

# The London General Omnibus Company

## S-Type Motor Bus



The S-type bus was a development of the K-type to take advantage of the expected relaxation of the strict limits placed on the dimensions of buses in London by the Metropolitan Police. In particular the overall length (excluding starting handle!) would be increased to 25ft (7.6m), and the laden weight raised to 8 tons (later 8½). The first prototype, known as the T-type, was ready by April 1920, even before the first of the production K-types was delivered. This prototype was not entirely satisfactory, but led to a redesigned longer wheelbase chassis and new body ready for inspection in November 1920. Fifteen vehicles were built to this specification by February 1921, then a batch of 250 production vehicles was delivered between June 1921 and April 1922. These later vehicles were of rather heavier construction with a larger engine, and the initial 15 were rebuilt to a similar specification. In all, just about 900 S-types were built up to late 1922, of which a number had single-deck bodies. A few more single-deckers following in 1923 and 1927.

The main change from the K-type was the longer body. This gave room for an extra row of four seats both upstairs and down, so increasing the total capacity from 46 to 54. Slightly less obvious was the fact that the upper deck projected roughly equally beyond the lower deck at front and rear, whereas on the K-type there was no projection at the rear, all the overhang being at the front. The wheels were also significantly larger than those on the K, being 1050mm diameter over the tyre, instead of 920mm, and the front wheels were placed rather farther back from the front of the chassis.

As with the K-type, later body sides curved inwards near the floor instead of going straight down, and several paint schemes were used, generally becoming more simplified with time.

There are three S-type buses in working order today:








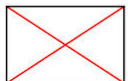
- S742, preserved by London Transport and owned by the London Transport Museum,
- S454, found in a scrapyard in 1965 by Michael Banfield and restored by him,
- S433, a single-deck conversion restored by Barry Weatherhead and owned by him.

# The Model

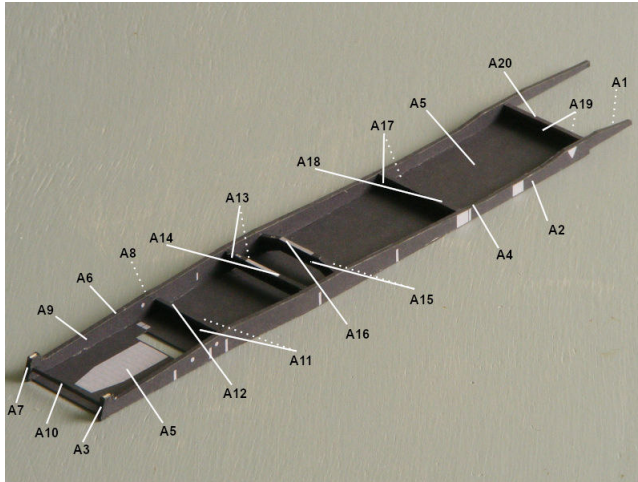
My model is based on S454, mainly using photographs taken for the sales catalogue for the auction of Michael Banfield's vehicle collection in 2014, after his death. However, I have tried to represent it approximately in its original condition rather than its preserved state, which shows a few (fairly unimportant) discrepancies from older photographs which I have seen.

The main material is 160g/m<sup>2</sup> card (0.2mm thick), but small use is made of other thicknesses of paper and card for laminating parts to specific thicknesses, and thin glazing material. Parts are provided for a simple lower saloon with opaque windows and entrance, and for a full one with glazed windows and a full, if simple, interior. For the first, print page C1 and omit D1, D2 and D3, for the latter option print D1, D2 and D3 and omit C1. In either case, print all the remaining pages.

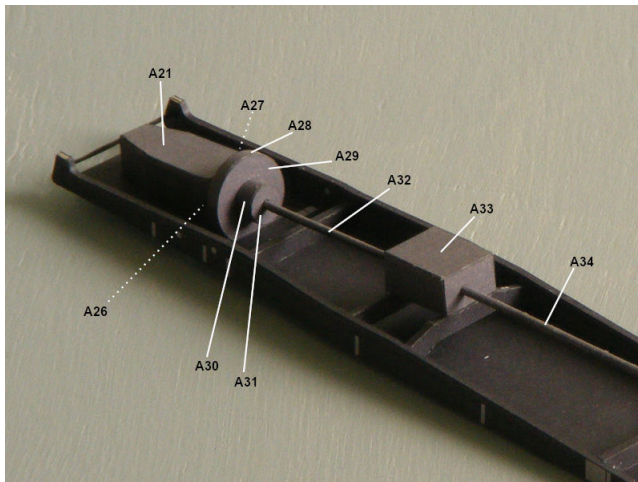
On the part sheets symbols are used to indicate cutting, scoring and folding options, as follows:

	Score on front, mountain fold
	Score on back, valley fold
	Cut slit
	Do not cut or score
	Curl the part between the lines, printed side out
	Curl the part between the lines, printed side in
0.8mm	Laminate on card to the total thickness given
	Laminate two parts on either side of card to the total thickness given
	Cut out internal shape

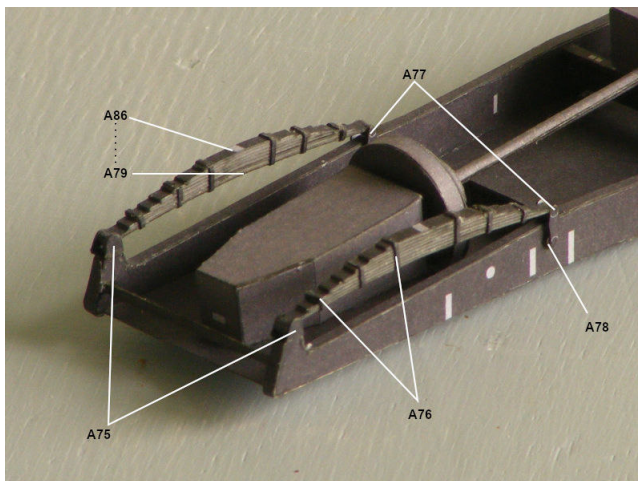
## A. Chassis



Make the right chassis rail by gluing A1 and A2 back-to-back with a card filling to make a total thickness of 1.5mm. Face the front and bottom edges with parts A3 and A4. Do the same for the left-hand rail A6-9 and for the cross beams A11-12, A13-14, A15-16, A17-18 and A19-20. Fit them all on the floor A5 in the positions marked. Note that the middle cross beams A13/14 and A15/16 are not quite vertical, and the markings on A14 and A16 are towards the left-hand side of the chassis. Double the front brace A10 leaving the end tabs free, and fit between the dumb irons at the front of the side rails.

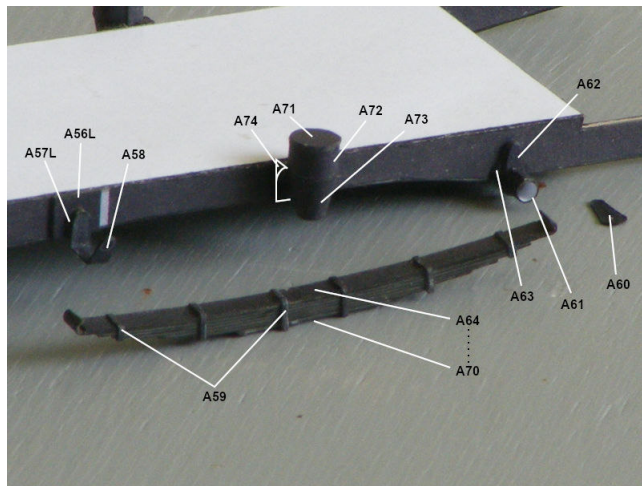


Construct the engine block A21 and flywheel A27-31, and join them using the ring A26. Glue the block to the floor A5. Make up the gearbox A33 and prop shafts A32 and A34, place the front shaft in the holes in the flywheel and gearbox, and glue the gearbox to the cross beams A14 and A16. The gearbox is offset towards the left-hand side of the chassis, but the holes for the shafts should be on the centre line.

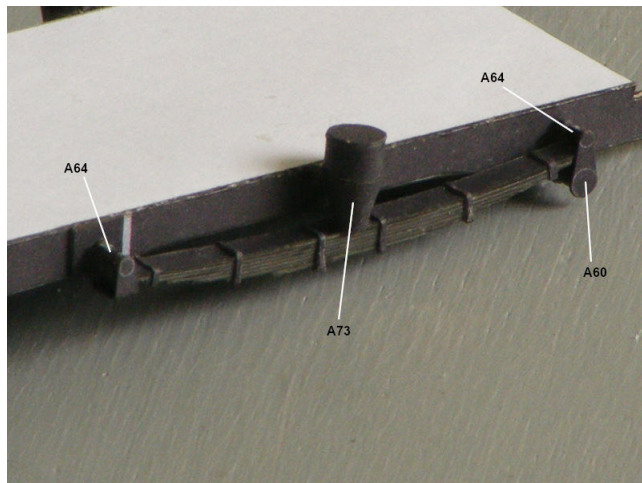


Make two front springs by laminating parts A79-86 together, and shaping them in the former. Wrap the narrow strips A76 around to suggest U-clamps. Curl the ends of parts A79 tightly to make a hook. Fit hangers A75 to the chassis dumb irons, and shackles A77 and spacers A78 to each side of the chassis rails where marked. Glue the springs to the hangers and shackles, ensuring that they stand upright.

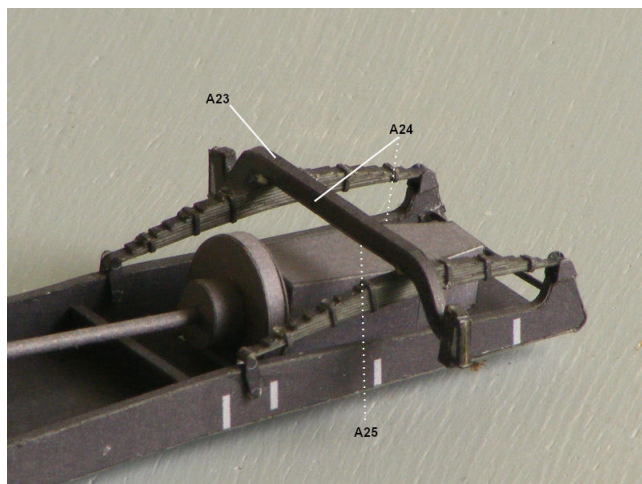




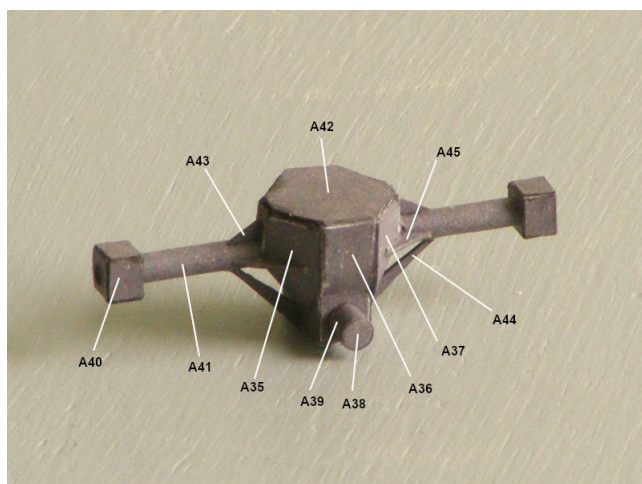
Prepare the rear springs in the same way, with leaves A64-70 and wraps A59. Make the front hangers from A56-58, noting that they are handed because of the tapering chassis rail. Make the rear hanger from A61-63, but leave off the outer shackle A60 for the moment. Assemble the auxiliary volute spring A71-74. Fit all of these to the chassis.



Glue the rear springs to the hangers A58, volute springs A73 and the inner rear shackles A62. Add the outer shackles A60.

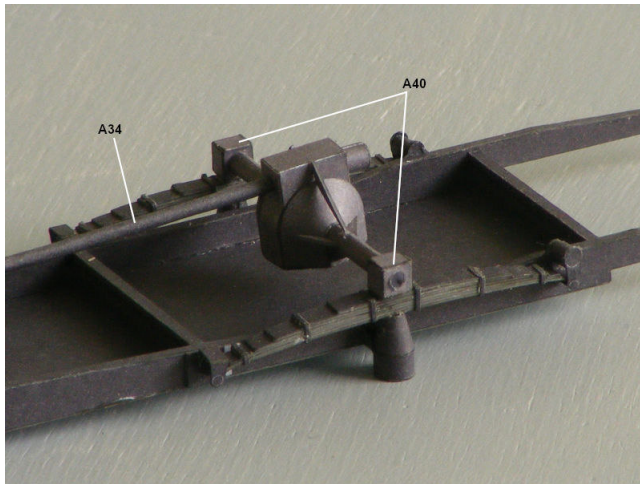


Construct the front axle from two pieces A24 backed with card, and edged with A23 and A25. Fix to the centres of the front springs.

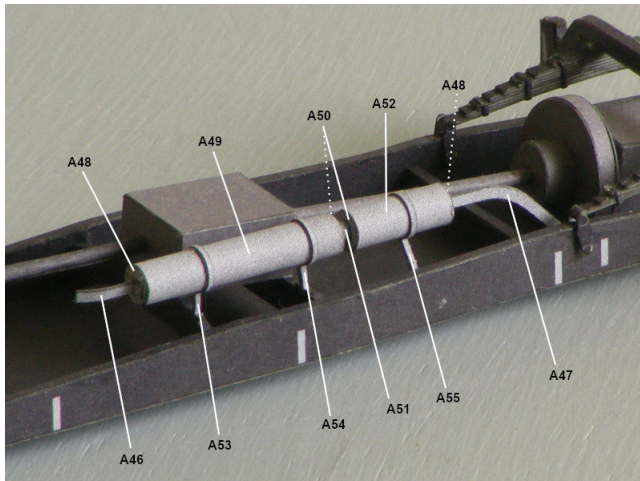


Make the differential and worm gear housing from A35-39 and A42. Roll the axle housing A41, thread it through the differential and fix it centrally. Add bracing pieces A43-45. Make the mounting blocks A40 and glue them to the ends of the axle housing. They should be angled approximately  $5^\circ$  clockwise (as viewed from the right-hand side) of the axis of the worm housing, so that when mounted on the springs the housing is in line with the rest of the drive train.

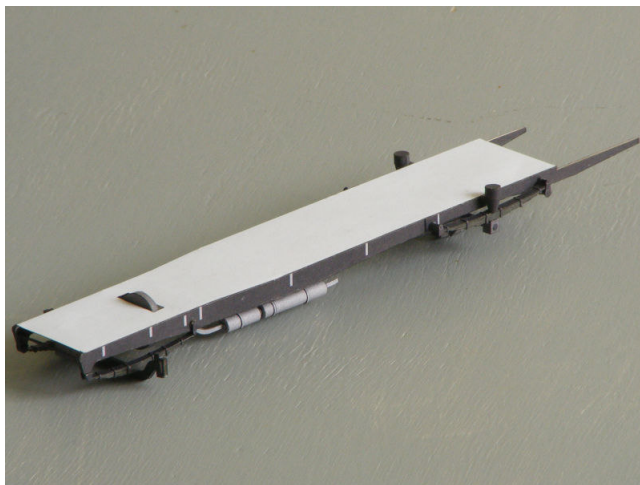




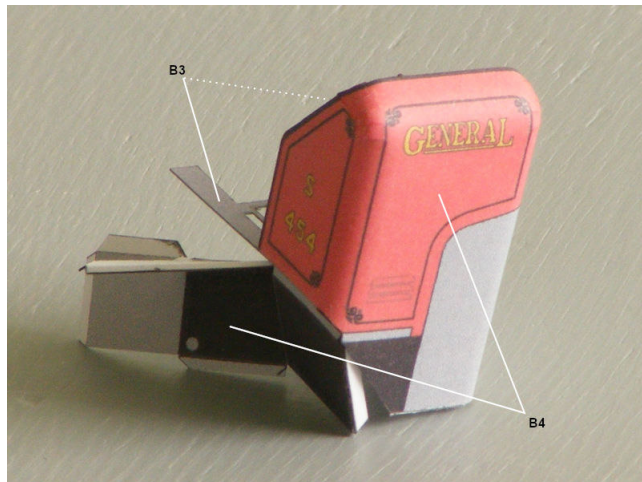
Fit the rear drive shaft A34 into the front of the worm housing, and glue the mounting blocks A40 to the centre of the rear springs.



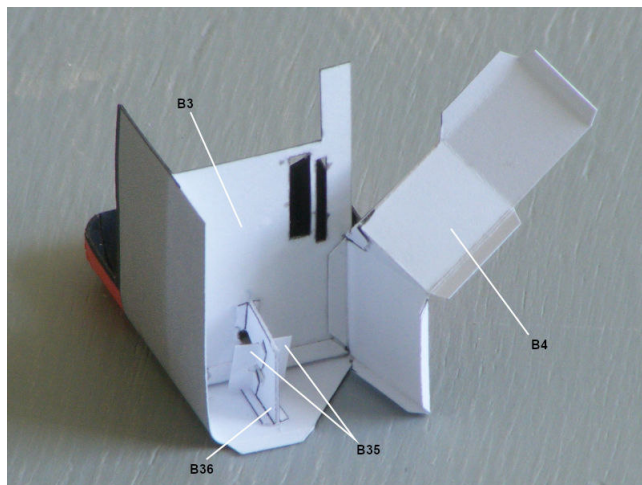
The cylindrical exhaust silencer (muffler) is in two sections, a short front one A52 and a longer rear part A49, each with one A48 end and one A50. These are joined by the short pipe A51. The assembly is supported from the middle cross members by straps A53 and A54, and from the chassis side member by strap A55. The two end pipes are very narrow, so are represented by flat strips A46 and A47. The front end of the main pipe A47 is attached to the floor A5 on the mark close to the flywheel.



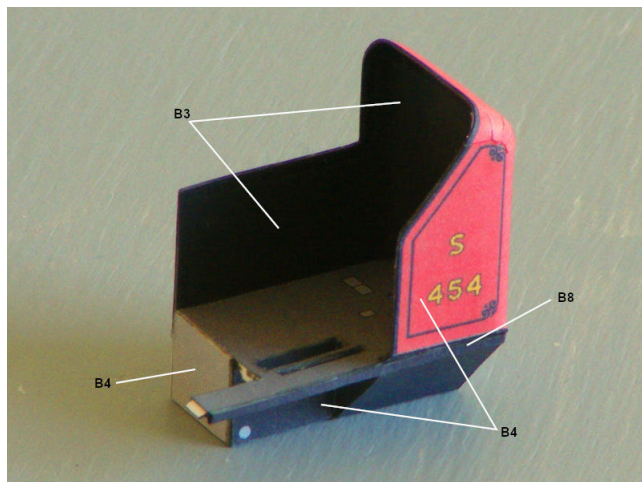
## B. Front End



Start by shaping the rounded edges of the interior of the driver's compartment B3 and forming an open box with the sides and floor. Apply the outside layer B4 starting with the engine side, then wrapping round tightly and gluing the right-hand side. Laminate the curved top and then the "petals" of the corners aiming for a tight but smooth fit.

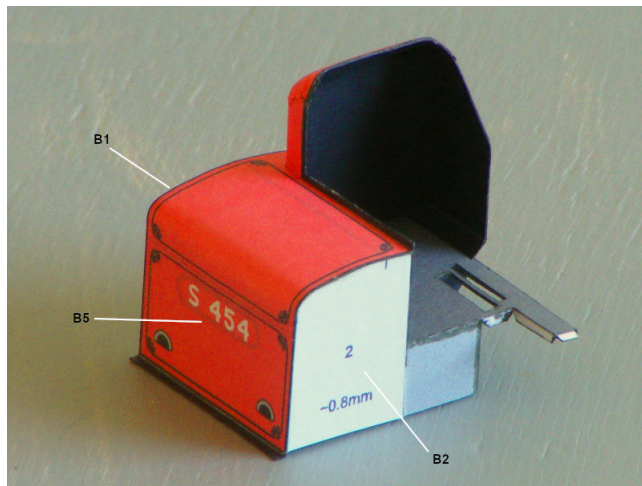


Parts B35 and B36 form underfloor bracing for the steering column beneath the hole cut in the compartment floor. The steering column should rake backwards by about 20°.

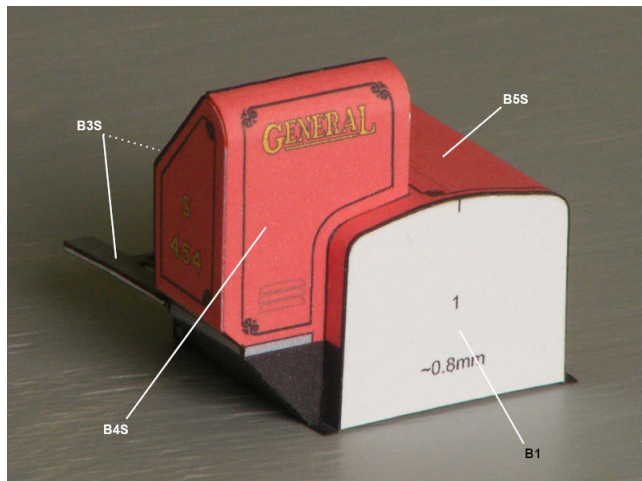


Complete the underfloor section of B4 forming a recess beneath the slots in the floor. Add the floor edging B8.

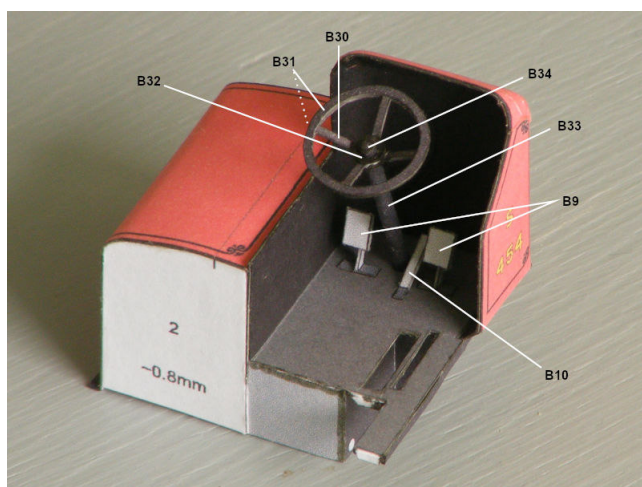




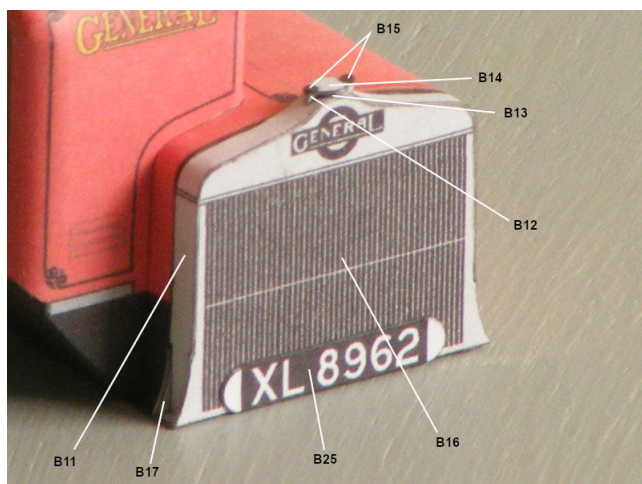
Form the engine cover B5 around the formers B1 and B2 - the second copy of B1 is to form and strengthen the rear edge of the narrow offside (right-hand) section of the cover. Assemble B3/4 and B5.



A simpler version with sharp front edges is also provided, to avoid the doubly-curved top corners. For this use parts B3S, B4S and B5S instead of B3-5.

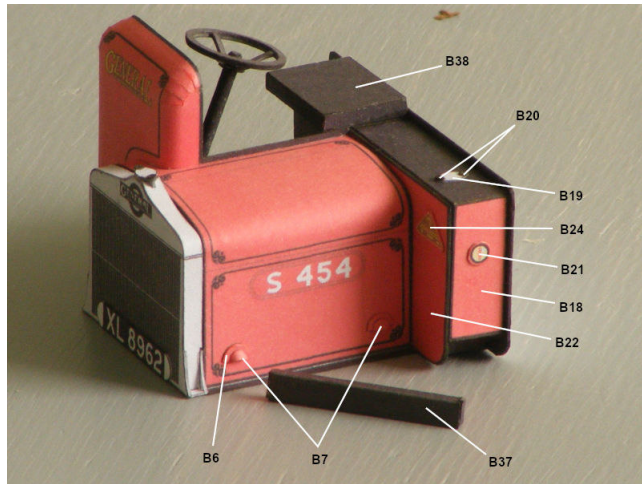


Make the pedals B9 and B10 and glue them to the floor in the positions marked. Make a four-layer sandwich for the steering wheel with a rim B31 on either side of the doubled spokes B30. Dish the spokes and secure in position above and below by the centre rings B32, ensuring that the holes for the steering column are lined up and not obstructed by the ends of the spokes. Roll the column B33, fit the wheel to it, and seal the top with B34. Glue the column into its support bracket.

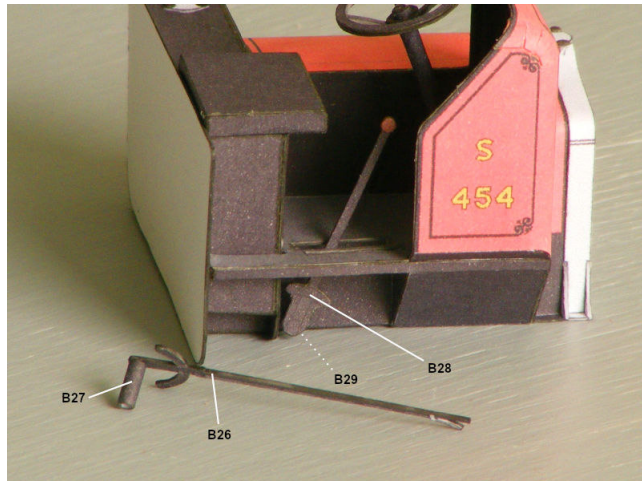


Double the front B16 and back B17 of the radiator, then wrap them with B11, using the former to ensure that the reverse curves at the top are firmly attached. Make up the filler cap from B12-15 and attach. Fit the front number plate B25, then glue the assembly to the front of the engine cover former B1.



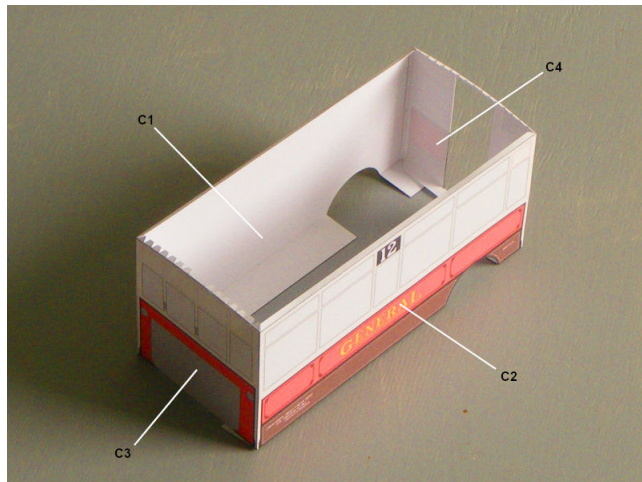


Make two hand grips B6/7 and attach to the engine cover. Assemble the fuel tank cover B18, B22 and B23. Decorate it with the fuel filler B19/20, tax disc B21 and maker's plate B24 and then fix it to the back of the engine cover and driver's floor. Make up the driver's seat B38 and backrest B39. Glue the seat to the top of the fuel tank but reserve the backrest for now.

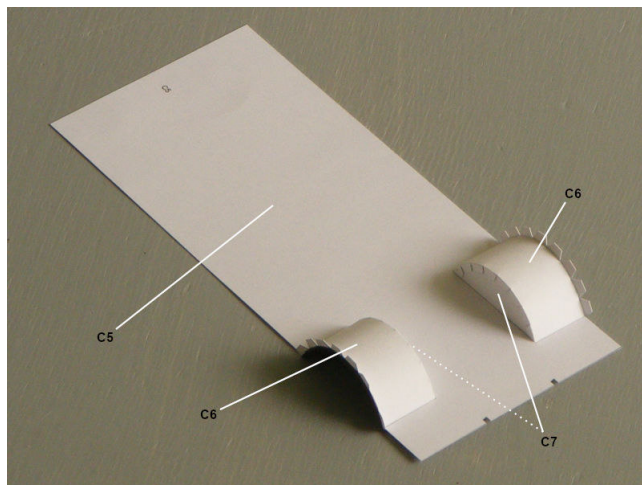


Prepare the handbrake lever B26 and gear stick B28 and roll their mounts B27 and B29 respectively into cylinders. Fix the mounts to the bottom of their levers. Slide the gear stick through the wider slot in the floor and glue the mount to the recess wall beneath, at the spot marked. Reserve the hand brake for the present.

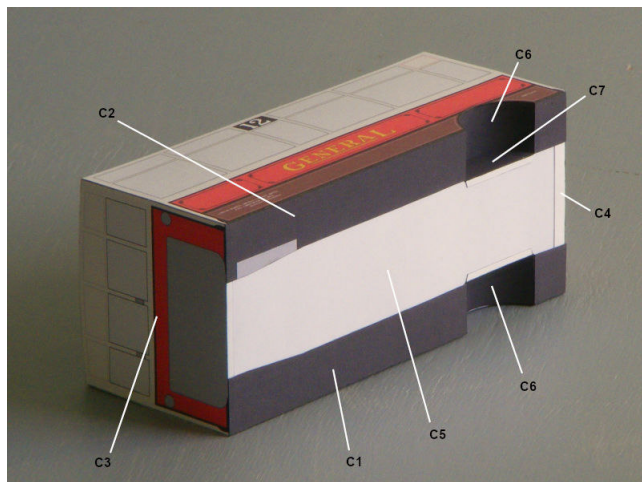
## C. Simple lower saloon



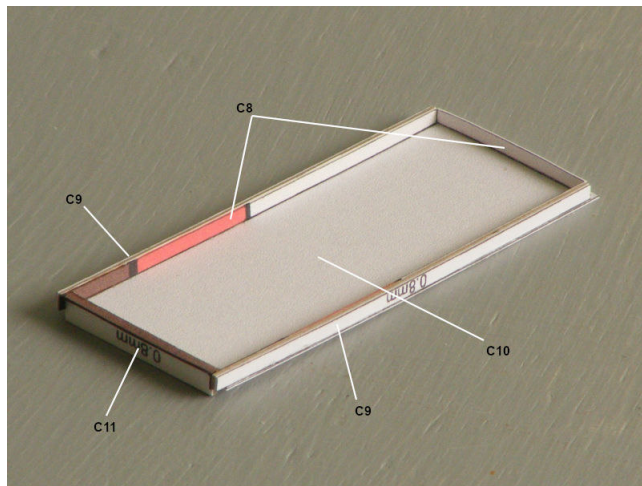
Assemble the sides C1, C2, C3 and C4 into an open box.



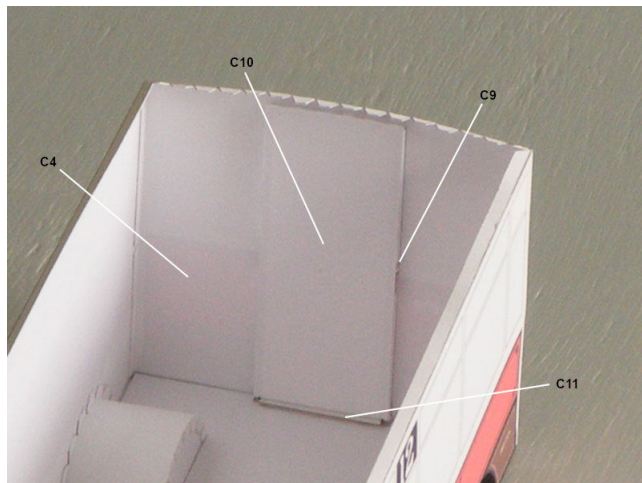
Assemble the wheel arches C6 and C7 and fit in the cutouts of floor C5. Glue the floor to the inside of the tabs on the body ends C3 and C4, and the outer edges of the wheel arches C6 to the sides C1 and C2.



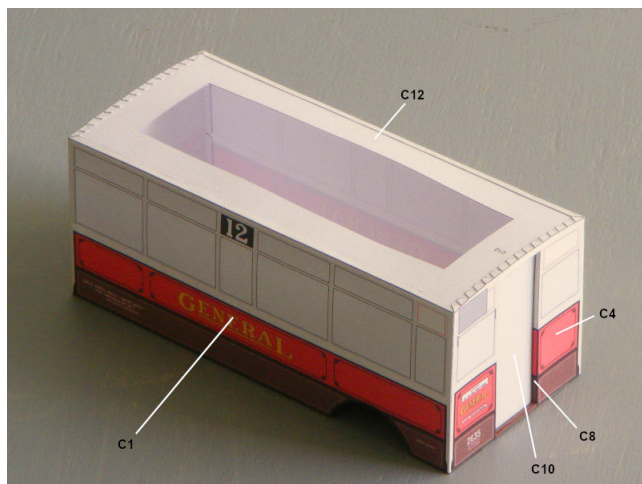
Fold the black parts of the sides C1 and C2 underneath, and laminate to the floor C5.



Thicken parts C9 with card, then glue to the sides of the entrance reveal C8. Fix to the edges of C10, then form the bottom step around the core C11.



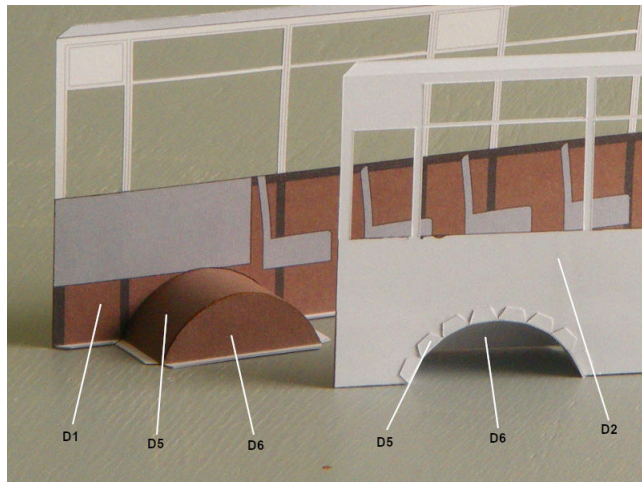
Attach the whole to the inside of the rear wall C4.



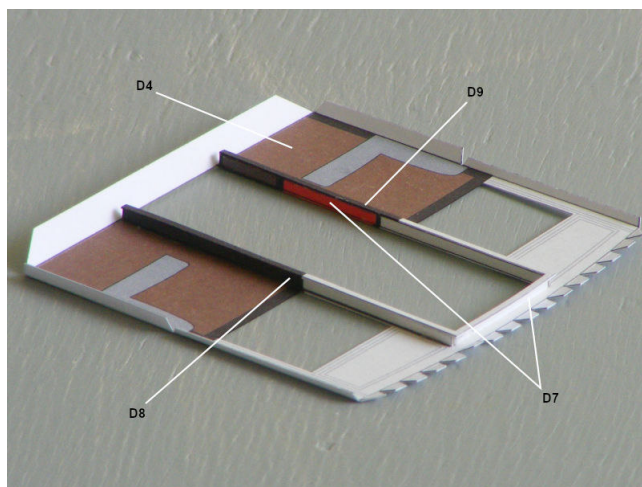
Fit the ceiling C12 to the top of the walls C1-4, beneath the tabs, and ensure that everything is square.



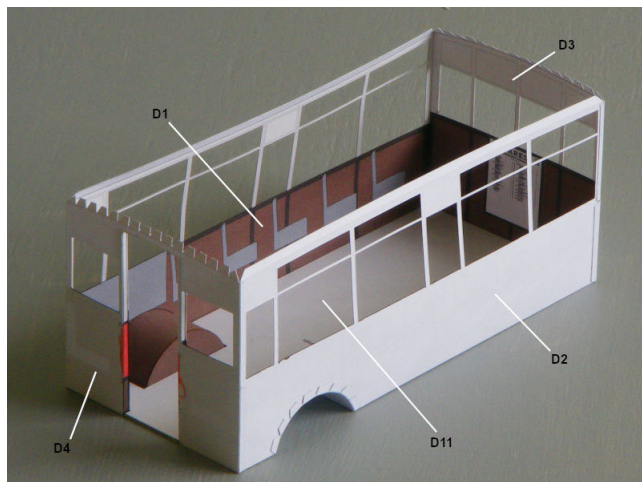
## D. Full lower saloon



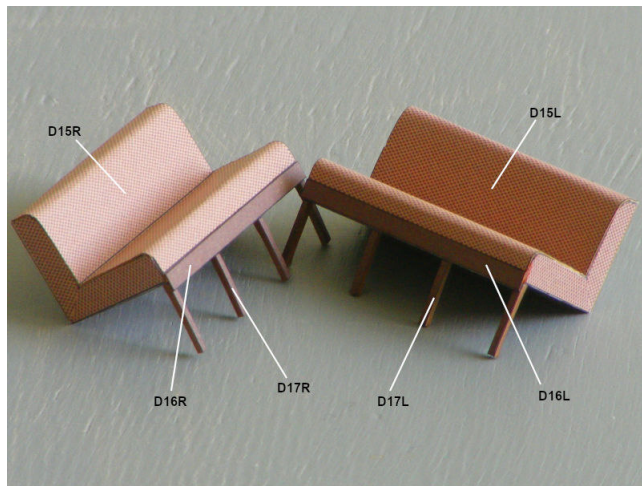
Curve the wheel arches D5, fit the ends D6. Attach to the interior body sides D1 and D2.



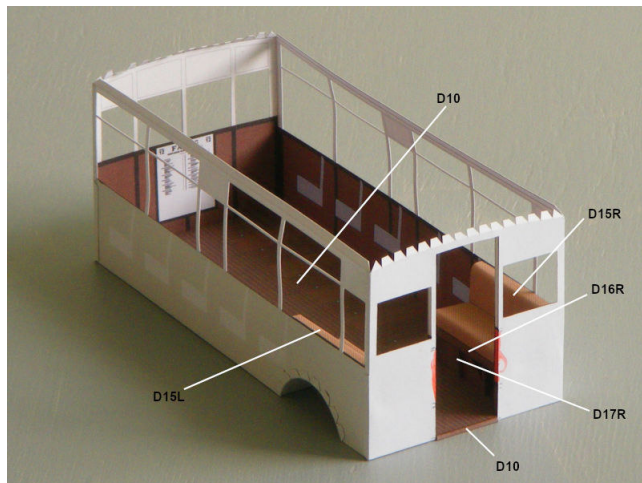
Laminate the door pillars D8 with card, and glue to the reveal D7. Fit this around the opening in the saloon back wall D4, then cover the inside edge with D9.



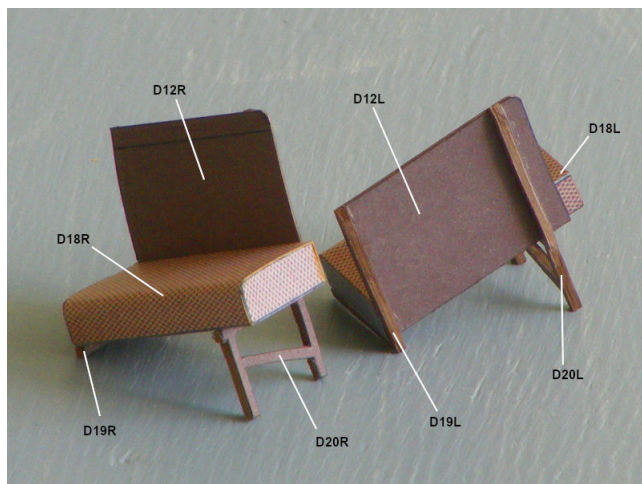
Form a box with the walls D1-4, then fit the subfloor D11 on top of the side tabs.



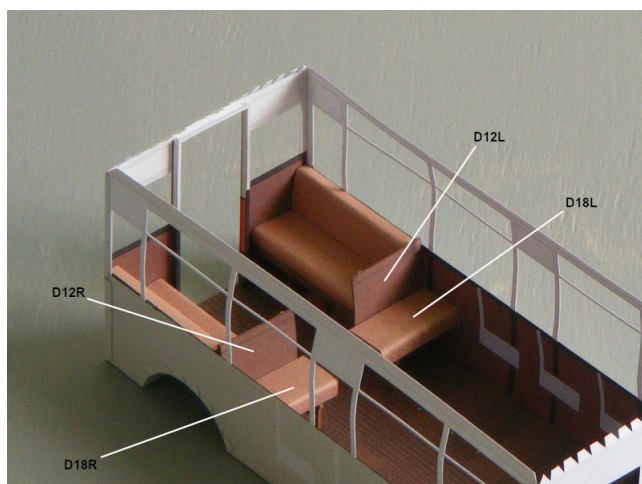
Form the left rear seat cushion D15L, then attach the support D17L using the front rail D16L as a joining strip. Repeat for the right-hand seat.



Fit the saloon floor D10 on top of the subfloor D11, with the rear lip bent down and glued to the back edge. Glue the rear seats to the marks on the saloon sides, rear and floor.

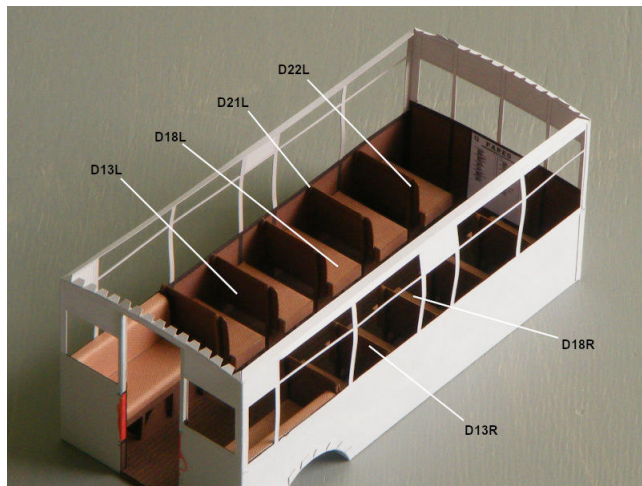


Make the left rear transverse seat using the tall seat backs D12L and frames D19L and D20L, and cushion D18L. Repeat for the right-hand seat using D12R and D18-20R.

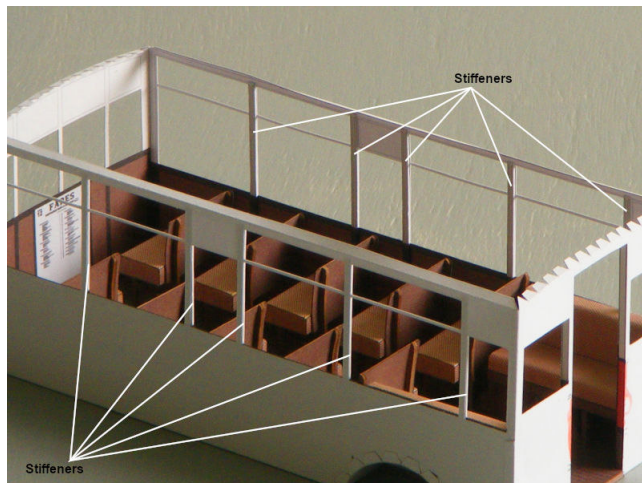


Fit to the marks just forward of the longitudinal seats.

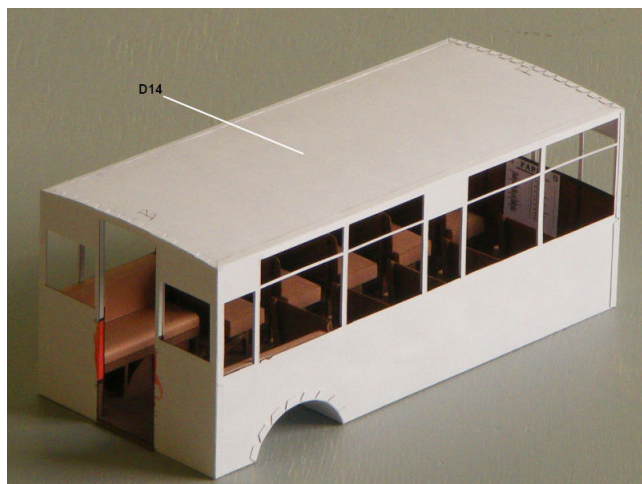




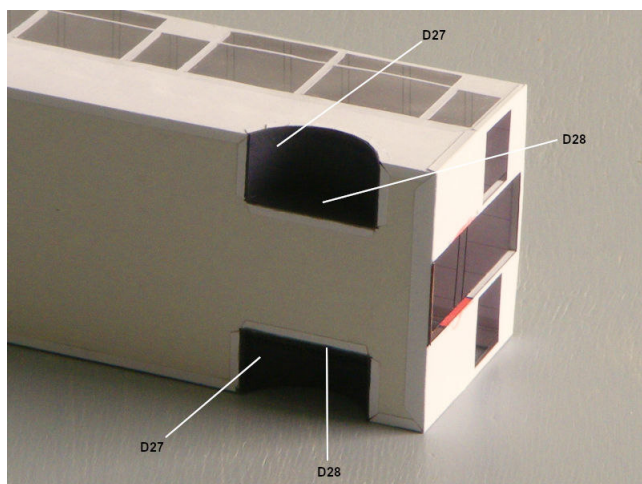
Make the remaining seats using the short seat backs D13L/R and frames D21L/R and D22L/R, and the rest of the seat cushions D18L/R. Fit in the marked positions.



If needed, use the stiffeners provided to strengthen and straighten the window uprights.

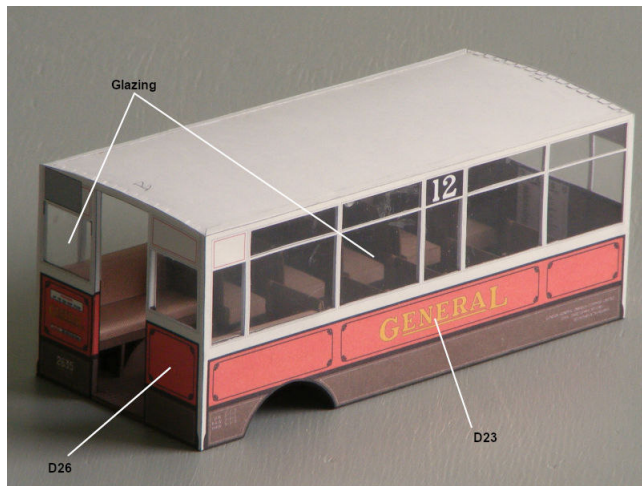


Insert the ceiling D14 beneath the top tabs. The large side window openings should give enough access to allow the tabs to be glued firmly.

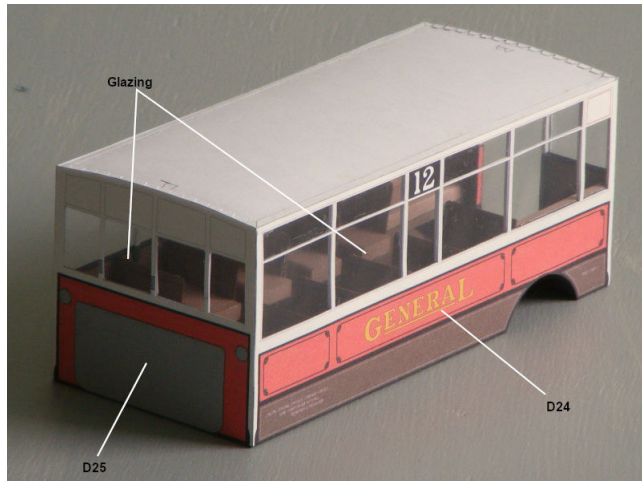


Line the wheel arches with parts D27 and 28.



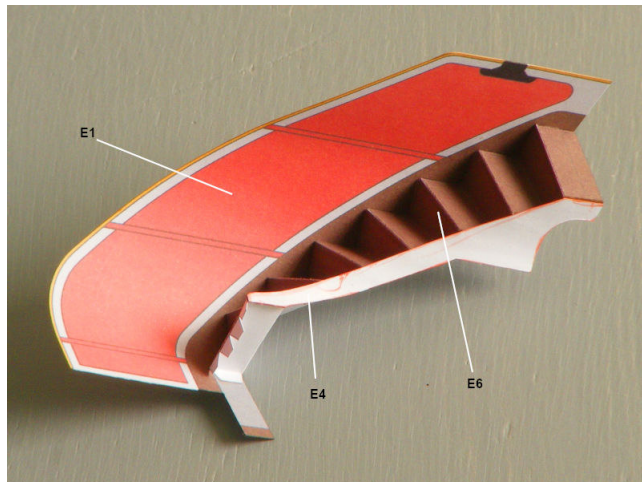


Add glazing, if desired, to the outside of the window openings, then add the outer skin of the saloon, D23, D26, ...

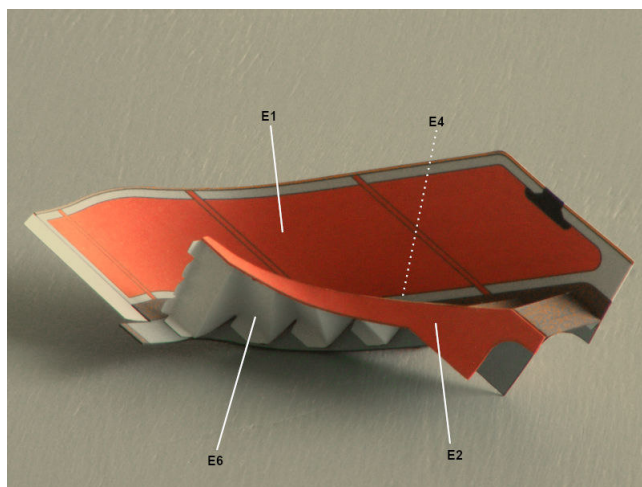


... D24 and D25.

## E. Platform and Stairs



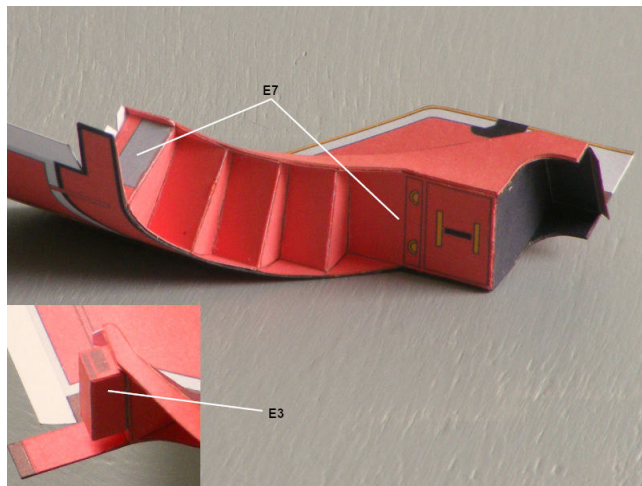
Bend the stair side piece E1 into roughly a quarter circle between the outer two red uprights printed. Fold the steps E6 concertina-fashion, and glue the outer tabs to the stringer at the bottom of E1. Curve the inner stringer E4 and attach to the inner tabs on E6.



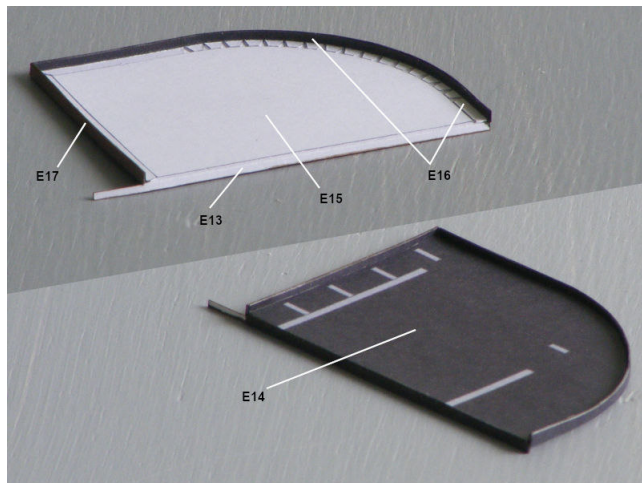
Laminate the inner surface E2 to the stringer E4.



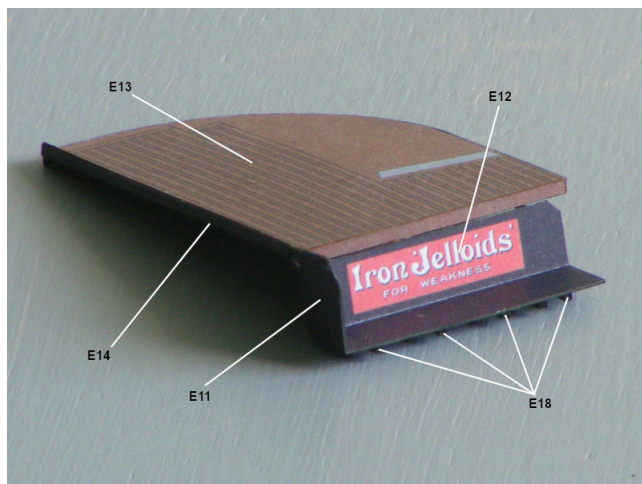
Laminate the outside E5 to E1.



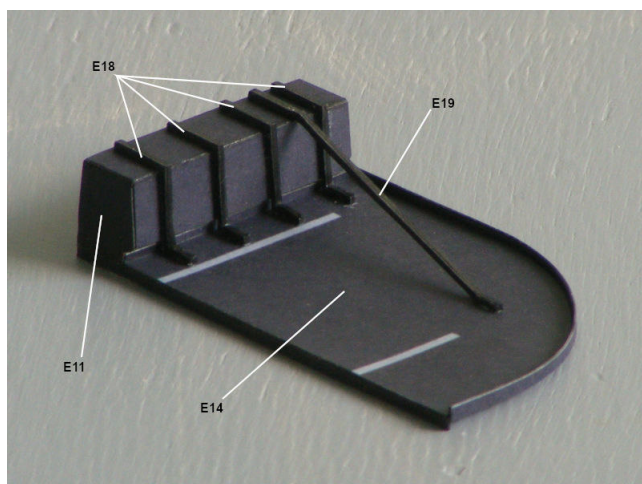
Fold up the underside of the stairs E7 and fit to the stairs E6 and side rails E1 and E4. Make up the conductor's document rack E3 and attach to the back of the top step.



Glue the platform rim interior E16 around the sides and rear of the platform top E13, then add the outside layer E17. Glue the filler E15 to E13 inside the tabs of the rim E17 to form a flat surface on which to fit the platform underside E14.

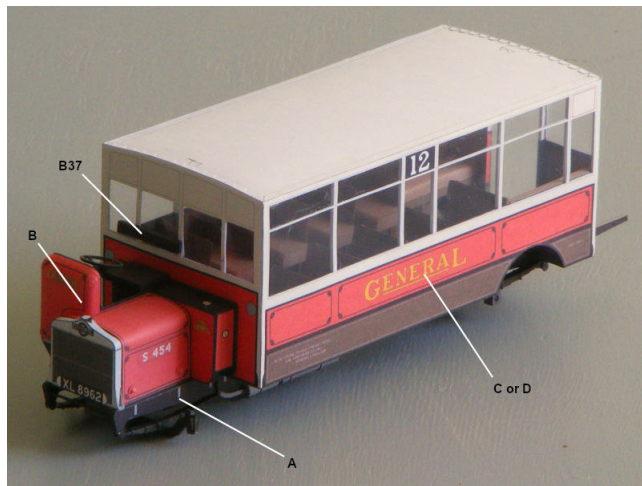


Form the step E12, then apply E11 to the reverse side. Make four brackets E18, fit them to the step E11, then mount the step on the platform underside E14.



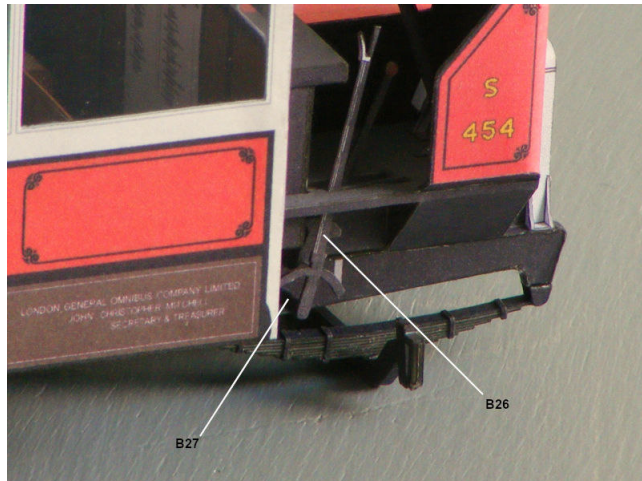
Fit the stay E19 to the underside of the platform E14 and step E11.



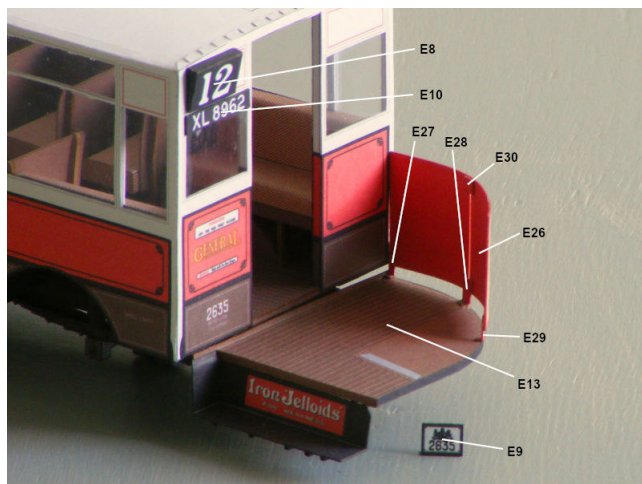


Now assemble the lower deck. Fit the front end assembly B to the front of the chassis A, and then add the lower saloon (assembly C or D). Do not attempt to centre the wheel arch over the rear axle - the axle should be slightly forward of the centre of the opening.

Attach the driver's backrest B37 to the front of the saloon.

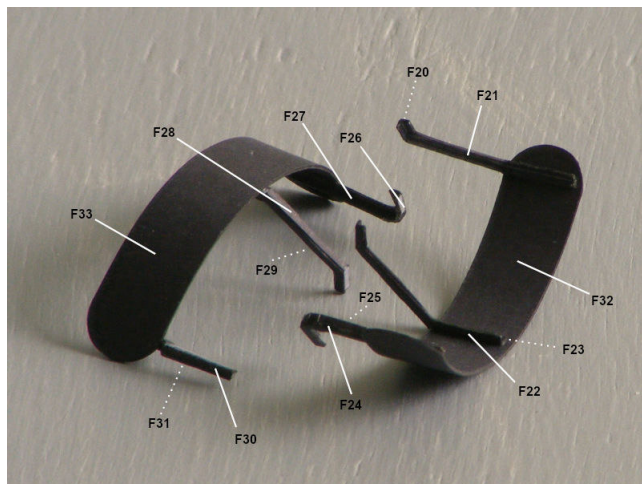


Pass the brake lever B26 through the outer slot in the driver's compartment floor and glue the end of the mounting B27 to the right-hand chassis side.

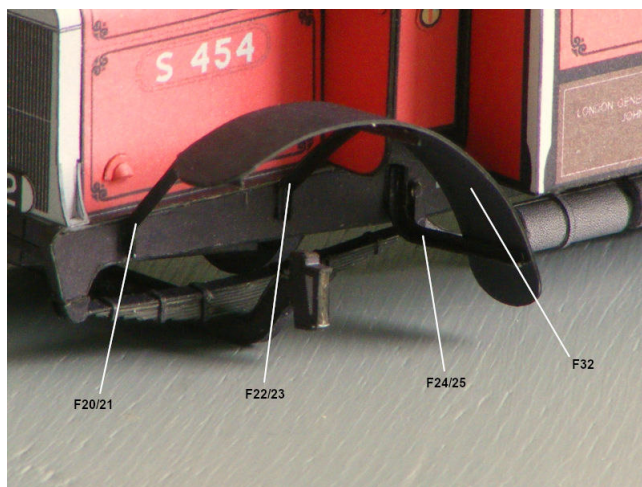


Glue the platform to the projecting chassis rails. Make and fit the route number stencil E8 and number plate E10. Laminate the platform barrier E26, curve it to match the platform edge and add the legs E27-29 and the joiner E30. Fit to the outer edge of the platform E13 and the rear of the lower saloon. Do not attach the stairs or Stage Carriage plate E9 at this point.

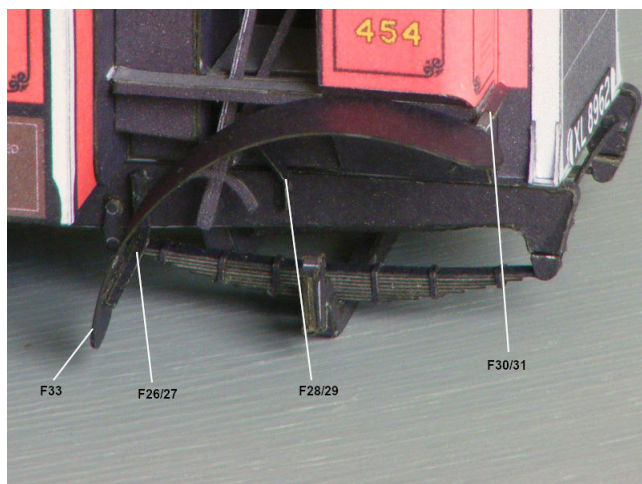
## F. Canopies and Guards



Double and shape the right front mudguard F33. Make up three angle brackets F26-27, F28-29 and F30-31, and glue to the inside of F33 where marked. Prepare the left front mudguard F32 similarly, with brackets F20-21, F22-23 and F24-25.

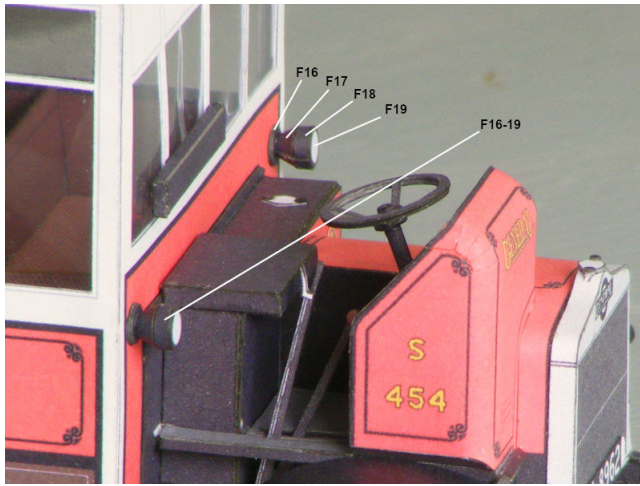


Fit the left mudguard brackets to the chassis side.

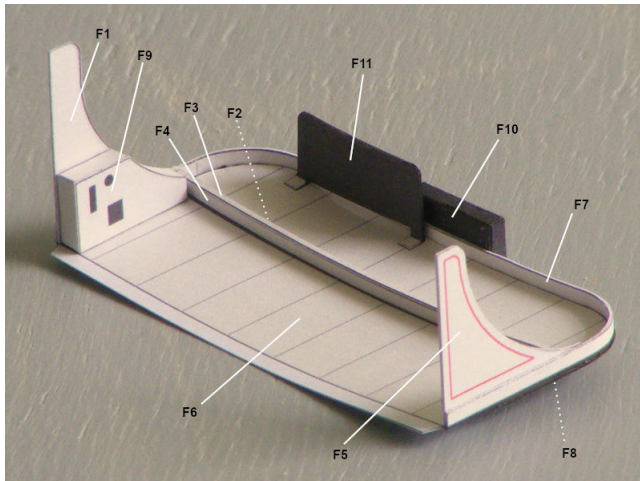


Fit the right mudguard brackets, two to the chassis side and the front one to the front of the driver's enclosure.

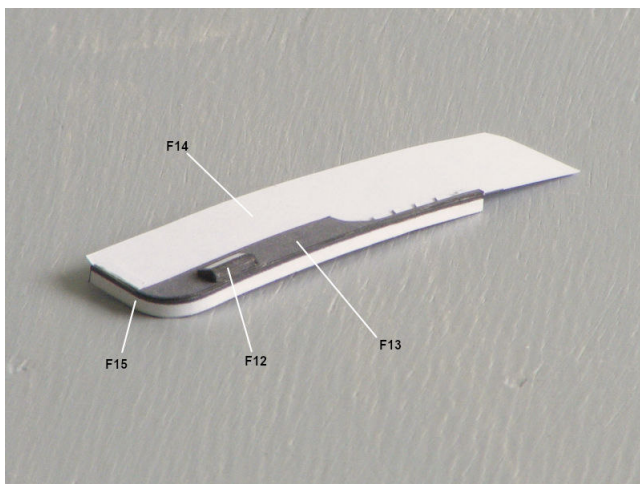




Make up two police lights from F16-19 and fix to the front of the lower saloon.



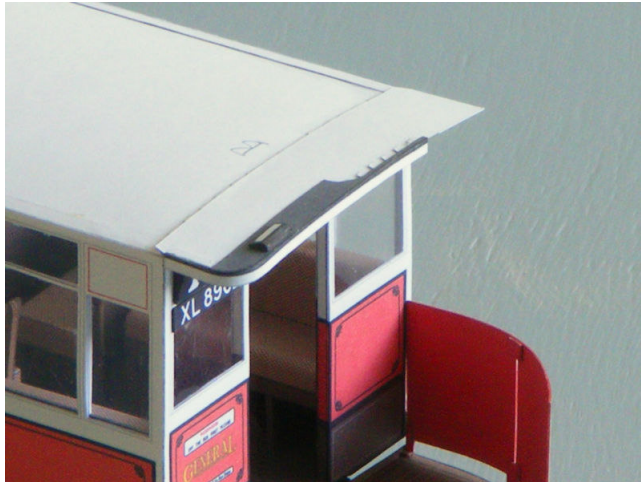
Make the front canopy. Start by doubling the rim F7 then glue it slightly inside the edge of the top F8 - it should be flush with the edge of the central cutout. Add the roof interior F6 to hide the rim tabs, then the side brackets F1 and F5, flush at the back of the rim. Double the roof beam sides F2 and F3 with a card filler, cover the lower edge with F4 and glue between the brackets in the position marked on F6. Make up the switch box F9, sun visor F11 and route box F10 and position as shown.



Double the rear canopy rim F15 and fix it around the edge of the canopy interior F14. Add the top F13. Make up and fit the route board illuminator F12.



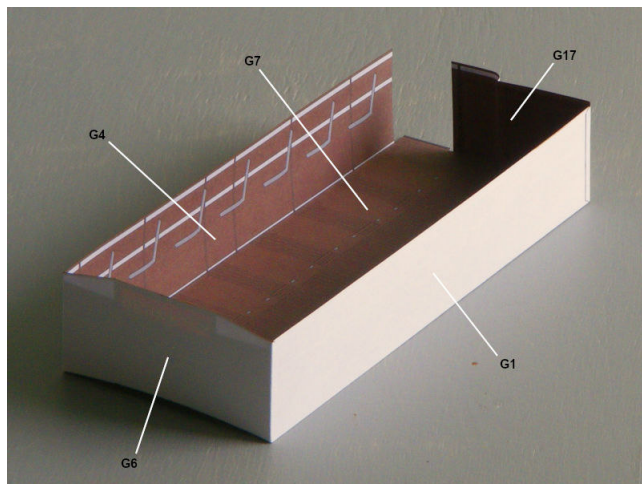
Glue the front canopy to the front of the lower saloon ...



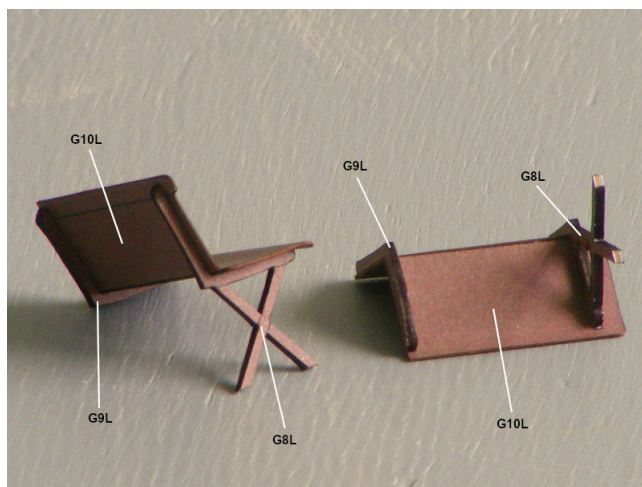
... and the rear canopy to the rear.



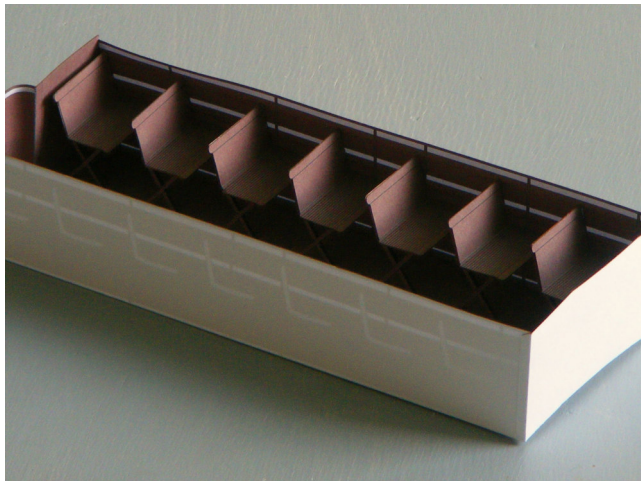
## G. Upper Deck



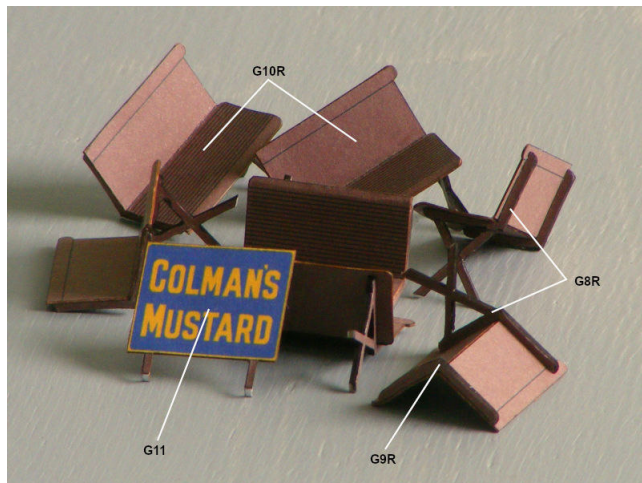
Form the inner box from sides G1 and G4, ends G6 and G17 and floor G7.



Prepare seven left-hand seats, each made up of parts G8L, G9L and G10L.



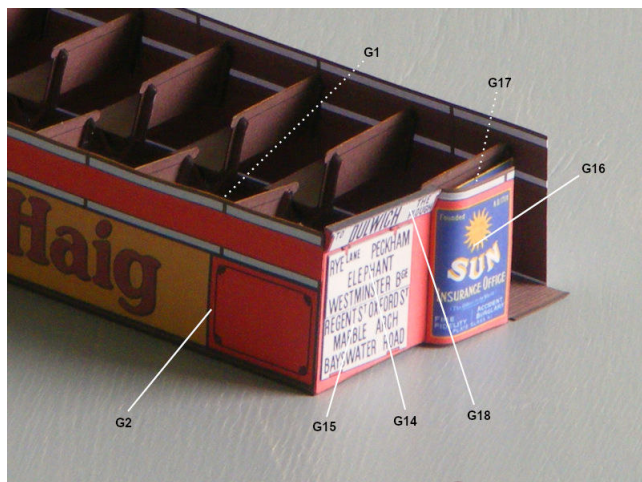
Fit the seats to the floor and left-hand side of the upper deck, on the locating marks. The seat backs should be horizontal, not parallel to the sloping floor.



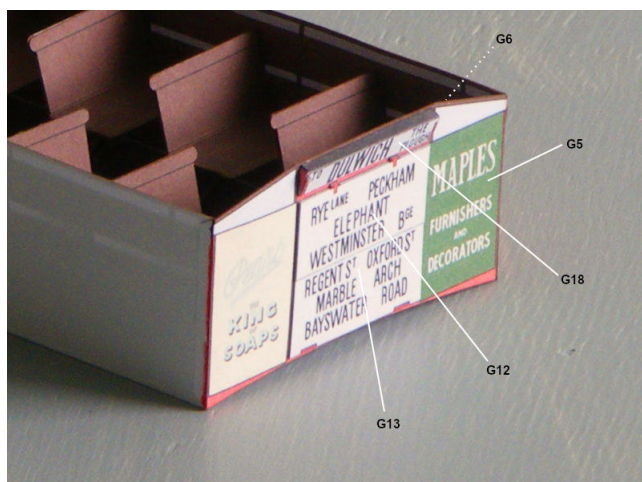
Construct seven right-hand seats from parts G8R, G9R and G10R, and fold and glue the advertising board G11.



Fit the seats to the floor and right-hand side. Glue the advertising board to the floor and to the rearmost seat frames G18R and G19R, ensuring that it stands vertical.



Make up the rear panel G16, with destination box G18 and route board G14 and G15, and layer on the outside of G17. Laminate the left-hand side G2 to G1.



Make up the front panel G5, with destination box G18 and route board G12 and G13. Layer this on the front of the upper deck.





Glue the base of the stairs to the platform, lining up the rear with the rear of the platform, and the bottom step with the slightly angled ends of the printed slats. Check and adjust if necessary the fit of the top of the stairs to the rear canopy and upper deck, then glue the tabs on the top step to the canopy.

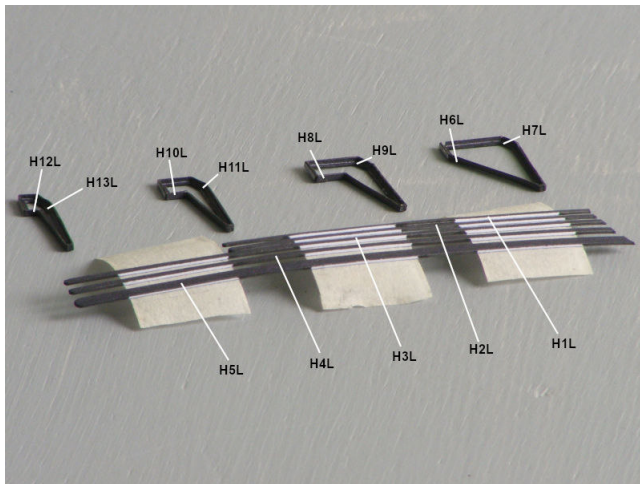


Glue the upper deck to the top of the lower saloon and canopies, and to the tab at the top of the stairs. Ensure that the rear top corner of the platform barrier is inside the stair rail, and glue it there. Fit the Stage Carriage plate E9 to the rear edge of the platform.

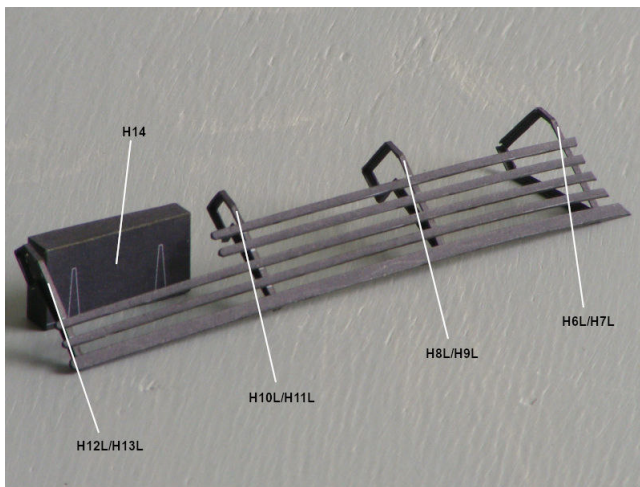


Finally layer on the right-hand side G3.

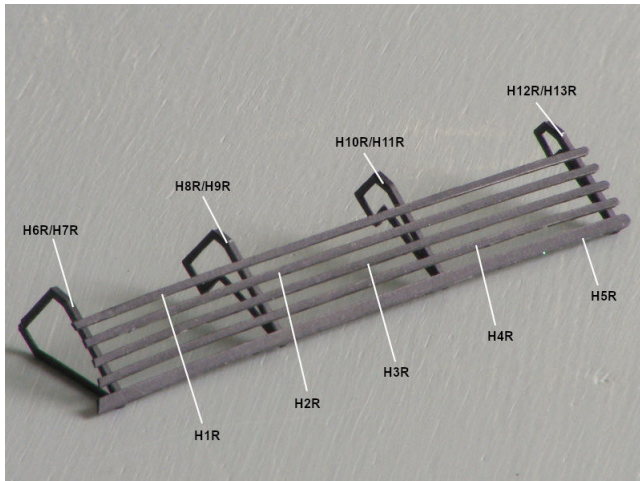
## H. Lifeguards



Form four brackets for the left side lifeguard from H6/7L, H8/9L H10/11L and H12/13L. Do not make the cut in the top corner of H6L and H7L yet so as not to weaken the bracket during construction and fitting to the slats. Double and cut out the slats H1L-H5L. It is convenient to tape them together with low-tack sticky tape to make fitting the brackets easier.

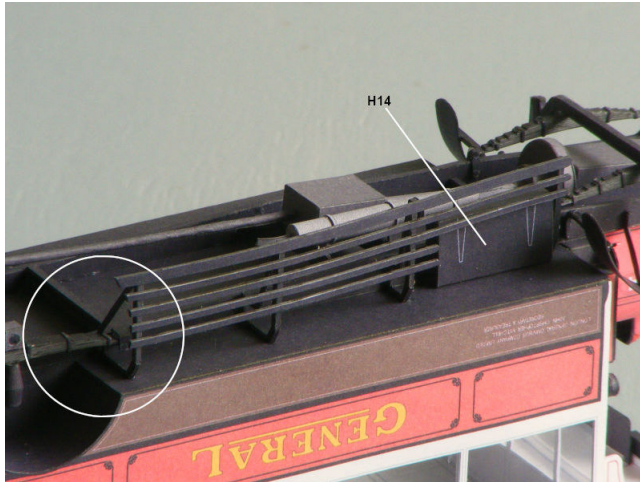


Shape the slats H1L-H5L according to the lines shown on the parts sheet, then assemble everything, matching up the markings on the back of the slats with those on the front of the brackets. Make up the equipment box H14.



Repeat for the right side with parts H1R-H13R.



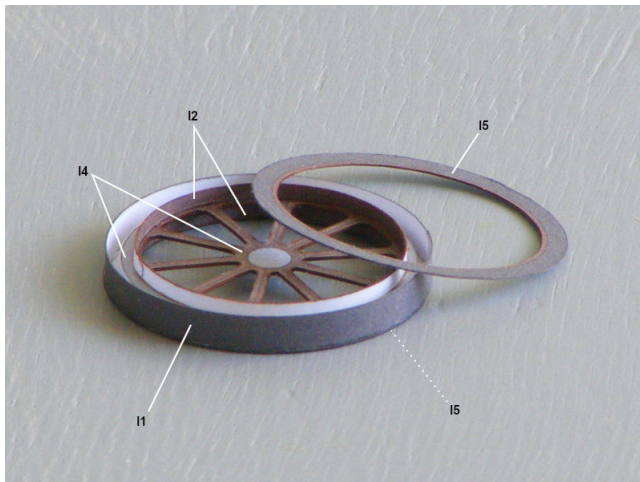


Attach the left lifeguard to the body and chassis. Split the rearmost bracket H6L/H7L at the top corner, as shown on the part sheet, and slide the upright portion between the chassis and rear spring. Glue it to the chassis on the mark just to the rear of the spring hanger. Glue the horizontal part of the bracket to the bottom of the lower saloon. The remaining three brackets are just glued to the chassis and lower saloon in one piece. Fit the equipment box H14 to the chassis and lower saloon in the marked position.

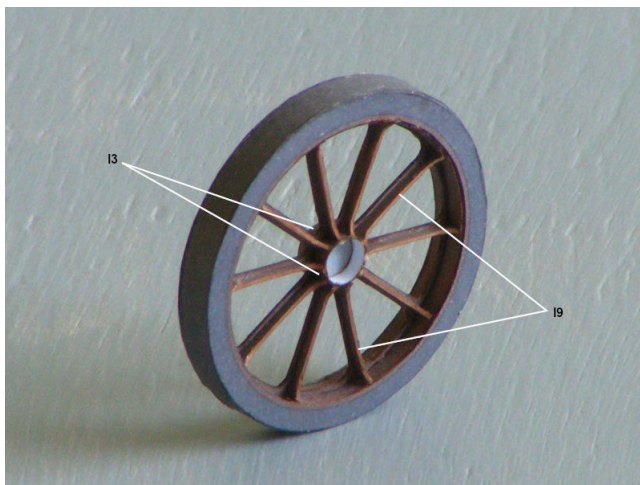


Fit the right-hand lifeguard similarly, but with no equipment box.

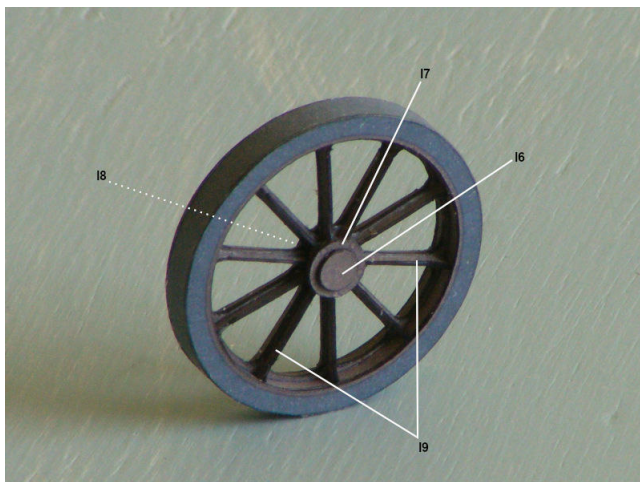
# I. Wheels



Double the front wheel spokes I4 and cut out the gaps. Edge-glue the rims I2 on each side, then the outer sidewall I5. Add the tread I1 and then the other sidewall I5.



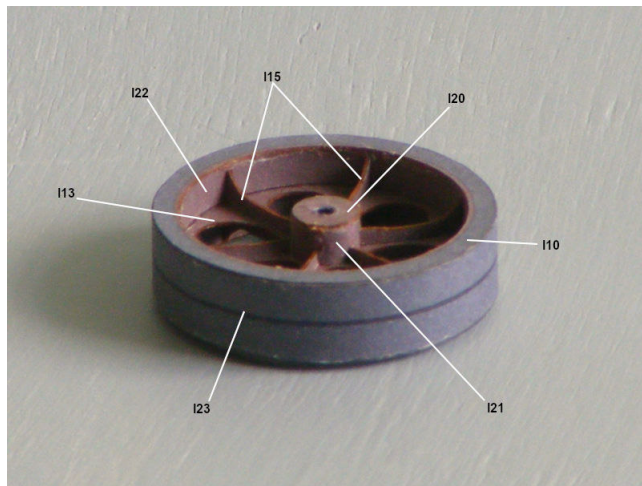
Glue the hubs I3 to the centre of the spokes on each side, then add ten ribs I9.



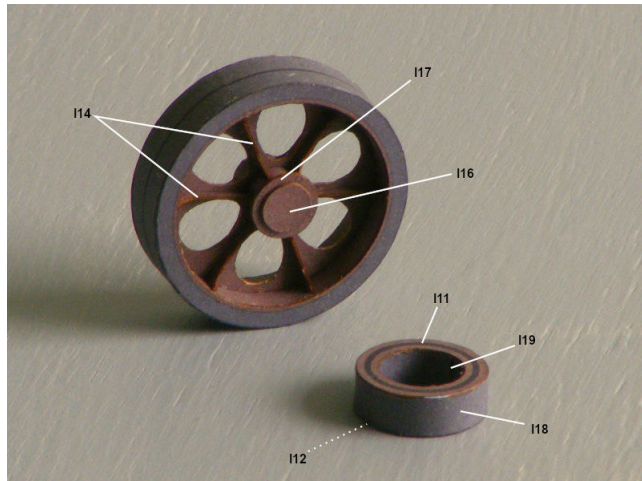
Turn the wheel over and fit the remaining ten ribs. Fit the hub cap I6 and I7 to one side and the end cover I8 to the other.

Repeat for the second front wheel.

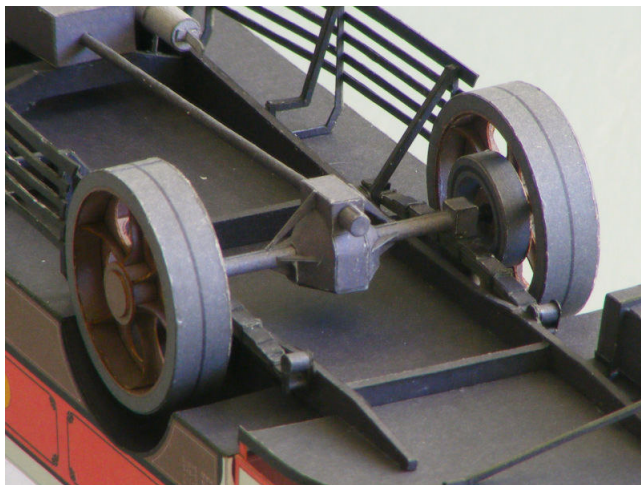




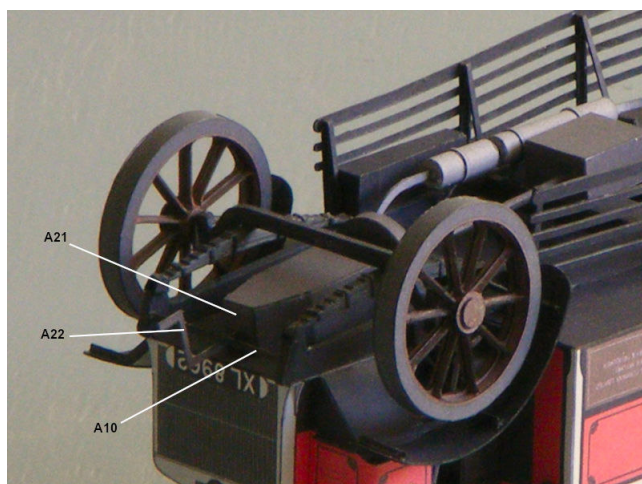
Make the rear wheels in the same way. Start with spokes I13, rims I22, sidewalls I10 and tread I23. Add the hubs I21, then six ribs I15 on the inside of the wheel. The straight end should be next to the hub and the flared end by the rim.



Add six ribs I14 to the other side, followed by the hub cap I16 and I17. Make up a brake drum from parts I11, I12, I18 and I19 and glue to the inside spokes I15, with the brown side I11 showing through to the outside.



Make the rear axle by rolling I24 or from 2mm diameter wood or wire, pass it through the axle housing and fix the wheels to its ends. Note that the wheels are not central in the wheel wells, but offset forward, as in the original.



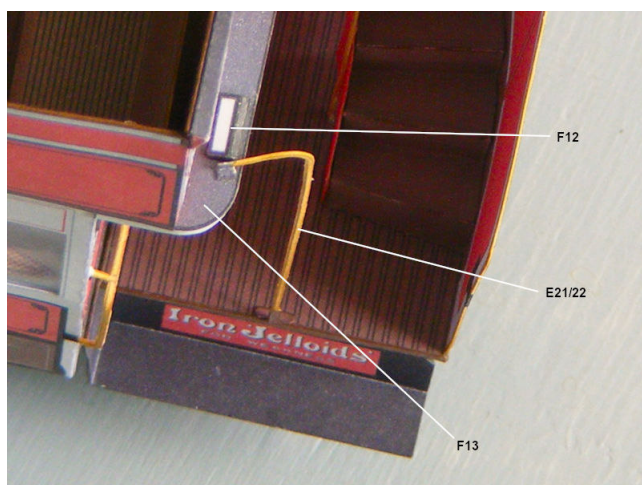
Glue the front wheels to the ends of the front axle beam, ensuring that the model stands level and stable on a flat surface. The wheels should lean slightly outwards (positive camber). Fit the starting handle A22 to the front of the engine block A21 and the chassis cross brace A10.



If desired, fit platform grab rails. They are narrow and fragile, so may be omitted. In order to allow this, their mounting positions are not marked on the supporting parts. Start with the stair rail parts E20 and E23, which are glued back-to-back. Glue the bottom vertically to the inside rail of the staircase as shown, and the top to the top right-hand corner of the upper deck back panel. The intermediate tab may be fixed to the canopy top F13 for stability.



The body rail E24/25 has two brackets with splayed tabs in its centre section. Fix these to the rear panel of the body, lining up the black and red bands on the lower tabs with the corresponding colours on the panel. Glue the bottom end to the rear of the body side, and the top inside the entrance opening.



The central pole E21/22 runs vertically from the centre of the platform edge to the canopy roof F13. The top section is attached to the canopy at a small angle to allow it to avoid the light box F12.



All is done.



