is a simple affair, as it bolts on to the existing spring mounting holes, when using 905 3604 rear springs. If you happen to obtain some twin leaf rear springs, you will have to relocate the fixing holes, slightly further back, as these springs are shorter than the 5 leaf type.

5.10. REAR HANGERS

At the back of the spring, short 105E shackles are used (142 8295), with small bushes top and bottom. These have their pivot pins welded onto the shackles, as they do occasionally come apart.

Finally, the springs are retained on to the axle via 105E bottom spring plates and 105E 'U' bolts, using double nuts on the threads to prevent these from being damaged.

The 5-leaf. 145 lb/ft slipper springs are available from RS Parts as are the rear shock absorbers, set at 220/110, under finis codes:

Rear spring	905 3604
Rear shock absorber	905 3385

Particularly in the case of tarmac events, it is more desirable to use twin-leaf slipper rear springs, rated at 175 lb/ft, normally used in conjunction with 260/60 rear shock absorbers.

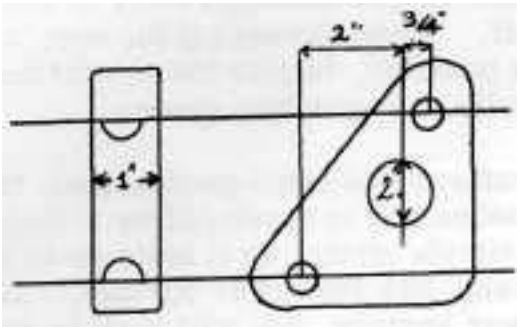
5.11. FOUR LINK DESIGN & BODY ATTACHMENT (to be read in conjunction with rear axle chapter)

The axle is attached directly by four radius arms, to the body thus:

In 1974 a 'short arm' was used, but from 1975 onwards, the 'long arm' has been employed, giving the axle greater travel, and proving to have lost no strength.

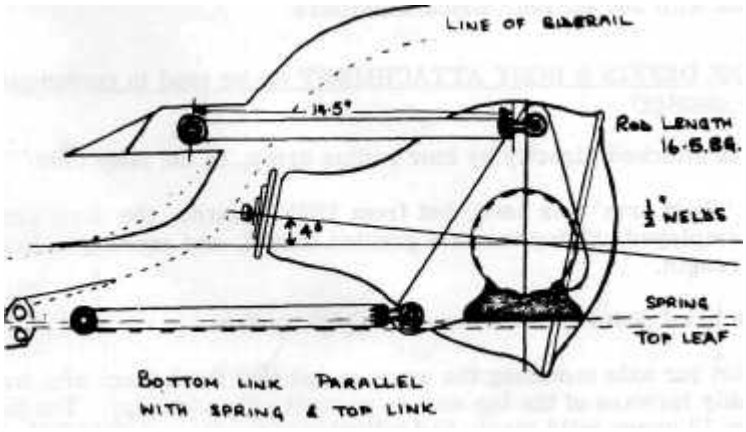
Firstly, a brief description of the older 14½" system.

The bracket for axle mounting the arms meant that the bottom arm was considerably forward of the top arm to prevent axle wind-up. The mount, made from 12 gauge mild steel, and fully boxed for Rose-joint protection and strength, looked like this:



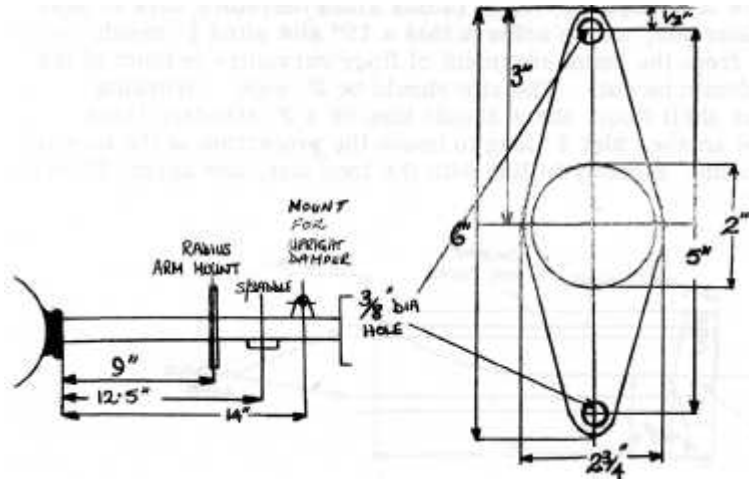
The linkage was, and remains, a means of providing positive location, stronger than the standard 2 arm set up, even with h/d rubber mounts, for the rear axle, so letting the springs just provide the springing. As such, the arms, attached to the body, must travel forward in a line exactly parallel with the side rails, whilst, when viewed from the side, also be parallel with the line of the top spring with the vehicle in the static position. From the next drawing, it can be seen that the shorter arms meant location of the lower one to the body was adjacent to the spring rollers, with the upper having a floor mounted box section just inside the cockpit.

The slipper spring was fitted between a lower hardened steel roller and an upper phospor-bronze bush at the front, using the standard bracket widths, and short 105E shackles at the backs.



Onto the latest spec now, using the 23" arm system.

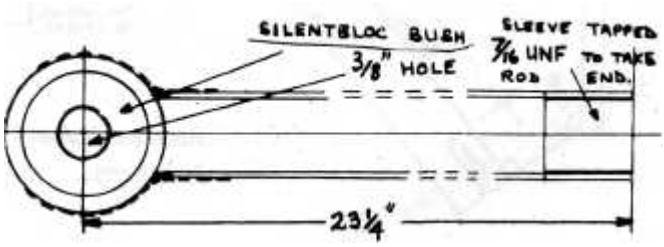
The bracket accepting the four arms on the axle measures as follows:



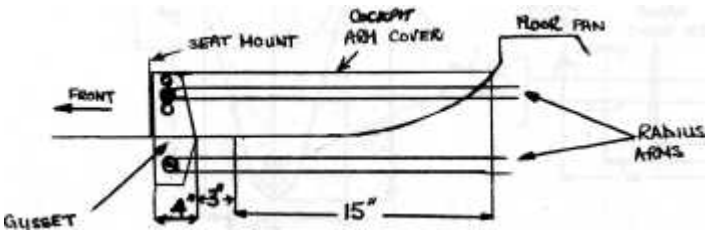
Unlike the earlier short arm system, the pick-up is at exactly 90 to the spring saddle horizontal line.

The centre line of the radius arm pick-up to the edge of the diff casing is exactly 9". Corresponding distances to the spring saddle centre line being an additional 3½" and the damper mount a further 1½".

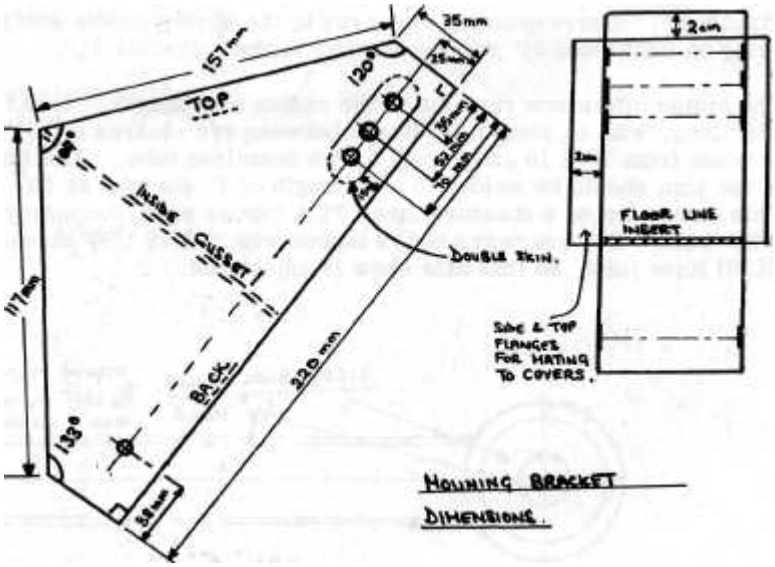
The major difference remains in the radius arm length. Now the arm is 23½" long, with an ideal total length between eye centres of 25½". The arm is made from 1" x 10 gauge cold drawn seamless tube. The foreward end of the arm should be welded to a 1" length of 1" dia tube at 90° to the arm. This should house a standard inner TCA rubber bush, accepting a 11/16" x 2½" bolt. The rearward end is tapped with a 7/16 UNF thread to take an RC8H Rose joint, so that axle skew is adjustable.

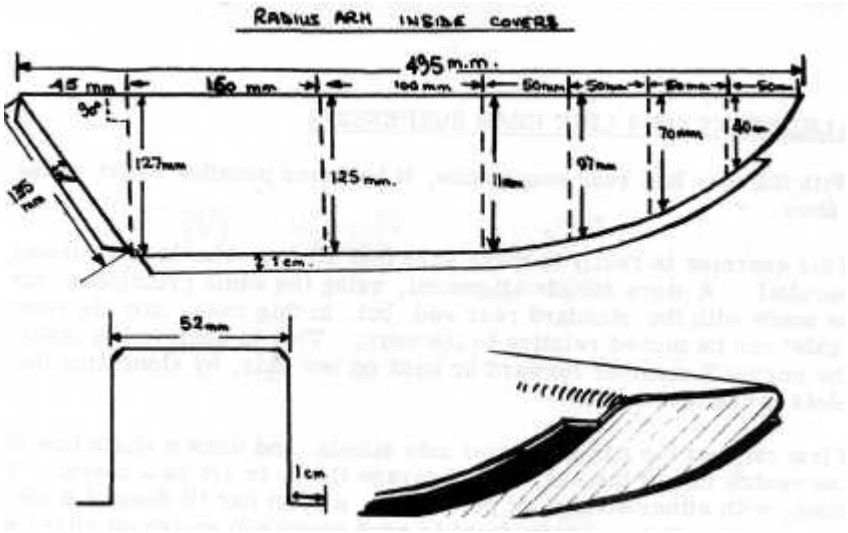


The length of the radius arms means that the front mounts are inside the cockpit on a bracket forming part of the transverse floor support for the rear seat were it in position. The radius arms therefore have to pass through the floor pan, and to achieve this a 15" slot sited 1/4" inside each chassis rail, from the commencement of floor curvature in front of the axle recess should be cut. The slot should be 2" wide. Working forward on the shell floor, there should then be a 3" standard floor section before another slot 4" long to house the projection of the forward radius arm mount, directly in line with the long slot, and again, 2" wide.

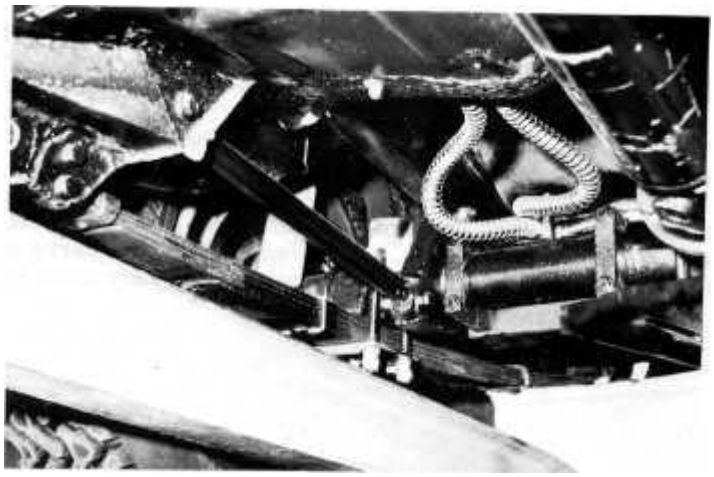


Full dimensions of the front radius arm mount, and the cover over the upper arm for cockpit mounting (both fabricated from 16 s. w. g.) are thus:





Top arm front mount running forward to rear seat crossmember. Note three pick-up points for arm adjustment.
Below. View of four link system. Note position of bump stop over U bolt.



5.12. ALIGNMENT OF 4 LINK REAR SUSPENSION

With the four link rear suspension, it becomes possible to set up the axle skew. This exercise is really to make sure that all four wheels are running parallel. A more simple alignment, using the same principles, can be made with the standard rear end, but, in this case, only the front 'axle' can be moved relative to the rear. This is achieved by moving the engine X member forward or back on one side, by elongating the slots in the X member.

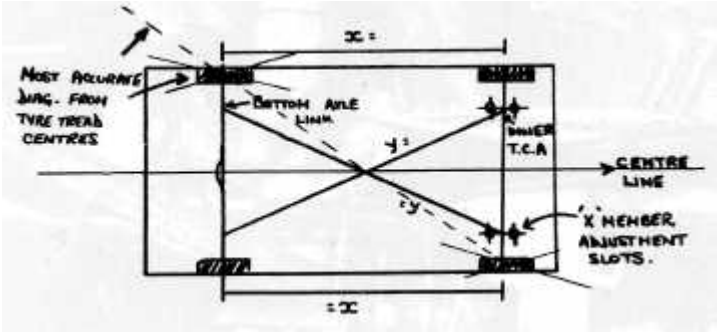
First off, get the car on 4 level axle stands, and draw a chalk line down the centre line of the car, on the garage floor, to act as a check. This done, with either string, or preferably, a steel bar (it doesn't stretch:) measure the distance from front to rear wheel hub centre on either side. From this, you will be able to tell whether you have any correcting to do - and if you've just built up and installed a 4 link system, you can bet that you'll be out somewhere. Having found that there is a difference between either wheelbase, you've now got to find out which 'axle' to move to correct it, as either front or rear could be out.

So, the next move is to drop a plumb-line from each inner t. c. a. bush up front, to the floor, and chalk the point where the bob falls. On the rear do the same, taking the centre point at the rear of the bottom axle link as your plumb-line drop position, again chalking a mark on the floor.

After this, chalk-up a piece of string and join the diagonals, front to rear, by two more chalk lines on the ground, and measure. Your task is now to get your 2 pairs of measurements the same - ie, diagonals and wheelbase equal.

Adjustment on the rear can easily be carried out by lengthening or shortening the radius arm lengths, remembering to adjust both arms on each side by the same amount.

At the front, adjustments can also be made by elongating the slots in the X member in a fore/aft plane as well as the standard east/West direction, although adjustment here is obviously not as easy as at the rear. When your diagonal and wheelbase measurements are paired equally, you should have a correctly set up car. Incidentally, although we don't bother for rally machinery, in racing, to be really accurate, you can take measurements from each tyre tread pattern when resting on the ground, and do your calculations from there. It's also advisable to carry out the above procedure with the correct geometry settings already made to the front end.

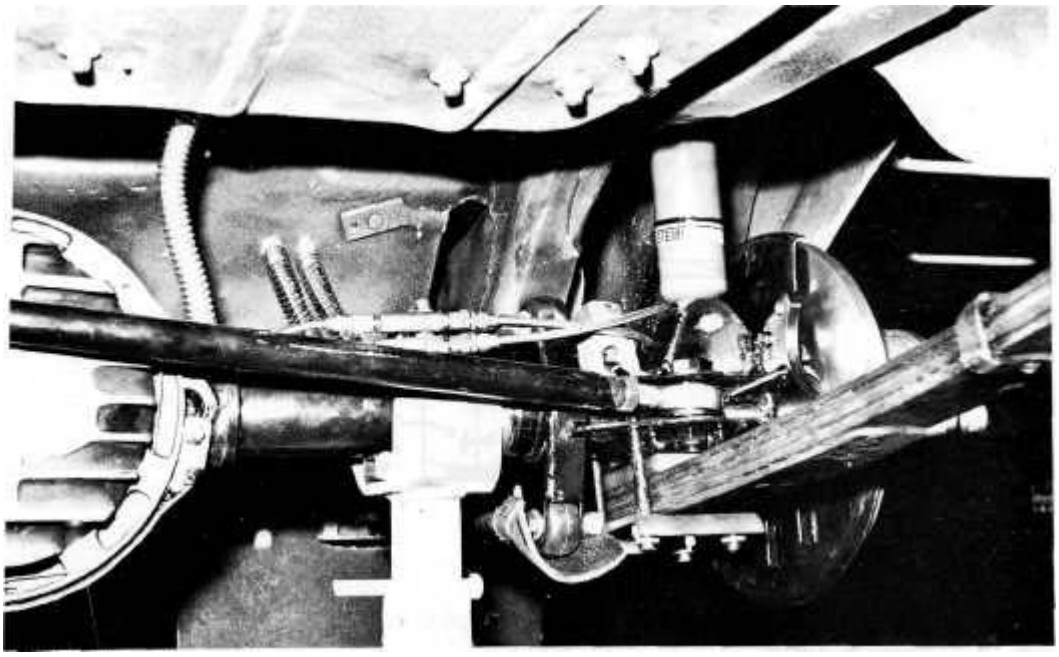


5.13. PANHARD RODS

When Boreham began rallying Mk II Escorts, it was decided to incorporate a Panhard rod on the rear suspension. It is now a permanent feature on all works cars, as well as most competitive Gp 4 cars.

The Panhard rod is made out of 1" steel tubing and measures in at 36½" long, from the centre of the body end bush to the axle end of the tube. At the axle end, a bracket is welded on the axle casing (see photograph) and an AGS 3084 Rose joint is used.

At the body end, a special bracket (available from Bracey Price, Gartrac, etc) is welded to the floor pan. The Panhard rod is terminated by a tube welded on to the end of the rod, and carries an inner Track control arm bush.



General suspensions seen from below. Note Panhard rod mountings

Panhard rod body mount

Please be aware that these articles were written in the 70s and some of the regulations may have changed. Please consult the MSA Blue Book before preparing your car