

## **VARSIITY**



Thank you for buying this locomotive kit from Boot Lane Works, please read all the instructions carefully before assembly.

### **Tools & Adhesives**

I recommend a few tools to help you assemble your kit –

- Small Bench Vice
- Modelling Knife (*I use a scalpel*)
- Tweezers, Pliers, etc...
- Needle Files, various shapes
- Wet & Dry abrasive paper (*the mixed selection from Halfords is very good*)
- Selection of small twist drills, including 1.5mm & 2mm diameter
- A 90-degree angle (*I use a set block, but a small set square will work well*)
- Personally, can't manage without my small, tapered reamer, look for them on eBay!  
*TAKE CARE WITH THE REAMER - MAKE A SMALL CUT, TRY, AND CUT AGAIN*

I also recommend the following adhesives –

- Super Glue  
*I use Gorilla Super Glue*
- Dichloromethane, A liquid solvent for the acrylic  
*I use E.M.A. Model Supplies "Plastic Weld"*

### ***A little about the printing process.***

*The printer extrudes a filament of plastic, layer by layer, to create an object. As it does so, it can leave tiny ridges along the object.*

*The printer can also leave a bit of a "squish" from the build-plate and there is usually a tiny "ridge" around the flat surface of the object that was attached to the build-plate.*

*For best results, clean the ridges off with a file.*

### ***THE RESIN PARTS ARE BRITTLE AND MUST BE HANDLED WITH CARE***

*The resin is hardened by an ultraviolet light process but continues to adsorb the light after the process.*

*Please ensure the resin is thoroughly painted to stop the hardening process.*

### ***THE ACRYLIC IS ALSO BRITTLE, CARE SHOULD BE TAKEN DURING CONSTRUCTION***

\*\*\*\*\* **IMPORTANT** \*\*\*\*\*

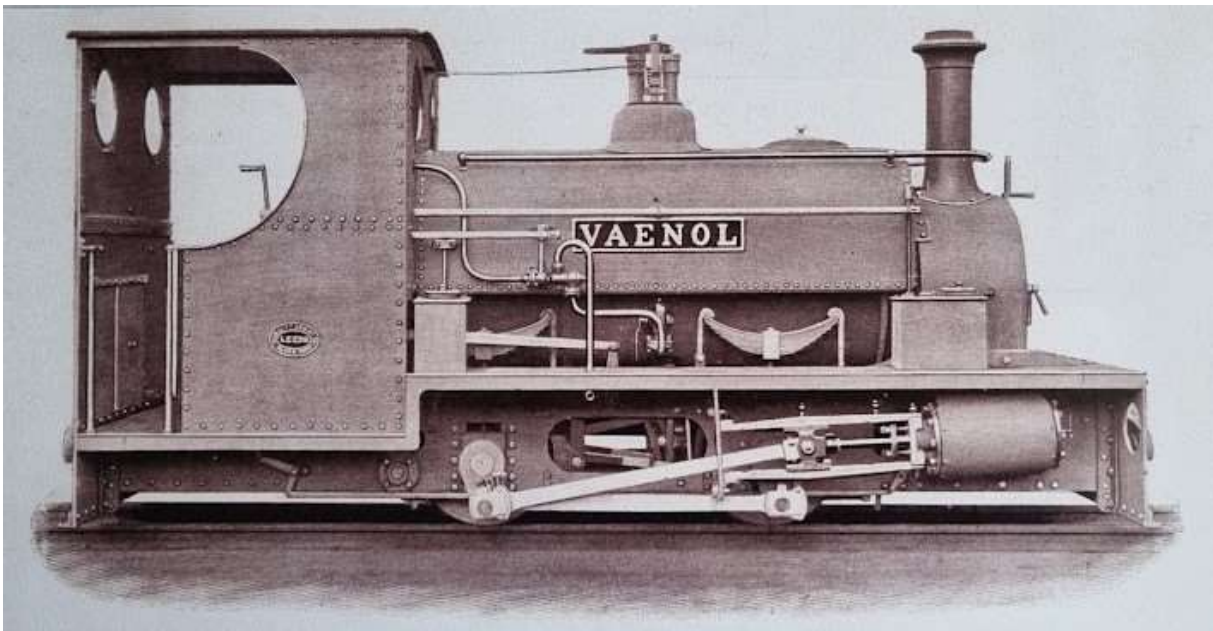
Please bear in mind that this kit, although intended for garden use, is a reasonably small power unit, designed for hauling a handful of wagons or a couple of carriages.

**We DO NOT guarantee this model if used for “Heavy Haulage”!**

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Inspired by the Hunslet Engine Company “Tramroad or Mills Class” VAENOL, built in 1895 for the Dinorwic Quarry Company. VAENOL was renamed “JERRY M” in the early 1900’s.

A second of the class was built in 1898, originally named PORT DINORWIC, it was later renamed CACKLER. Both machines survived into preservation.



This kit is Boot Lane Works first venture into an outside framed prototype and comes with an “idiot-proof” method of quartering the cranks.

*There are two gearboxes provided in this kit -*

*One fits the 3/6v motor supplied with the kit, complete with two M3 5mm securing screws.*

*The second gearbox has a different a fixture mount to fit an MFA 385 5 Pole Motor (6-15v). This motor is not supplied, but the gearbox is included should the customer wish to “upgrade” to the larger motor.*

*Also included is a nylon worm gear that has been bored to 2.2mm to fit the MFA 385.*

*There is ample room in the boiler & under the saddle to fit 8X AA’s, and a remote control of the customers choice.*

*There are included within the kit, a couple of jigs to enable a reasonably easy build, and (I promise you) an idiot-proof system to quarter the outside cranks.*

*Much of the kit is built from laser-cut 2mm acrylic, I thoroughly recommend the use of -*

- *Dichloromethane, A liquid solvent for the acrylic  
I use E.M.A. Model Supplies “Plastic Weld”*

## RIGHT, LETS BUILD A CHASSIS...

We will start with the wheelsets.

Locate the four Peter Binnie 29mm wheels, the two axles (*one already has a grey gear centred on it*), two of the small 1/8" brass top-hat bushes and the two white printed tube jigs with a small hole down the centre.

Take the plain axle and carefully push a wheel onto either end. I use a small, tapered reamer to open the hole in the back of the wheel very slightly, to help the wheel start onto the axle. Be careful, if you are using a reamer, take only a tiny twist...

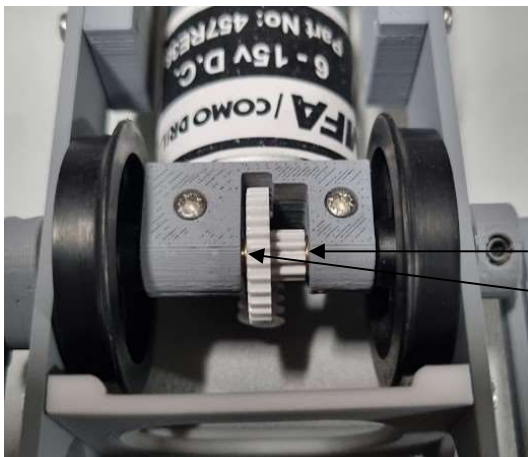
As you push the wheels on, take care to keep them square to the axles. We want to avoid wheel "wobble". I used a small vice to push the wheels onto the axles.

Using the white tube jigs as a depth gauge, push the wheels onto the axle.  
You can use both gauges simultaneously (*as in the image*), or one on its own.

The jigs are the correct depth to ensure that wheels are pushed onto the axle to give you a "back to back" of 28mm. And they will give you equal lengths of axle on each side, on which to mount your cranks later in the build.



The second axle requires a brass top-hat bush be placed either side of the grey gear, between the wheel & grey gear. The lip of the brass top-hat bush must be flush against the grey gear on both sides. Again, use the white tube jig to ensure the wheels are pushed onto the axle to the correct depth.



Locate the two gearbox parts (*there are two gearboxes, choose the correct one for the motor you intend to use*).

The two halves of the gearbox are held together with two M2 8mm panhead screws.

Clamp the two gearbox parts over the axle. The two, brass top-hat bushes are clamped up against the grey gear with the lips visible between the grey gear and gearbox.

Do not attach the motor yet, it's much easier to build the motion without the constraint of the motor.

Next, you need to press the cranks onto the crank bushes.

Locate the four bushes, four M3 grub screws, four white printed cranks & the Allen key supplied. A few spares have been provided.

Using a vice, squeeze the bush into the crank.

The hole for the grub screw in the bush needs to align with the hole in the crank. I did not use any adhesive to attach the crank to the bush, it was just a push fit.

After testing, my cranks have not moved on the bushes, but it's obviously a possibility, and you may wish to use an adhesive?

## CRANKS

Once you've pushed the bushes into the cranks, you need to locate two 12mm & two 10mm conehead M2 screws.

Fix the screws into the cranks, the two longer screws will become the longer crankpins for the rear wheelset, the shorter, for the front wheelset.

I painted the cranks before fixing the screws.



## LET'S PUT THE FRAMES TOGETHER

Locate the cylinders blocks, these are helpfully marked with an "L" & "R", you will also need the cylinder-head covers.

Ensure that the 2mm brass rod passes freely through the centre of the cylinders. I also take the time to ensure that the 2mm square brass rod will fit in the slidebar runner on the rear of the cylinder.

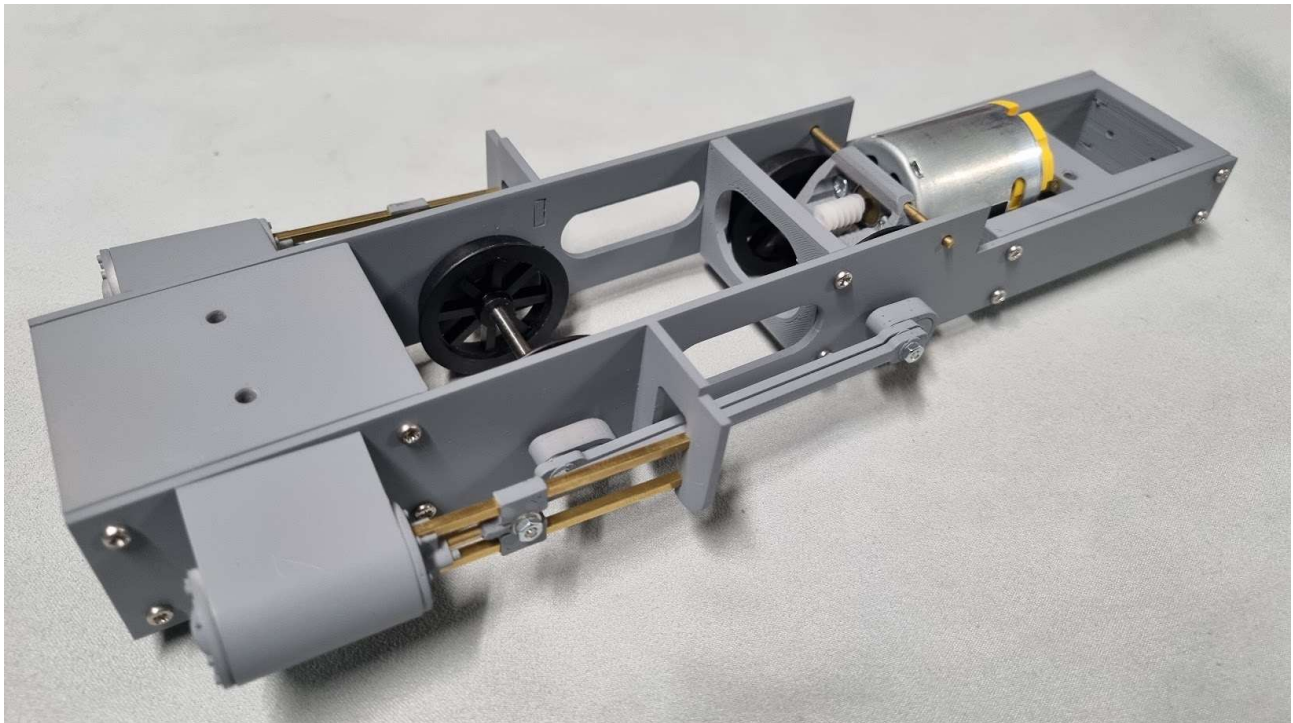
Glue the cylinder-head covers on the cylinder blocks.

I also cleaned and painted the cylinders before attaching to the frames.

*Actually, I covered the cylinders with same very thin styrene sheet. In fact, I also covered the smokebox, firebox & saddle-tank with the same styrene...*

Take both acrylic main frames, and the two acrylic motion brackets.

Glue (suggest Plastic Weld) a motion bracket to each frameplate, ensure you build a matching pair of left and right.



The above image shows a completed chassis. (*Larger MFA 385 motor fitted in all images*)

Note the motion brackets on each frameplate, and the correct orientation for the bracket, top & bottom.

I painted the frameplates once the brackets were in place.

Next, screw the cylinders to each frameplate. These are attached with four M2 8mm panhead screws (two each cylinder).

I have designed the whole loco to allow the screws to “self-tap” into the white filament printed part. However, you can, if you wish, tap out the holes first, before using the screws.

With the cylinders attached to the frameplates you can now attach the stretchers.

There are three stretchers in total -

One for the front, the front of which is identified by the two screw holes for the front buffer-beam.

One for the rear, again there are two holes for the rear buffer-beam.

A centre stretcher. This is almost cosmetic but does add a little rigidity. *This NEEDS to be placed the correct way around, otherwise it will foul the rear wheelset tyres.*

The recessed side faces towards the rear of the locomotive.

Attach the front & rear stretcher to one of the frameplates using the M2 8mm panhead screws. To make life a little easier, I slid the centre stretcher into place after I had the chassis together.

With one side and stretchers together, the wheelsets need to go in.

Place a brass top-hat bush on each axle end with the lip up against the wheels.



#### NOTE

The wheelset with the gearbox must go in the correct way round, rotate it on the axle and ensure that the 2mm holes in the frameplates & gearbox align.

*The image shows the gearbox mounted with a length (50mm) of 2mm brass rod.*

Finish off by, by attaching the second frameplate to the whole assembly.

## BUILDING THE MOTION

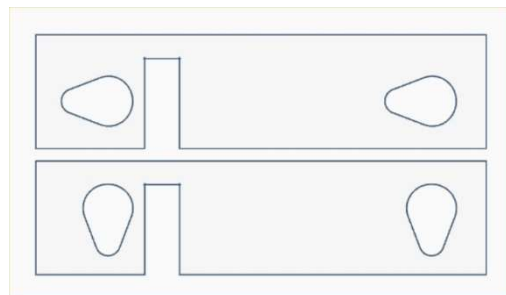
With a smooth rolling chassis, you can now attach the cranks.

Place the cranks on the axle ends, the end on the axle will need to be flush with the bush in the crank. attach the cranks on one side and tighten the grub screws. Now attach the cranks on the other side, but do not tighten the grub screws.

### QUARTERING JIGS

Locate the quartering jigs, these are cut from 2mm acrylic, there are two jigs with the cranks cut away and slots to clear the motion brackets (*right*).

The jigs are set to the locomotive wheelbase and will fit over both cranks on one side of the engine.



Use the jig with the cranks set horizontally on the cranks you have already tightened.

The other jig will slip over the other side and loose cranks. Because the crank cut away is upright, the grub screws should be accessible on the underside of the chassis to tighten up.

With both jigs on both sides, the cranks MUST be quartered correctly. Although fiddley, with both jigs in place, all grub screws should be tightened, and the model will be properly quartered.

**KEEP THESE JIGS SAFE - THEY WILL COME IN HANDY IF YOU EVER NEED TO SERVICE YOUR MODEL IN THE FUTURE**

## SLIDEBARS

Cut the 2mm square brass rod into 50mm lengths and fixed into place between the cylinders & motion brackets.

A tiny amount of glue will be necessary to secure the bars.

*(The slidebars in the image are longer than 50mm and are protruding from the rear of the motion bracket)*



Locate the following –

Two coupling rods (*the shorter rods*)

Two connecting rods (*the longer rods*)

Two crossheads

Two M2 8mm coneheads screws

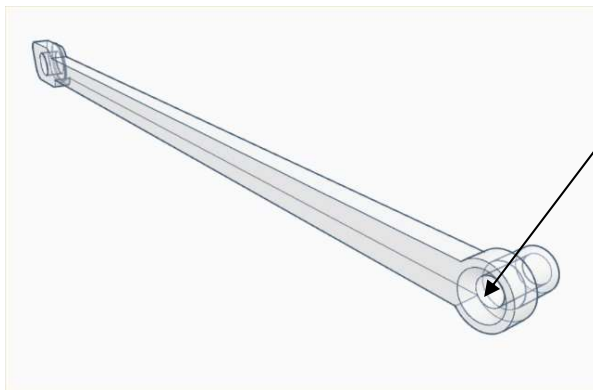
Six M2 nuts

Six M2 washers

Four white ABS tubes (*two long & two short*)

2mm brass rod, cut to two 38mm lengths

Once again, I painted all the components prior to assembly.



Create a better countersunk hole in the rear of the connecting rods, small end.

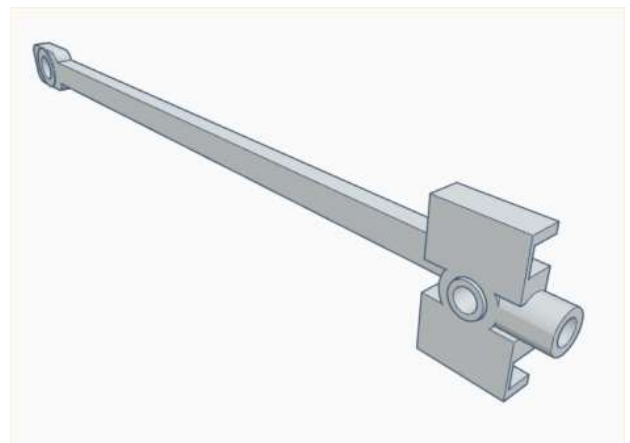
*(Unfortunately, it is very difficult to get a better countersink on the printer).*

Fit the M2 8mm conehead screws into the countersunk hole, try and get the head of the screw flush with the back of the connecting rod.

Fit a 38mm length of brass rod into the crosshead, you may need a dab of glue to secure it into place. Do not push the brass rod too far and block the hole for the connecting rod.

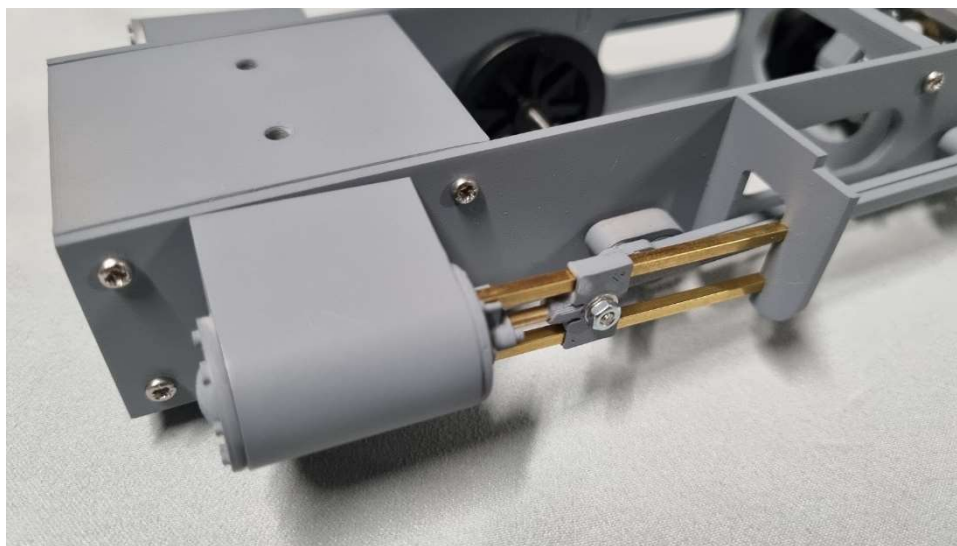
Place the crosshead over the connecting rod, then a washer and finally a nut to attach the crosshead to the rod.

Once tight, the crosshead should move freely on the connecting rod.



Place a washer over a crankpin, this washer will keep the rods off the cranks and stop them fouling as the wheels rotate. Now drop an ABS tube over the crankpin. The long ABS tubes for the rear crankpins, the shorter tubes for the front.

With the ABS tubes over the crank pins, the coupling rods can be dropped over and the M2 nuts to captivate the front crankpins. All the rods have a small boss printed into one side; the boss should face outwards.



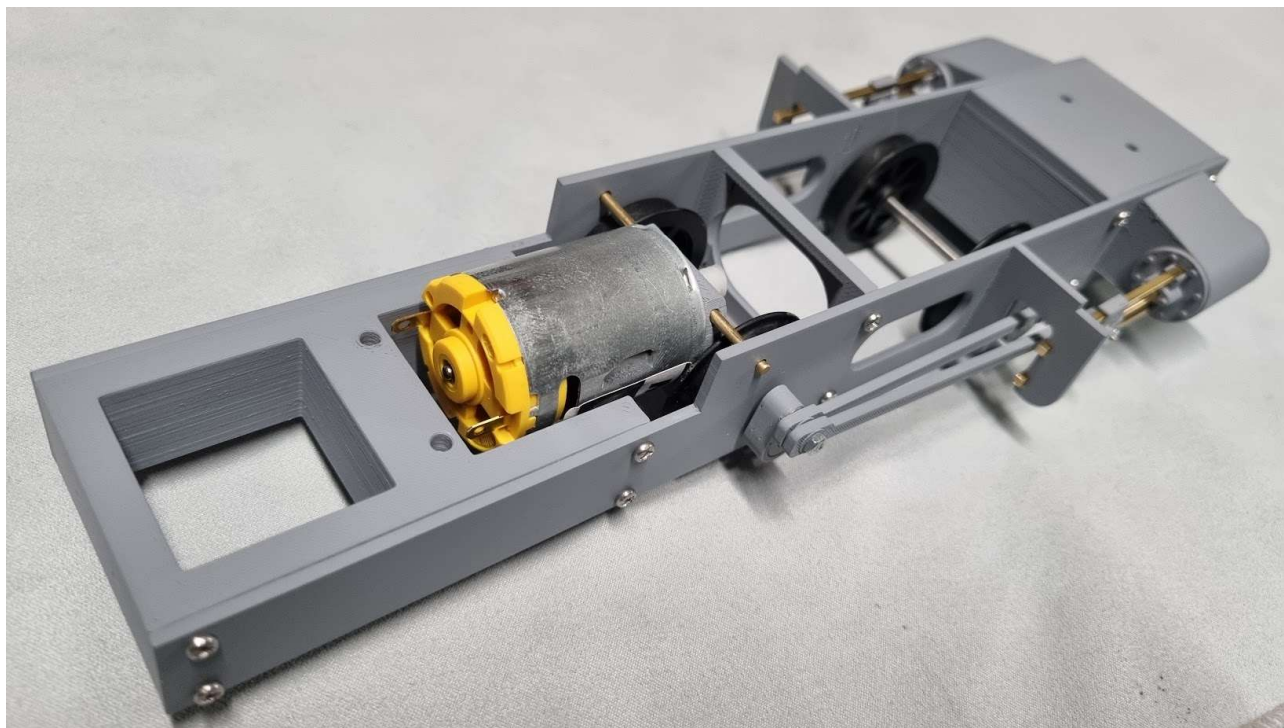
The rear cranks will also require the coupling rods fitting.

You will need to feed the crossheads onto the slidebars, and at the same time the piston rod into the cylinders.

It's a little tricky, but once done, you should have a rolling chassis.

With a smooth-running chassis, fit the motor using the two M3 5mm screws (*if using the 3-6v motor supplied*). The motor gearbox assembly is held in place by a 50mm length of 2mm brass rod.

**A LITTLE OIL ON THE GEARS AND ALL BEARINGS WILL WORK WONDERS FOR THE MODEL LOCOMOTIVE – BOTH FOR SMOOTH RUNNING AND LONGEVITY OF THE GEARS, ETC.**



You should now have a solid chassis on which to build the rest of your locomotive.

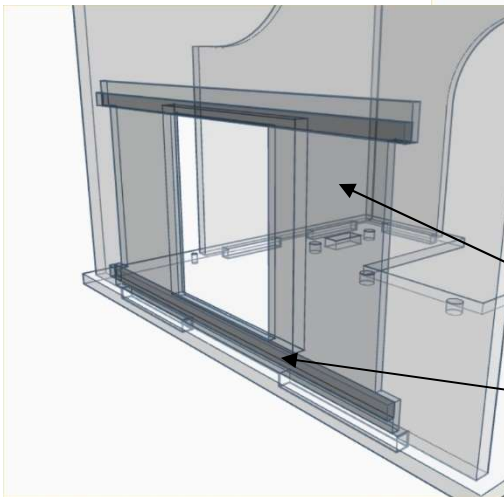
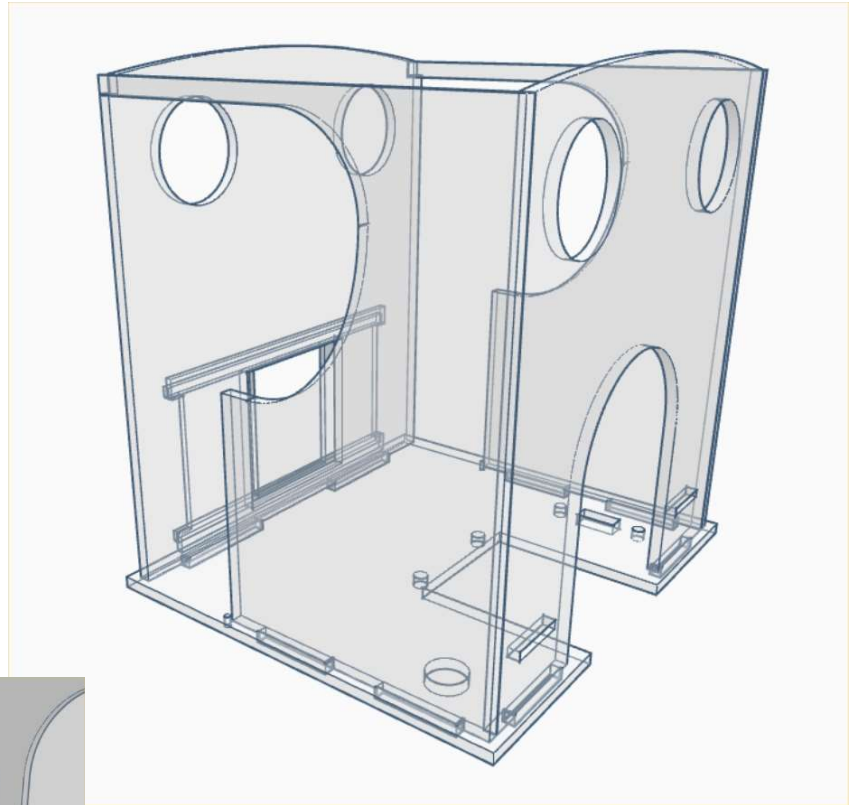
## THE BODY

It's all easy from here on in, preparation is the key to a good-looking model.

I would recommend that all acrylic surfaces are rubbed down with a 250 wet'n'dry, to ensure a good key for both liquid glue & paint.

Consisting of five pieces of 2mm thick acrylic, these are pretty much self-assembly, the slots only enabling one form of build.

There are two, white printed cabside beading pieces, that follow the cabside curve. They allow the 1.5mm brass rod handrails to locate at the top and into the cab floor.



To simulate the rear cab doors, there are three pieces of 1mm thickness acrylic.

The larger section is laid onto the rear cabsheet and represents the sliding doors.

The two thinner strips represent the door runners and are glued on top of the door acrylic piece.

The cab roof is built up from a piece of 0.5mm black styrene sheet and a printed roof piece. Glue the styrene onto the printed part. I usually do this with the parts upside-down suspended over two edges (to similar sized books), and a weight on top of the assembly (another couple of books!)

The footplate is built up from more 2mm acrylic and shown is the image below.

The front footplate slots into the front cabsheet.

There are two small sections that fit under the front footplate and attach to the front cabsheet.

There are two valance pieces that fit under the cab floor, and two more that fit under the front footplate.

*(I suggest the whole assembly is offered to the chassis before fixing valances.)*

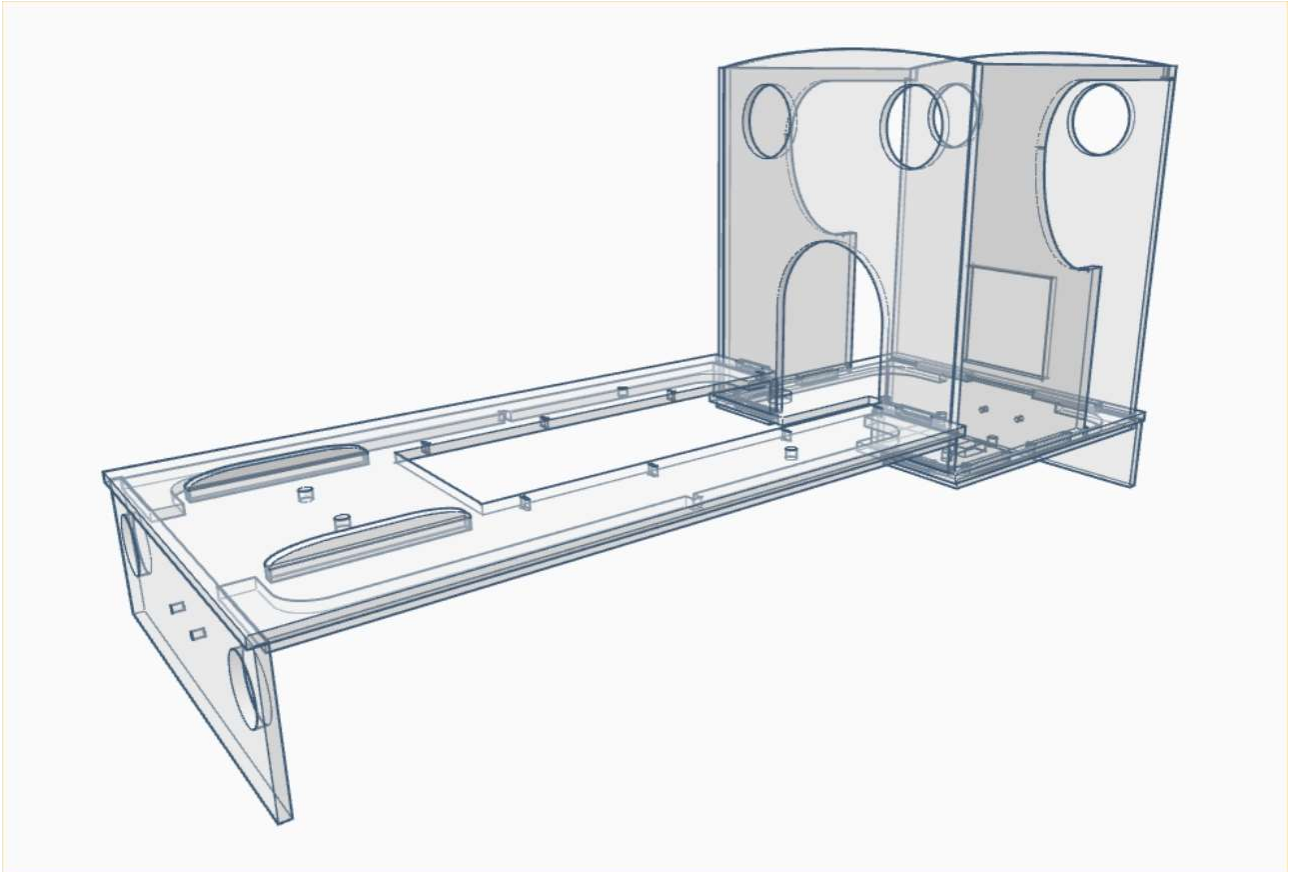
Two small frame uprights that fit into slots either side of the smokebox.

There are holes in the cab footplate to fit the supplied switch (if desired), and for a charger socket if needed.)

Both buffer-beams have small "ledges" on the undersides, there are two strips of 1mm acrylic that can be attached to the buffer-beams to simulate these "ledges".

*Note - the front buffer-beam fits with the holes uppermost, inline with the cylinder heads.*





The body is held in place by four M3 16mm panhead screws, two through the smokebox and two through the firebox.

The saddle-tank fits on the boiler/smokebox with a locating lug at the rear.

Details include -

- White filament printed springs (*with locating holes in the footplate.*)
- White filament printed coal bunkers (*these include holes for wiring runs, with corresponding holes in the firebox.*)
- White filament spectacle rims (*and 1mm acrylic spectacle glass.*)
- Resin printed chimney.
- Resin printed dome (*with safety valves.*)
- Resin printed sandboxes.
- Plus, resin printed tank filler, fire door, regulator, clear gauge glasses, smokebox door & smokebox door handles, handrail knobs.
- 1.5mm brass rod for the tank (*and cab*) handrails.
- 1mm styrene strip for use on the roof as rain strips.
- Name & works plates (*for that final finish!*)

An electronic copy of these instructions can be found at -  
[www.bootlane.org.uk/instructions](http://www.bootlane.org.uk/instructions)

*Andrew & Jacqui*

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