

Price 16 Wheeler

The genesis of this project goes back to an article in Garden Rail no.86 called 'Another New Zealand Bush Lokey' by Eric Londesborough. I looked very carefully at the Price type E, and decided that I would build a Shay... But back in my mind there was still this thing called a 16 Wheeler. I had to find out more. The WWW led me to NZ Geared Locomotives and at last to some drawings and pictures. I knew I couldn't do it –so I left it.

A year passed and I was more confident. I had built three locomotives, four carriages, six wagons and I now looked again (COULD I DO IT?) and the answer was 'I'm not sure'. Most of September was spent playing around with bits of cut up cardboard and I drew more than a few full scale (@16mm) drawings of it.

I downloaded the manufacturers drawing from the web and started to produce a working drawing that I could model with. I knew that it had to take 2 foot 6 inch curves and yet it was going to have to be no longer than 500mm to get through 'Strawberry Cutting'. What confused me for some time was the fact that the original was capable of taking 90 foot curves –yet the mathematics said it would bend in the middle if it did!

I have a 'thing' about articulated locomotives so I tried some of the more common methods –all with no success. I almost gave up. I was reading about what will be my next project (a Golwe) when something in the text made me try it out. I had not tried inverting a mallet i.e. fixed outer sets of power bogies and floating bogies on swing arms for the inner pair. After e-mails I tried it out with Lego Technik. It worked; in fact it worked perfectly first time...

Problem 1: I now had to build it with something available to hand.

Problem 2: All the drawings were now heavily scribbled on by my small son.

Section One: The baseboard

I have developed my own construction method which is based on a sturdy baseboard to which I attach everything.

A: Cutting.

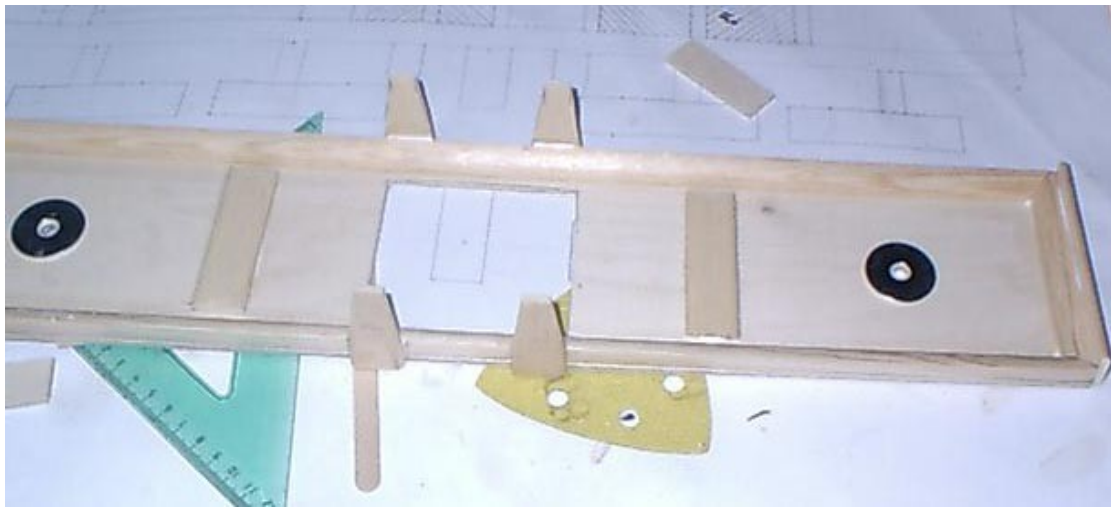
1. Cut a piece of 3mm ply 500mm x 100mm.
2. Cut two 500mm lengths of 9mm quadrant and mitre the ends.
3. Cut two 100mm lengths of 9mm quadrant and mitre the ends.
4. Cut two lengths of 6mm ply 20mm x 80mm.
5. Cut two lengths of 6mm ply 20mm x 100mm.
6. Cut four pieces of 3mm ply 50mm x 20mm.
7. Taper them to 10mm at the end after 20mm to produce a dagger like shape.

Price 16 Wheeler

I use waterproof PVA wood glue.

B: Assembly.

1. Frame the piece of 3mm ply with the pieces of quadrant.
2. Fix the two pieces of 6mm ply 20mm x 100mm to either end.
3. Fix the two pieces of 6mm ply 20mm x 80mm at 160mm from either end (length includes new end pieces). These are the rubbing strips for the INNER bogies.
4. Drill a 5mm hole centrally 80mm from either end.
5. Superglue an M8x25mm washer over each 5mm hole.
6. Cut a hole 80mm square in the centre of the baseboard to take the battery housing.
7. Fix the four ply daggers at the ends of the hole.



Section Two: The Power Bogies

I had decided on IP Engineering small chassis with 4WD chains to power the model, but I was not happy with the power of the motors. So, I replaced them with 12V 500mW motors of Italian manufacture. SME FC - 170. The process is quite easy.

A: Modifying the IP Eng Chassis

The Italian motor comes with a heat shrunk brass gear wheel on its shaft

1. Grind off the brass gear
2. Take a 2mm twist bit and using fingers only - drill out the worm gear to 2mm.
3. Slide on the worm gear
4. Drill out the motor hole on the U shaped chassis to 10mm taking it 1 mm at a time.
5. Measure 55mm from one end drill a 5mm hole centrally.
6. The motor fits to the same screw holes as the one supplied...

Superglue the spur gear and the 4 wheel drive chain cogs to the shaft. The gearing takes the additional power quite easily (I think the worm and spur are made of Pocan –a glass + nylon composite). Grease all moving parts with LM and run in for 10 minutes.

B: Start of Articulation

The secret of how the Price articulates is down to some sewing machine parts available from your local wife (or Haberdashery).

1. Take two of the converted IP Chassis; saw both the ends off level with the edge of the wheels, and round the ends to follow the curve of the wheel. These are the INNER two
2. Take the other two; saw one end of level with the end of the wheels and round the end to follow the curve of the wheel. These are the OUTER two.
3. Fit an M5x60mm bolt through the 5mm hole of each chassis and the slowly work a DOMED locking nut, dome side UP, down the thread onto the chassis plate and tighten.

C: Produce Sway Bar

The Sway Bar acts in two different fashions; in the first it acts as a traction bar between the two power bogies; in the second it acts as a torsion bar stabilising the inner bogie in an upright position only. To complete the next section you will require eight sewing machine bobbins (AKA shuttles) the type with holes all around the edge. Two K+N ¼ inch brass square section tube each 10cm long. Two packets of 5mm rubber grommets, eight 'festoon rings' with an internal diameter sufficient to sit over the centre of the bobbin (it should just take a 5mm nut inside it). Eight M8x25mm washers. Lots of 5mm nuts...

1. Take one of the bobbins and place the section of brass tube so that the end of the tube sits level with the top of the bobbin inside the two sets of holes.
2. Soft solder, bolt, superglue etc the brass tube to the bobbin.
3. Repeat for the other end making sure that the bobbin sits on the OTHER SIDE of the brass tube. The two should form a slight Z shape. **IMPORTANT!** The distance between centres should be 80mm.
4. Superglue a festoon ring to either side of EACH bobbin.
5. Repeat all above for the second Sway Bar.

This is how we begin to assemble the Sway bars to the power bogies. If you have done it right, the remainder is simple...

1. Take an OUTER bogie drop the Sway bar onto the 5mm bolt.
2. Screw a 5mm locking nut (dome side DOWN) onto the Sway Bar until the bar is held in a horizontal position but is still free to move horizontally (i.e. no more than 1mm wobble at the end).
3. Drop the other end of the Sway Bar onto one of the INNER bogies.
4. Screw a 5mm nut onto the Sway Bar and tighten as 2.

What you should now have are two power bogies linked by the Sway Bar. Repeat for the other two power bogies.

Ensure that the Z is at the same angle on both bogies i.e. // or \ \ not / \ or \ /

D: Suspension .

The suspension system is based on compressing rubber –rather like an old Mini Minor.

To produce the suspension units for the OUTER bogies:

1. Superglue a festoon ring to one side of a bobbin.
2. Superglue a 5mm rubber grommet to the inside of the festoon ring.

Price 16 Wheeler

3. Superglue the other side of the bobbin to the M8x25mm washer on the baseboard.

To produce the suspension system for the INNER bogies:

1. Superglue a festoon ring to one side of a bobbin.
2. Superglue a rubber grommet to the inside of the festoon ring.
3. Screw down a 5mm nut onto the 5mm bolt on the INNER bogie.
4. Superglue an M8x25mm washer to the other side of the bobbin.
5. Drop the assembly onto the 5mm bolt on the INNER bogie so that the grommet rests on the nut.



You will now see that the bolt for the INNER bogies is far too long. Using a saw shorten it so that end of the bolt sits below the level of the washer. Cut out two discs of felt using M8 washers as templates and superglue them to the tops of the M8 washers - to provide slipping surfaces to the rubbing strips. Position the two sets of power bogies and then drop the baseboard onto them. Screw down two 5mm nuts onto the projecting bolt heads just enough to hold them (a couple of turns).

You will have to adjust the nuts holding the suspension units for the INNER bogies until they make firm contact with the rubbing strips on the underside of the baseboard. Apply thread lock or superglue to ensure that they do not move.



Section Three: The Superstructure

The superstructure is made by sheets of 3mm ply being covered with a combination of matchsticks, lollipop sticks and 7mm square strip wood.

A: Build the firewall

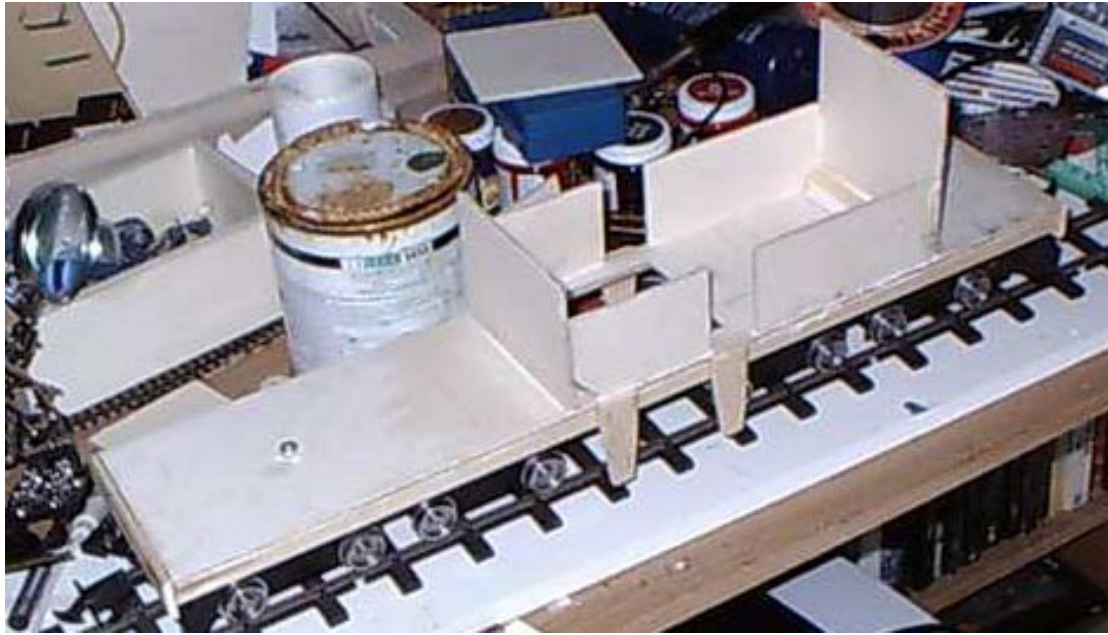
1. Saw an 84 mm length of 9mm quadrant and glue this centrally, 198mm from the front end, with the flat side facing forward. There should be a 3mm gap on either end of the quadrant.
2. Cut a piece of 3mm ply 85mm x 100mm and glue this in front of the piece of quadrant.
- 3. Wait for it to set absolutely solid.**
4. Cut two pieces of 3mm ply 75mm x 50mm. This is the FRONT_PANEL
5. Line two of the edges of the ply (4) with glue and glue the ends of the quadrant.
6. Place the ply at the end of the quadrant and cramp it.
7. Repeat for the other side

You should now have a plywood 'box end' structure. Wait until the assembly has set before continuing to the next section.

B: Build the rear end

1. Saw an 84mm length of 9mm quadrant and glue this centrally, 98mm from the rear end, with the flat side facing rearward. There should be a 3mm gap on either end of the quadrant.
2. Saw a piece of 3mm ply 100mm x 100mm and glue this to the quadrant.
- 3. Wait for it to set absolutely solid.**
4. Saw two pieces of 3mm ply 110mm x 50mm. This is the REAR_PANEL.
5. Line two of the edges of the ply (4) with glue and glue the ends of the quadrant.
6. Place the ply at the end of the quadrant and cramp it.
7. Repeat for the other side

If all has gone well your baseboard should have two box ends and a 'ski like' look to it.

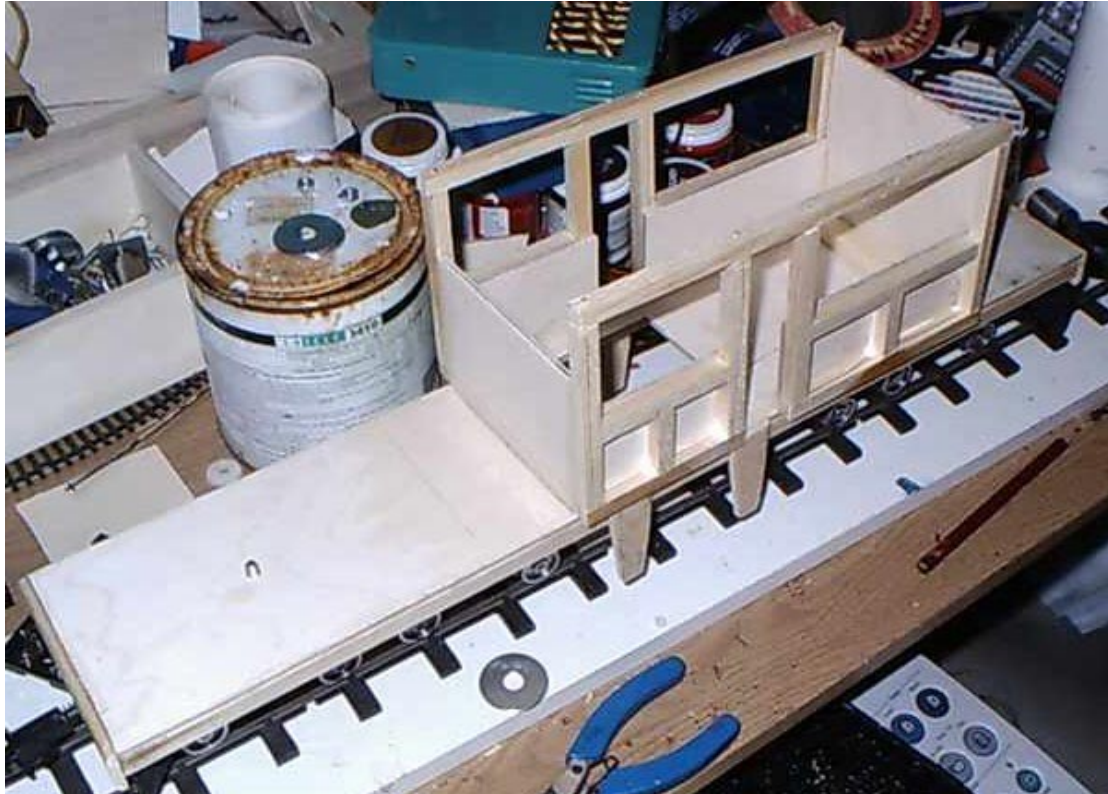


The next section is tricky and is best done when you are fresh and your eyes are sharp!

C: Raising the roof.

1. Cut eight pieces of 7mm square strip wood 90mm long. These are the VERTICALS.
2. Cut two pieces of 7mm square strip wood 110mm long.
3. Cut two pieces of 7mm square strip wood 75mm long.
4. Glue one of the 75mm lengths to the bottom of the FRONT_PANEL, so that the bottom of the strip wood is level with the bottom of the ply of the baseboard.
5. Do the same with the 110mm length for the REAR_PANEL.
6. Repeat for the other side.
7. **Wait for it to set absolutely solid.**
8. Glue the edge of the firewall and stick a VERTICAL to it; it should sit flush with the front.
9. Glue the rear edge of the FRONT_PANEL and stick a VERTICAL to it; it should sit flush with the edge.
10. Do the same for the REAR_PANEL.
11. Repeat for the other side.

If all has gone well you should have eight verticals all lined up with the edges of the FRONT_PANEL and the REAR_PANEL. The picture is here to show you the completed stage and the end of the next stage as well. This is because the description can only go so far....



Wood is a natural product and what follows is simply a 'how to do it' list as each dimension will be unique to your model!

D: Panel the sides.

1. Measure the distance between the set of VERTICALS on the FRONT_PANEL and cut a piece of 7mm square strip wood to fit.
2. Glue it into place along the top of the FRONT_PANEL.
3. Do the same for the REAR_PANEL.
4. Repeat for the other side.
5. Measure the internal distance between the top and bottom of the FRONT_PANEL and cut a piece of 7 mm square strip wood to fit.
6. Glue it into place centrally.
7. Do the same for the REAR_PANEL.
8. Repeat for the other side.

You should now have T shaped piece in each of the panels

The next step requires a couple of spring clamps, a hand brace and a steady hand!

E: Fixing the top bar.

1. Measure the distance between the end of the foremost VERTICAL and the rearmost VERTICAL, and cut a piece of 7mm square strip wood to length. This is the TOP_BAR
2. Position the TOP_BAR on top of the front end VERTICAL and spring clamp it there.
3. GENTLY position the end of the TOP_BAR at the top of the rear end VERTICAL and spring clamp it there

It is UNLIKELY that the other two VERTICALS will line up with the position of the TOP_BAR!

4. Drill a 2mm hole centrally down through the end of the TOP_BAR so that it just bites into the top end of the VERTICAL.
5. GENTLY tap a veneer pin into the hole leaving about 3mm free at the end.
6. Do the same for the other end of the top bar.
7. Remove the spring clamps from the ends and GENTLY clamp the two inner VERTICALS.
8. Repeat the procedure for the inner two VERTICALS.
9. GENTLY lift the TOP_BAR up to the limit of the veneer pins and glue the tops of the VERTICALS.
10. GENTLY tap home the veneer pins.
11. Repeat for the other side.

If you study the picture above you will be able to see the tops of the veneer pins. All that remains to do is measure a piece of 7mm strip wood between the top of the first pair of verticals and superglue it in place level with the tops of the VERTICALS. This should give you a front and rear ledge for your roof. Measure and cut it from 3mm ply.

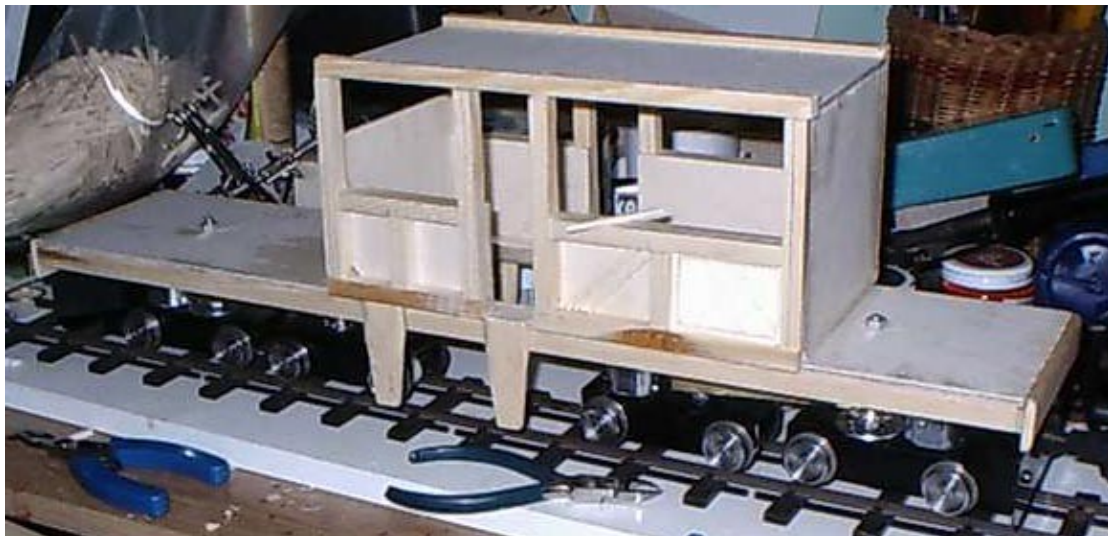
Section Four: Planking

This is the easiest yet the most time consuming part of the construction... At the end you should have chevron panels.

A: Matchsticks and Glue

1. Apply slow setting PVA wood glue to one of the panels; ensure that the glue reaches into the corners.
2. Place a matchstick diagonally into the panel and press gently.
3. Continue until the panel has as many full length match sticks as it can.
4. Crop the sticks to size and continue filling the panel.
5. Repeat the process for the other seven panels....
6. Wait for everything to set solid.
7. Using superglue stick matchsticks into the edges of the panel – this hides all the ends!

You should now have eight panels of matchsticks all framed with matchsticks. Measure the panels on the REAR_PANEL and cut out four pieces of cardboard the same size. Glue matchsticks to them in the same manner as above. Put them to one side and keep them safe.



The next part is again easy –but SLOW! Remove the articulation from the baseboard. The length of the lollipop sticks that I have are: 115mm and they are 10mm wide. Place them on the front of the baseboard and trim to size. All future lengths relate to a squared off lollipop stick.

B: Lollipop sticks and Glue.

Apply slow setting wood glue to the front half of the baseboard.

1. Place each lollipop stick in turn onto the glue until you reach the end.
2. Using a hair dryer gently cook the assembly for a couple of minutes.
- 3. Leave to set absolutely solid.**
4. Sand down the edges of the planks until flush with the edge of the ply of the baseboard.
5. Apply a sealing wipe of glue to the ends of the lollipop sticks –locking the ends to the edge of the baseboard

You will notice that the planking now has a slightly warped and wrinkled appearance.

Now you will have to plank the inner back half of the cab in the same manner, cut eight lollipop sticks. Work forward from the rear. Ensure that you stop short of the end of the REAR_PANEL. Glue a short length of lollipop stick between the FRONT_PANEL and the REAR_PANEL to act as a step. Remember that you will have to re-drill the 5mm hole for the M5x60mm bolt.

Section Five: Boiler + Fixings

I use a length of grey polyprop drain pipe as my standard boiler. It has an external diameter of 55mm and comes in 4.2m lengths. The other type of pipe is styrene 'white waste' at 40mm diameter

A: Make a boiler.

1. Saw off a 10mm length of pipe.
2. Draw around the inner edge to produce four discs of 6mm ply.
3. Glue two discs together and place the now 12mm thick disc into the 10mm length of pipe. Keep the others safe.
4. Glue the discs to the front of the firewall centrally so that the top of the pipe sits level with the top of the firewall. Cramp it there.
5. **Wait for everything to set solid.**
6. Remove the 10mm ring of pipe. This should leave you with a glue free firewall!
7. Drill a 25mm hole centrally through the 12mm disc, (for cables).
8. Saw off a length of pipe 160mm long.
9. Drill a 2mm hole 5mm from one end. This is the SMOKE_END
10. At the other end gently scrape saw lines in the inside 25mm of the pipe to produce a nice roughened surface. This is the FIRE_END.
11. Saw a piece of 20mm x 10mm wood 35mm long.
12. Wrap 60 Grit Wet+Dry around the boiler and rub the piece of wood along it to take the curve of the pipe.
13. Nail the boiler to the piece of wood through the 2mm hole at the SMOKE_END with a veneer pin.
14. Present the other end of the boiler to the 12mm disc and (hopefully) slide over.

All things being equal you will most likely have to sand the end of the boiler to fit perfectly to the firewall. Sand the end support block until the boiler sits level with the baseboard.

B: Mount the boiler.

1. Spread 'constructional adhesive' ('No More Nails' etc) around the inside of the boiler at the FIRE_END.
2. GENTLY twist the boiler onto the 12mm disc at the firewall.
3. Superglue the piece of wood at the SMOKE_END to the baseboard.
4. Poke a finger through the Firewall hole and wipe the adhesive around the 12mm disc to get a good seal on the inside of the pipe.
5. Remove any external adhesive while still wet.

The adhesive will NOT stick to the pipe. BUT it will set in the grooves cut -thus locking the pipe to the wood. When it has dried the excess glue will peel off the pipe quite easily.

How you make your boiler dome is up to you. But no surprise where I got mine from....

C: Firebox

1. Measure and cut a piece of 60 thou plastic sheet to go from the end of the planking to 9mm quadrant on the firewall. The width should be that of the cab. This is the FLOOR
2. Measure and cut a piece of 60 thou plastic sheet to go from the top of the 9mm quadrant to the top of the firewall. The width should be that of the firewall. This is the FRONT. You will have to cut/sand the lower sides of the FRONT to clear the FRONT_PANEL.
3. Cut two pieces of 60 thou plastic sheet 65mm x 45mm. Measure 15mm either side of one corner and cut off the triangle.
4. Repeat for the other piece. These are the SIDE. It should now clear the quadrant –otherwise sand to size.
5. Saw a 65mm length of ‘white waste’ pipe and section it into quarter slices. These are the CORNERS.
6. Invert the baseboard and place the FLOOR as it would sit in the cab.
7. Draw around the hole where the battery will sit.
8. Place the baseboard right ways up.
9. Cut an inverted U shape in the FRONT to clear the wiring hole.
10. Measure 7mm in from the side edges of the FRONT and superglue a 40mm length of 7mm strip wood each side
11. Repeat this for the FLOOR.
12. You should now be able to superglue the SIDES to each of the corner strips.
13. Measure and cut a piece of 60 thou plastic sheet to fit between the free ends of the SIDES and level with the top of the FRONT. This is the BACK.
14. Superglue this into place.

You should now have the start of a box like structure.

15. Sand to fit two of the CORNERS until they fit between the FRONT and the BACK pieces.
16. Superglue them into place leaving a flat top.
17. Measure and cut a piece of 60 thou plastic sheet to fit between the two CORNERS. I recommend leaving a 5mm air gap at the BACK end of the piece.
18. Superglue it into place.
19. Measure and cut a lollipop stick to fit between the VERTICALS of the firewall.

20. Superglue this to the top of the FRONT. It will also reinforce the two CORNERS and the piece of plastic sheet between them.
21. Measure and cut two strips of 60 thou plastic sheet to fit between the FLOOR and the FRONT and superglue them in place.

How you do the next part depends on how you power your 'Lokey'. I use battery power by 12V Lead Acid Gel. There is plenty of room in the boiler to fit NiCad Race packs and such like –in fact there is plenty of room in this Lokey for practically anything....

D: Battery Box

1. Cut two pieces of 3mm ply 80mm x 50mm.
2. Cut three pieces of 3mm ply 80mm x 86mm.
3. Cut two pieces of 7mm strip wood 80mm long.
4. Glue one of the pieces of 7mm strip wood to edge of one of the pieces of 80mm ply.
5. Repeat for the other piece.
6. Assemble and glue the three remaining sides to the ends.

You now have the pieces to build the battery box and suspend it via the two pieces of 7mm strip wood to the underside of the baseboard. You can now stick the cardboard and match stick panels into place on their respective REAR_PANELS.

E: Motor

1. Cut two 50mm lengths of 9mm quadrant and glue together to produce a D shape.
2. Cut two 50mm lengths of 7mm strip wood and glue the edges together to produce a rectangular bar.
3. Cut a 60mm length of 10mm x 20mm wood.
4. Saw a thread bobbin in half.
5. Cut two pieces 20mm x 10mm of 60 thou plastic sheet.
6. Superglue the pieces of plastic sheet to the ends of the quadrant
7. Screw in two ring picture hooks 10mm from either end.
8. Superglue a 15mm 'Yorkshire' in line solder ring fitting to the half bobbin. Making sure that the total length is 50mm
9. Superglue the assembly Yorkshire uppermost to the D assembly. Ensure that each barrel sits centrally in line and 5mm from the edge.
10. Superglue the bottom of the assembly centrally to the piece of 20mm x 10mm wood, on the 20mm face.
11. Superglue the 50mm rectangular bar centrally between the two – but in line with the edge of the 20mm piece of wood.

Believe me this was the hardest part of the modelling process. I could not find anything that I thought looked like it could be a motor!

Section Six: Smoke box and Wood box



As you can see the end of the firebox sits further forward of the battery box, but there is still room in the battery box for either a 4.2Ah Lead Acid OR a pack of eight 1.2V NiMH. You will have to carve the FLOOR to fit your type of installation. Placing the battery **here** lowers the centre of gravity and increases the traction to all wheels. I place the electronic speed controller in the boiler along with the receiver and antenna wire. The wood box is another place.

You will need to cut 15mm strips of 60 thou plastic sheeting and superglue them to the edges of the baseboard. Sand it to shape.

A: Smoke box

1. With the 10mm piece of pipe draw a circle in 60 thou plastic sheet and cut it out.
2. Measure and cut a piece of 60 thou plastic sheet from the top of the baseboard to the top of the SMOKE_END of the boiler tube. It should be 55mm wide.
3. Place the circle of plastic sheet on it and superglue it together.
4. Glue the two remaining 6mm ply discs together.
5. Superglue the now 12mm thick disc to other side of the sheet.
6. Present the assembly to the SMOKE_END of the boiler and (hopefully) slide it in. You may have to carve a notch for the nail –or sand to shape.
7. Carve the plastic sheet to the shape of the boiler top –you should now have an inverted U shape at the end of it.
8. Measure and cut a 10mm strip of 60 thou plastic sheet to edge the front of the assembly.
9. Superglue in place.
10. The smoke box front can now be removed for access to any electronics in the boiler tube.
11. Cut a 40mm circle of 60 thou plastic sheet and superglue this to the 55mm circle.
12. Superglue an M8x60mm washer to the 40mm circle.

Price 16 Wheeler

If all has gone well you should have a front that looks like the picture above.

B: The Woodbox

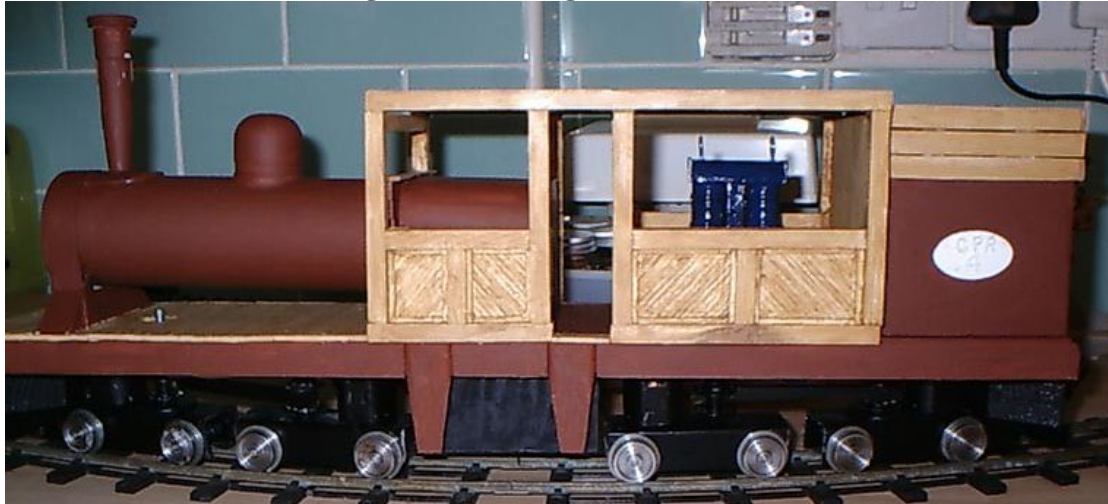
1. Cut two pieces of 60 thou plastic sheet 90mm x 70mm.
2. Cut one piece of 60 thou plastic sheet 80mm x 70mm.
3. Cut four pieces of 7mm square strip wood 70mm long.
4. Cut two pieces of 60 thou plastic sheet 10mm x 90mm.
5. Cut six lollipop sticks to 90mm.
6. Cut three lollipop sticks to 80mm.
7. Cut 6 lollipop sticks to 25mm.
8. Cut a piece of 3mm ply 80mm x 90mm.
9. Superglue the four pieces of 70mm strip wood to the 70mm edges of the 90mm plastic sheet. These are the BACK_PLATES
10. Superglue the 10mm strips of plastic sheet to the edges of the baseboard at the rear –on top of the 3mm ply. They should be flush with the 15mm strips that now cover the 9mm quadrant edges of the baseboard.
11. Superglue the BACK_PLATES to the rear of the 100mm square piece of 3mm ply so that they sit just inside the two strips of 10mm plastic sheet.
12. Superglue the 80mm x 70mm piece of plastic sheeting to the ends of the BACK_PLATES. Sand to size...
13. Place the piece of ply on top of the plastic box, mark around it, and sand to size.
14. Glue two 90mm lollipop sticks to the sides of the 3mm ply top and the 80mm lollipop stick as well. Note you may have to sand all these to size as well... Ensure that the centre of the ply lines up with the centre of the lollipop stick.
15. Test fit the lid of the wood box.
16. Superglue the six 25mm lengths of lollipop stick to the edges.
17. Superglue the remaining lollipop sticks to them to produce the 'hungry bars'. Put the top one in first and then the middle one.

The final step is to superglue a line of matches along the edge of the front planking.

C: The Smoke Stack.

I have bent a D shape of 60 thou plastic sheet and superglued it to the smoke box assembly. For the smokestack I used the nozzle end of a cartridge of 'No More Nails' and drilled a 10mm hole into the (empty) boiler tube. This can be embellished with suitable conical bottle tops to produce a balloon if required.

Section Severn: Priming and Waxing.



Here you can see the almost finished model with the motor bolted to the back of the cab. The motor has been painted and the totem affixed to the wood box. The bottom half has been painted matte black, it disguises a multitude of sins...

This is how I wax the model. I use 'Ronseal Brushing Wax' applied very sloppily with a 4x1 paintbrush. It normally takes 2 days for the amount of wax to dry to a touch dry state -I apply that much!!!

When dry, the excess wax slopped onto the plastic can be removed with a tissue dampened with brush cleaner.

One advantage of waxing is that nothing will now stick to it -so you can be fairly free with your brushes from here on in... I used red oxide primer and slow drying enamel paint.

I have not put in the entry about the control chains as they have been a perpetual nuisance and are best left off the model. Imagine eight small sweeping brushes and you begin to see where I am coming from...

How you wire or control your model I leave to you. Just remember that some of the motors have to be wired backwards -to go forwards. **c.f. F.W.Webb CME LNWR**

regards

ralph