

BUILDING A 2CV THREE WHEEL SPECIAL

by Steve Spence
PART ONE

WHY A SPECIAL?

For me, the only disappointing feature of the Citroen Specials Club is the lack of true specials - very few cars in the club are one-offs. Every Lomax may be slightly different, but they are still kit cars and owe their design, in the main, to Nigel Whall and not their builders. In an attempt to encourage more people to at least consider designing and building their own dream machines, I have put finger to keyboard to describe my experiences in building a true Citroen 2CV Special. What follows is by no means a build manual, but I hope it will show that building a special is not much harder than building a kit.

Like many club members, the Morgan three-wheelers of the inter-war years have always held a fascination for me, but at current prices I doubt if I will ever be able to afford one. So having convinced myself that a Morgan was out of the question, I was left with choosing between a kit and building my own. I rather liked the Triking, but at £17,000, it was a non-starter. The JZR and SuperVee had not been thought of at the time - if they had, I might not be writing this now. That left the Lomax or the Falcon. I looked long and hard at the Lomax but was unhappy with the front end. I realised that this could be changed but was persuaded that while redesigning a Lomax I might as well go the whole hog and design a complete car. Whilst considering the Lomax, I also bought a Falcon manual. (I would recommend anybody thinking of building a 2CV-based kit or special to read this, it contains a wealth of information). Again, the Falcon was not really what I was looking for, but I could see that by adapting the plans in the manual, I could possibly build the type of three-wheeled special I had in mind.

THE DESIGN

I sketched out a number of designs and eventually finished up with a car that looked not dissimilar to a mid 1930's barrel-back Morgan Aero Super Sports.

The next step was to turn my sketches into scale drawings. At this point I realised that I was going to need some experienced help, so I joined the club and started to pester the life out of Derek Smith! Derek was the Club Secretary at the time, but most importantly, he was building a three-wheeler special. Thanks to Derek, I was able to get the exact dimensions of the tin box that Citroen pass off as a chassis, but more on chassis later. Armed with my scale drawings, I set about building a model out of cardboard and Meccano. (The man who invented Meccano has got a lot to answer for). The model was not very good, but it proved that my body design would work.

It was now time to consider the method of construction. I was attracted to the Falcon largely because it is built of wood and fibreglass, both materials I already had some experience of using, as I am a keen dinghy sailor. However, I was not totally convinced that wood alone would be strong enough, so I drew up a hybrid design using a simple space frame of square section mild steel tubing to which would be bolted marine ply bulkheads and body panels. With the Falcon, the wooden body tub is built first and all the steelwork is inserted afterwards. Although the end result should be the same, I am not convinced that this method of construction gives as much torsional rigidity. It does, however, make it easier to repair should you be unfortunate enough to bend the car.

GOVERNMENT HEALTH WARNING

PROCEEDING BEYOND THIS POINT COULD BE TAKEN AS A SIGN OF PARANOID SCHIZOPHRENIA, RESULTING IN LONG HOURS BEING SPENT WORKING ALONE, MUMBLING TO ONESELF, AND BEING ACCOSTED BY TOTAL STRANGERS ASKING WHAT YOU ARE DOING.

CONSTRUCTION

I had now reached the point where building could start. It was also where I hit my first serious problem - I could not find a donor 2CV. Yet again Derek Smith came to my rescue. He found me a stripped-down four wheeled rolling chassis which I bought. Within a week of buying it I was offered two more complete donors, a 2CV and a Dyane. The Dyane was a runner but had been damaged in an accident. By this point I knew that I was going to need a number of parts not on my rolling chassis, so I bought the Dyane as well. I was able to drive it home, which proved that the mechanical bits were all OK. The car also had a log-book which my rolling chassis did not have. So after three months of looking, I now found myself with a rolling chassis and a complete, albeit bent Dyane.

Before stripping the Dyane, I took a few photographs of the engine bay and the main bulkhead, these pictures proving invaluable on more than one occasion. On removing the bodywork, I discovered that the chassis was full of rust and way beyond repair. The engine and running gear were in good order so I kept them, together with most of the fittings, seats, switches etc., and dumped the rest at the local tip. The chassis number is mounted on the bulkhead, not on the chassis, so do not forget to remove it before you dump the old body. I also removed the wiring harness. Remember, if you intend to re-use the wiring, make sure that you clearly label all the connections before disconnecting them.

PREPARING THE CHASSIS

I now had two sets of running gear and one good chassis, this I had stripped completely and tested for weak spots using a 6" nail and a masonry hammer. The Citroen chassis is notorious for rusting from the inside out. The main points that need careful scrutiny are the side members and the front outriggers. If you are building a three-wheeler, you do not have to worry about the rear outriggers because you cut these off. Chassis can be repaired, but you need to assess whether it is worth going to the trouble of repairing a rotten one when both Lomax and Falcon can supply a much stronger replacement. Alternatively you could build your own using the club's plans, details of which are in 'FLAT OUT' Nos. 3 and 4 (I believe that back copies are available for a small fee from Carole Chitty, you can also speak to Derek Smith who has a full-size set of plans). My chassis appeared to be OK so I just cleaned it up, filled it with Waxoyl, painted and undersealed it.

The one modification I did make was to shorten the wheelbase by 100mm. You do this by moving the rear wheel assembly forward. However, a word of warning. If you do this, you will also have to reverse the spring assemblies and replace the longer rear shock absorbers with front shockers, which are shorter. You will also have to set up the ground clearance. A point worth noting is that the castor angle is fixed on the front wheels and cannot be altered. Therefore, if you alter the ground clearance, the steering geometry will also be altered. In practice this means that as you reduce the

ground clearance, the steering will become heavier, especially at low speeds. The Falcon manual covers the chassis and steering in greater detail, and is well worth consulting.

THE REAR WHEEL CONVERSION

The next job is the rear wheel conversion. There are a number of ways to do this, most of which are covered in various back numbers of 'FLAT OUT'. I used the method in the Falcon manual which involves cutting off both rear swinging arms at the point where the section changes from square to round, and linking together the two stubs with a length of 90mm by 40mm by 10 gauge box-section steel. This connects together the nearside and offside rear suspension. One of the swinging arm assemblies (I used the nearside one) is then welded to the box-section steel so that the wheel sits on the centreline of the chassis. It works very well but bearing replacement could be problematic as the box-section linking the swinging arms would have to be cut. The current Lomax method of reversing and adapting one of the swinging arms and then linking the rear suspension using an anti-roll bar is a simpler way of doing the conversion. The only drawback is that the anti-roll bar will twist under load and therefore the load on the suspension will not be spread evenly between the nearside and the offside. In practice, this probably has little effect on ride and handling.

THE ENGINE AND GEARBOX

I have made very few changes to the engine and gearbox. The oil cooler, oil filler and alternator are all in their original positions. The engine cowling, fan and heating ducts were removed, and the air filter and ignition coil repositioned. A guard for the alternator drive belt was made from fibreglass.

THE BRAKING SYSTEM

My car has disk brakes. I replaced all the piping, pads and shoes. You need slightly longer pipes at the back of the car. I obtained my new piping from Bonapart Products who advertise in 2CVGB News. I subsequently found out that they supply Lomax with their brake pipe kits. I have kept the original handbrake, but plan to fit an external handbrake lever in the future.

THE PETROL TANK

The petrol tank caused me a few headaches. I had intended to use a Mini-van tank, but this turned out to be too wide. In the end, I used a 2CV tank, which is smaller than either a Dyane or Ami tank. The tank sits in a cradle behind the passenger seat. If I had made my car slightly wider, I could have used a Mini-van tank, the Lomax tank, or a Triumph Spitfire Tank.

The work on the rolling chassis, which has to be done whether you are building a kit or a special, was now complete and I was ready to start constructing the bodywork.

THE FULL SIZE MOCK-UP

The most important single piece of advice I was given, and again it came from Derek Smith, was to make a full scale mock-up of the body before starting to build the real thing. From two 8ft by 4ft sheets of 4mm hardboard, I cut the bulkheads and body panels. These were glued together, effectively giving me a full size model of my proposed car. With this model, I was able to check, and where necessary alter, the size and shape of the car as well as being able to check the positioning of the steering column and pedal box. The whole mock-up cost about £15, money very well spent. Once I was happy with everything, I carefully dismantled the mock-up so that the hardboard panels could be used later as templates for the final marine ply panels.

THE STEEL SKELETON

The time had come to start building for real. The first job was to construct the steel frame. This was fabricated from 25mm by 25mm square section mild steel with a 3mm wall thickness. The frame was designed to provide a safety cage, plus fixings for the seat belts, spare wheel, steering column, and in the future, a roll-over bar. The frame also formed a skeleton onto which the marine ply bulkheads and body panels could be fixed. Once the frame was completed, it was temporarily bolted to the chassis, and I started work on fitting the steering column.

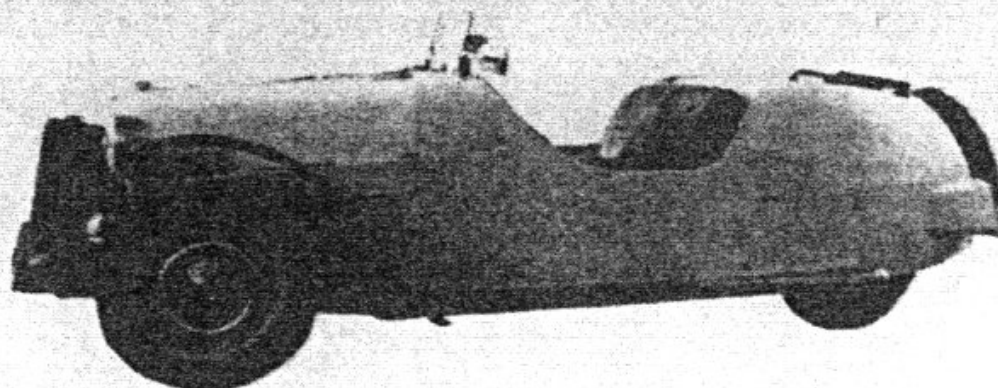
THE STEERING COLUMN

My original intention had been to use the Dyane steering column. But my car is narrower than the Dyane, and I found when I built the mock-up that the column could not be mounted square to the front axle. This resulted in the steering wheel not being square to the dashboard, which I felt might be uncomfortable. The problem was solved by using a steering column from a Fiat 126, this has two universal joints and allowed me to mount the column exactly as I wanted it. It was necessary to replace the lower UJ with one from a Citroen GS, as the spline on the Fiat UJ has a larger diameter than the spline on the Dyane steering rack. A better alternative would have been to use either a GS or an Ami steering column, both of which have two UJs. The final job was to clean and paint the frame, after first having ground flat the welds in those areas where the bulkheads and body panels were to be fitted.

CONSTRUCTING THE BODY TUB

With the frame completed, I now moved onto cutting and assembling, the body panels. I used boat-building techniques, first cutting and fitting four bulkheads, one at the rear (equating to the transom of a boat), one at the rear of the cockpit, one at the front of the cockpit onto which the dashboard would fit, and finally the front bulkhead which also formed the firewall between the cockpit and engine compartment. All the bulkheads were cut from a single sheet of 9mm thick marine ply and were fixed to the steel frame. Without the frame, the bulkheads would have had to be at least 12mm thick. The three rear bulkheads were all flat panels. The front bulkhead was more complex, as it was shaped to form the front footwell and also had to carry the pedal assembly. I followed the shape of the original Dyane firewall, (with hindsight, it might have been worth trying to use the original Dyane bulkhead which could have been fixed to the steel frame). The bulkheads were fixed to the steel frame using self-tapping screws.

Next came the side panels and rear luggage compartment floor. These were cut from a sheet of 4mm thick marine ply, and were fixed to the bulkheads using epoxy resin and copper nails. With the sides in place, the front scuttle was formed using 4mm ply for the slightly curving top section and fibreglass for the corner sections which join the side panels to the top of the scuttle. Finally came the barrel-back, so far the bodywork had been relatively straightforward, only the corners of the scuttle causing any difficulty. With the barrel-back I was now entering unknown territory. Wooden battens were fixed to the rear section of the steel frame and planed to shape, effectively making them into stringers. I then constructed the barrel-shaped back section of the car using strips of 4mm ply, each of which had to be individually cut, shaped and fixed between the last two bulkheads. It was a slow and tedious process, and although I am pleased with the final result, I would look long and hard at alternative ways of construction before repeating the process.



The major part of the body tub was now complete. I removed it from the chassis, turned it over, and reinforced all the joints with resin and glassfibre tape. Finally, the outside of the tub was planed and sanded smooth before being covered with a thin layer of fibreglass tissue embedded in resin. This, again, is a boat-building technique and is carried out to stiffen the structure, make it waterproof, and provide a good surface for painting. It is also very tedious to apply, expensive, and takes hours and hours to rub down. If you can avoid compound curves, cladding in aluminium is a lot cheaper and easier. I did clad the front bulkhead in aluminium, this was to make it slightly more fire-retardant and also easier to clean.

To complete the whole assembly, I fitted a floor. As I used the original Citroen chassis, all that was necessary was a narrow panel along each side to fill the gap between the top of the chassis and the sides of the tub. I finished up laying in a complete floor using 4mm ply, reinforced down the sides. But if you buy a Lomax chassis, or build your own using the Club's design, a more substantial floor will be required. The underside of the tub was then painted and undersealed. The tub was now ready to be bolted onto the rolling chassis.

BUILDING THE ENGINE BAY

With the body tub temporarily fixed in place, I turned to the engine bay. My car has the engine exposed, Morgan-style, so the engine bay is rather minimal (very similar to the Lomax), consisting of two small side panels running from the front of the body tub to the headlight supporting brackets. The headlight brackets, which also support the front wings, are fabricated from 25mm diameter steel conduit and 25mm steel box section. The side panels were made from 4mm ply, again sheathed in fibreglass. The panels are fixed in place using self-tapping screws into brackets mounted on the body tub, and Lugs on the headlight brackets.

THE BONNET

The bonnet proved to be the most difficult part of the whole car to build. Because of its shape, it had to be made from fibreglass. The nose-cone was relatively simple, I used an old spun aluminium light fitting as a mould. The main part of the bonnet was not so simple. I made a wooden mould and lined it with thin aluminium. I then cast the bonnet, mated it to the nose-cone, and strengthened the whole assembly with 4mm ply and fibreglass. It took a lot of filler and rubbing down to get the final finished shape, but it worked in the end. What I should do now is use the bonnet as a mould to make a plug and cast a new all fibreglass bonnet - ONE DAY !

MAKING THE WINGS

I did not want cycle wings, and having successfully built my bonnet, I thought I would have a go at making some glassfibre wings. Strand Glassfibre at Brentwood recommended that I made a former using flexible expanded foam. I cut the foam into the shape of the wing and then covered it in two layers of fibreglass. I had intended originally to remove the foam, but found that it added rigidity to the wing, so left it in place and covered the underside of the wing in fibreglass, forming a foam sandwich. Like the bonnet, each wing needed some filling before being rubbed down using wet and dry.

PAINTING

I hand-painted the body tub using two-pot polyurethane boat paint. This is obnoxious stuff and you need to wear a respirator when using it, but it does give a good finish and can be compounded to remove brush marks and runs. A sprayed finish would have been better, but I was working in a confined space and had very little choice but to hand paint.

- To Be Continued -

FINAL ASSEMBLY

Having made sure that everything fitted together before painting, the final assembly was relatively straightforward. I lined the sides of the chassis, where it came into contact with the body tub, with strips of neoprene, lifted the body into place, and bolted it down using the original fixings as far as possible. Next was the front light bracket, then the engine bay side panels, the wings, and finally the bonnet, which I have hinged from the scuttle.

THE EXHAUST

There are a number of exhaust arrangements that can be used. I chose to keep most of the original system up to the cross-box. From the cross-box, I made up a new side pipe, using the original Citroen curved pipe which originally connected the cross-box to the silencer. To this, I welded a length of 32mm diameter exhaust pipe. The system terminates in what I think is an old Triumph motorbike silencer. At some stage, I will have a stainless steel pipe made up.

ELECTRICS

This is where the tools start flying, frustration sets in, and engineering logic is replaced by black magic! I am an electrical engineer, but car electrics appear to turn all the normal wiring conventions inside out and upside down. I used the original Dyane wiring harness and modified it to match up with the switches mounted on the Fiat steering column. It does work, but it would have been much simpler to have just installed the Citroen electrics without modification. Do not forget to clearly label all the connections on the donor harness before you disconnect anything, especially if you do use the Citroen harness because most of the cables are the same colour - green.

The headlights are sealed beams from a Mini, the type that incorporate a side light, mounted in chrome housings. The rear light clusters came from a Mini-van, and the front indicators came off a Yamaha bike. (Don't forget to check the voltage of any existing bulbs - most bikes still have 6 volt electrics).

The battery is housed in a box on the floor, behind the driver's seat. The reason for locating the battery in this position, and not in the engine bay which is more usual, was to keep the centre of gravity as low as possible. I have also fitted a battery switch. Most car fires start as a result of electrical faults. With the battery switch, the whole electrical system can be isolated. I tend to switch the battery off every time I park the car. If you have a clock, or a radio with a built-in memory, switching off the battery in this way can be a pain - I am probably just over-cautious.

AERO SCREENS

I intend to build a Morgan-style split windscreen, but to get on the road I have fitted a couple of aeroscreens. These I made from two pieces of 6mm thick perspex, 12" by 8", which are rounded-off on the corners. Each screen pivots in a stirrup bracket made from 25mm wide by 3mm thick aluminium. The screen is bolted to the stirrup by means of two 'L'-shaped aluminium brackets which are fixed to the screen using pan-headed gutter bolts. I was given the perspex, so I only had to buy the aluminium. I doubt if both screens cost me more than £5. Even if you have to buy the perspex, it should be possible to make a couple of screens for around £10, that is a lot less than the £100 you would have to pay for a pair of genuine aeroscreens.

THE DASHBOARD

My dash is very simple, it is made from a piece of 4mm ply covered in thin aluminium sheeting. Most of the clocks come from a Citroen GS. I fitted a tacho, which I adapted as described in 'FLAT OUT' Nos. 10 and 11, but I had a problem. When the engine was running, the tacho worked perfectly, but the engine would not start with the tacho connected. I know that I am not the only person to have had this problem, and will be taking it up with 'Ivor Spark', who I hope will be telling us how to overcome this niggling problem in a future edition of 'FLAT OUT'. (Send in details of which kind of tacho you have been having problems with, two or three terminal, and whether you have an electronic ignition fitted, and I'll see what I can find out - ED.)

I have removed the tacho and replaced it with an oil pressure gauge, which I find far more useful as it gives me an indication of how hot the engine is getting - as the oil gets hotter, the pressure drops.

SEATS

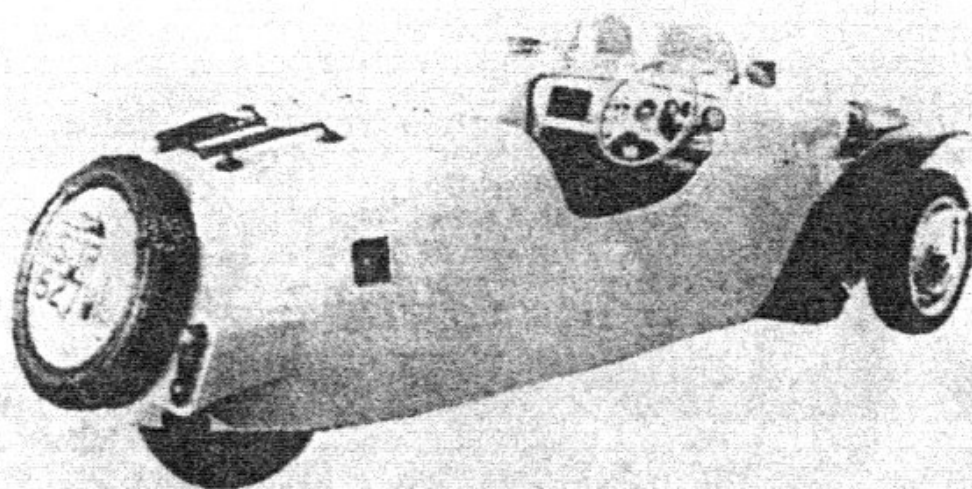
Initially, I fitted a bench seat from a Ford Transit Van, but it was a little too narrow for two people. I have now fitted two new reclining seats. They were expensive, but have proved to be very comfortable.

SEAT BELTS

I have fitted static belts. These are bolted to plates welded to the steel frame built into the body of the car. I have made provision to fit a roll-over bar (still to be made). Once this is in place, I may fit three-point harnesses.

FINAL TRIMMING

My car is fairly sparsely trimmed. The interior woodwork has been painted, edges have been padded with foam rubber covered in vinyl cloth, and carpet felt covers the floor.



At Last - The Finished Product !