Helix Building

I purchased 2 helices on eBay and, on construction, I experienced height problems as the 2 helix kits I bought turned out to be far less professional than I expected. Due to daily work it was several months before we could start the construction so when we did start, it became clear that 4 pieces did not make a circle! There was about a 2" gap! This was after my wife rubbed everything down and painted the whole set. I persevered in the build. By this time, we were in lockdown, on contacting the seller, he appeared to be "elderly" and couldn't do anything until after lockdown. He didn't seem interested. He stated that I should "leave gaps" to make it meet. I did this, put them together and made the best of a bad job bridging the gaps with picture framing tape. This was until laying the Kato track. There wasn't enough room for 2 tracks and I eventually realised that there was a height restriction due to the thickness of the track. I did specify that we were going to use Kato track...

Basically, we are looked at other helix products which meant that there would be no height restrictions (we dissembled the eBay ones and will re-use the MDF within the overall layout on raised curves).

Then, we decided to design and build 2 helices from scratch.

The Design Process

I used PowerPoint to create the overall designs.

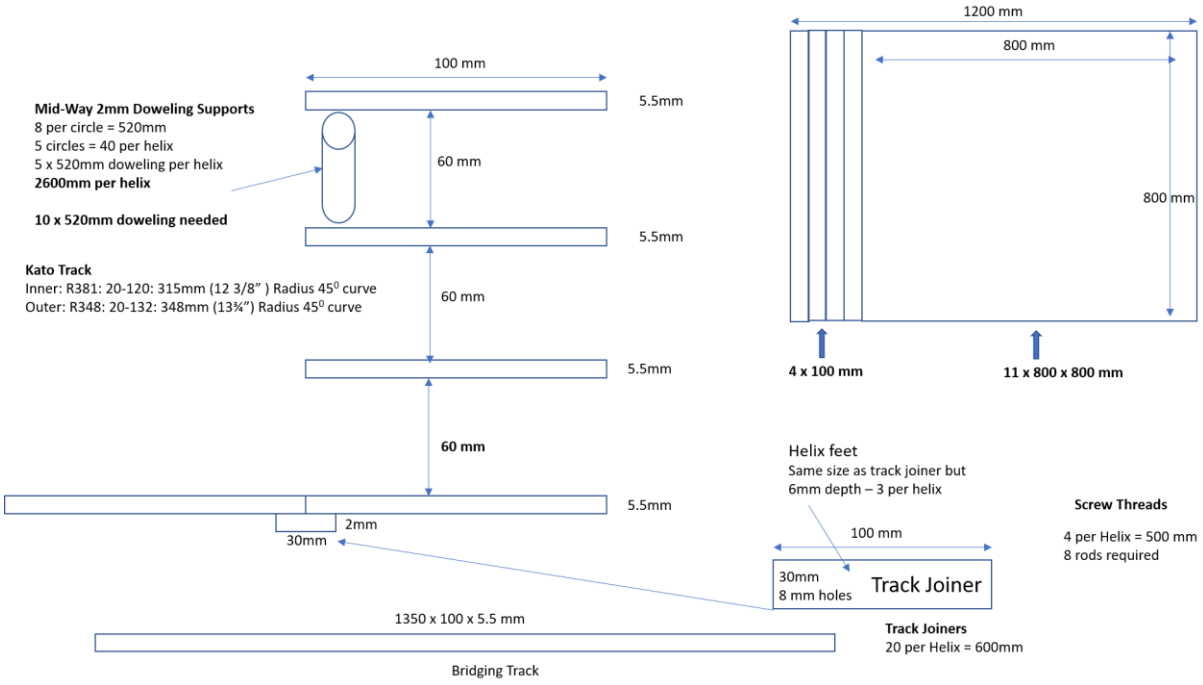

Figure 1 - General Overview

Figure 1 illustrates the general design of the helix. We wanted 4 full circles and the 5th ½ circle will be to be used to connect both helices. We decided on a 60mm headroom to remove any concerns about height restrictions. 4 x 6mm x 500mm threaded rods are used to provide the gradient with 60mm doweling supports equidistant between the rods on each side of the 100mm track bed.

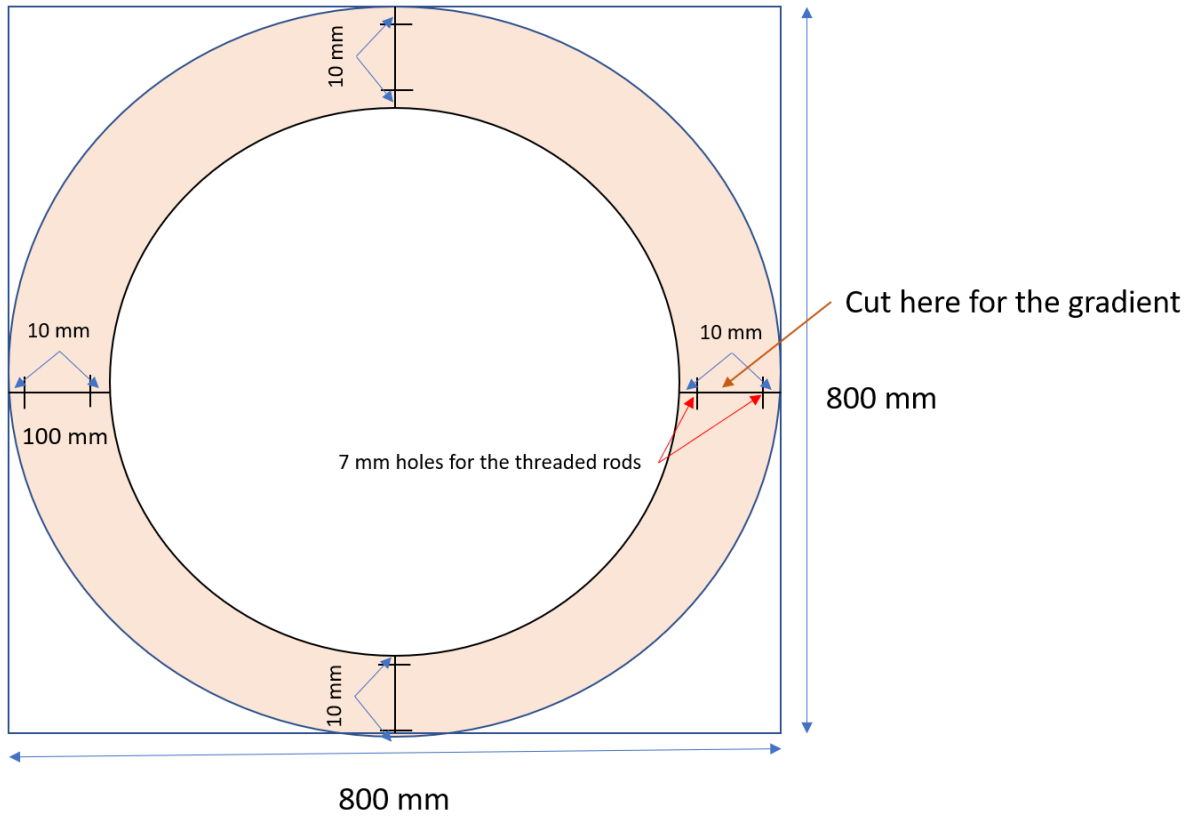

Figure 2 - Individual Track Bed Layer

Figure 2 illustrates each layer.

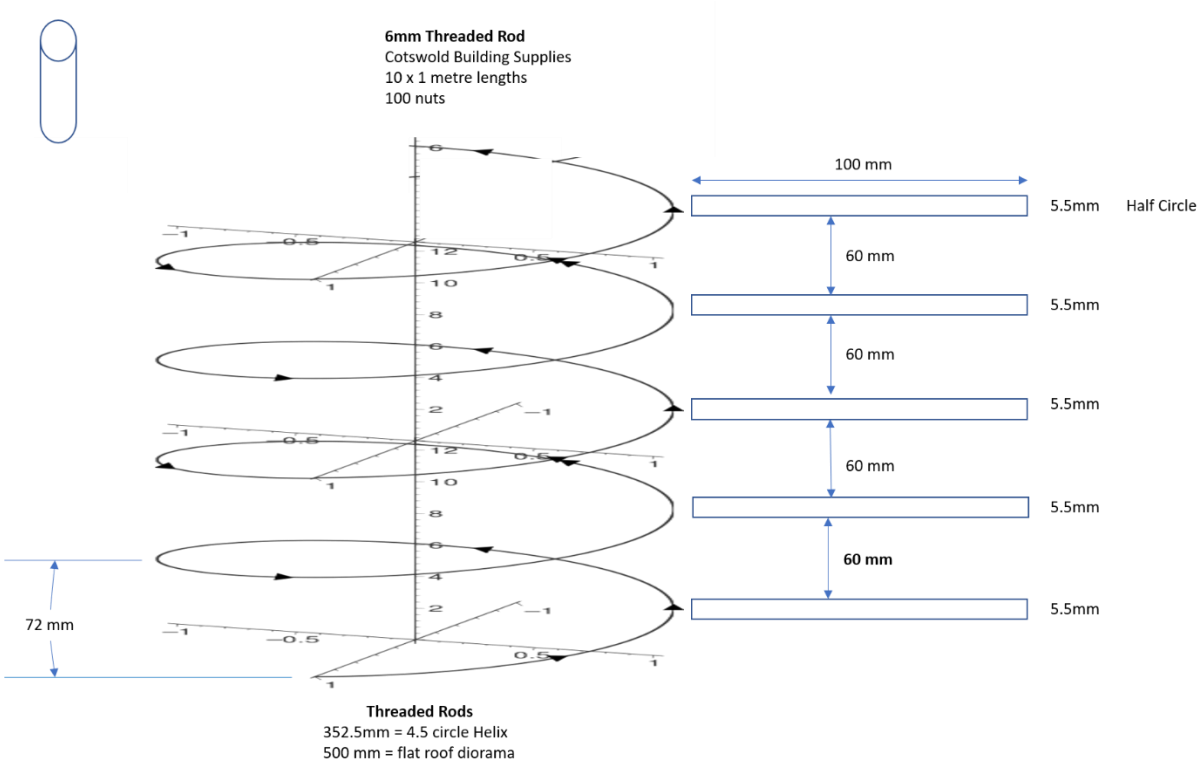

Figure 3 - Cutting List

Figure 3 illustrates the cutting requirements that we gave to Cotswold Building Supplies (http://www.cotswoldbuildingsupplies.co.uk/) where we bought 6mm plywood and 4mm MDF which they cut and delivered within 3 days. All items required to be sealed with matt floor varnish before being painted with a concrete coloured emulsion.

We decided to have a "flat roof" covering each helix so that we could build a scenic diorama.

Building the Helices

Cutting and Preparing the Wood

There were 9 layers that needed cutting out. The 1st layer was measured and used as a template.

Figure 4 - Marking the Track Bed

Figure 4 illustrates how the track bed was marked out. I did not have anything large enough to draw the circles so measured the middle of the board, fixed a pin with string at the midpoint and tied to a pencil at the end then drew an 800mm radius circle. This was repeated for the inner circle at 700mm so there would be a 100mm track bed.

I wanted to ensure that, as far as possible, once cut, all would align properly. Figure 5 illustrates that all 9 layers (both helices) are clamped with the template layer on the top.

Figure 5 - Marked and Clamped

All layers were drilled firstly with a 3mm “pilot” hole and then to 7mm to accommodate the threaded rods. A 7mm hole was drilled on the inside of the inner circle so that the saw blade would fit through as illustrated by Figure 6.

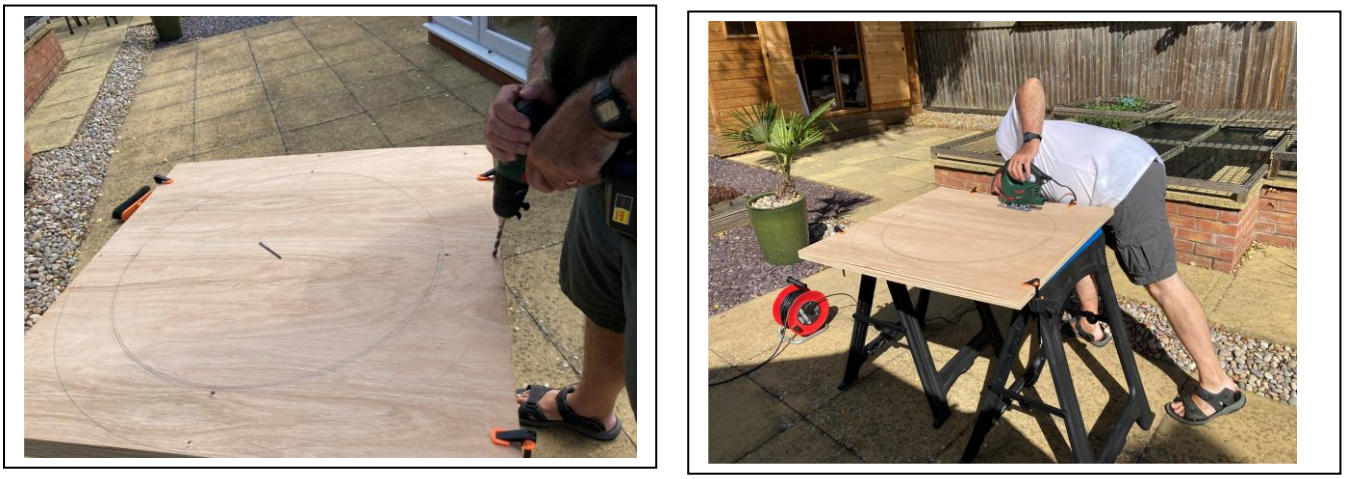

Figure 6 - Drilling All Layers

Figure 7 - Aligning the Cutting Set Before Sawing

Each set that was cut was firstly aligned using the threaded rods as illustrated in Figure 7.

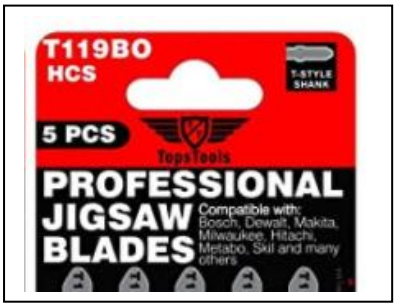

Figure 8 - Saw Blades

The saw blades used are illustrated in Figure 8, they were selected as they are designed to cut curves. Due to the length of the saw blade, it was only possible to cut 3 layers at each session. Once the first set had been cut, one layer was used as a template for the other cutting.

Figure 9 - Cutting the Track Bed

The inside circle of the track bed was cut first, it would be sturdier than trying to support the thinner strip of wood from the outer layer as illustrated by Figure 9.

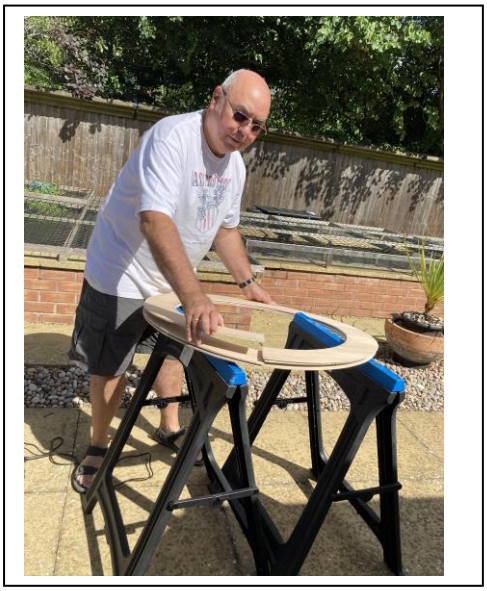

Figure 10 - Cutting the Join

Each layer will be joined to the one above by gluing the track joiner (Figure 3) to the 2 layers. Each layer is cut through the 7mm holes in exactly in the same place, illustrated in Figure 10.

Figure 11 - Helix Roof

Figure 11 shows the roofing panels for each helix, all holes are drilled having first aligned them from the layer template. The corners are rounded by using a tea plate to create the curved edge.

Figure 12 - Sanding the Wood

Every item that was cut was sanded on both sides and all edges ready for sealing and painting.

The threaded rod feet were cut from 6mm floor boarding and the joiners from 4mm MDF (Figure 3). They were marked before drilling using one of the layers as a template, illustrated by Figure 14..

Figure 14 - Feet

Figure 14 - Track Joiners

Preparing the Wood

The wood had to be prepared before assembly by firstly applying a coat of matt varnish recommended by Railway Modeller:

Figure 15 - Matt Varnish

Each piece of wood had a single coat on both sides to seal it before painting.

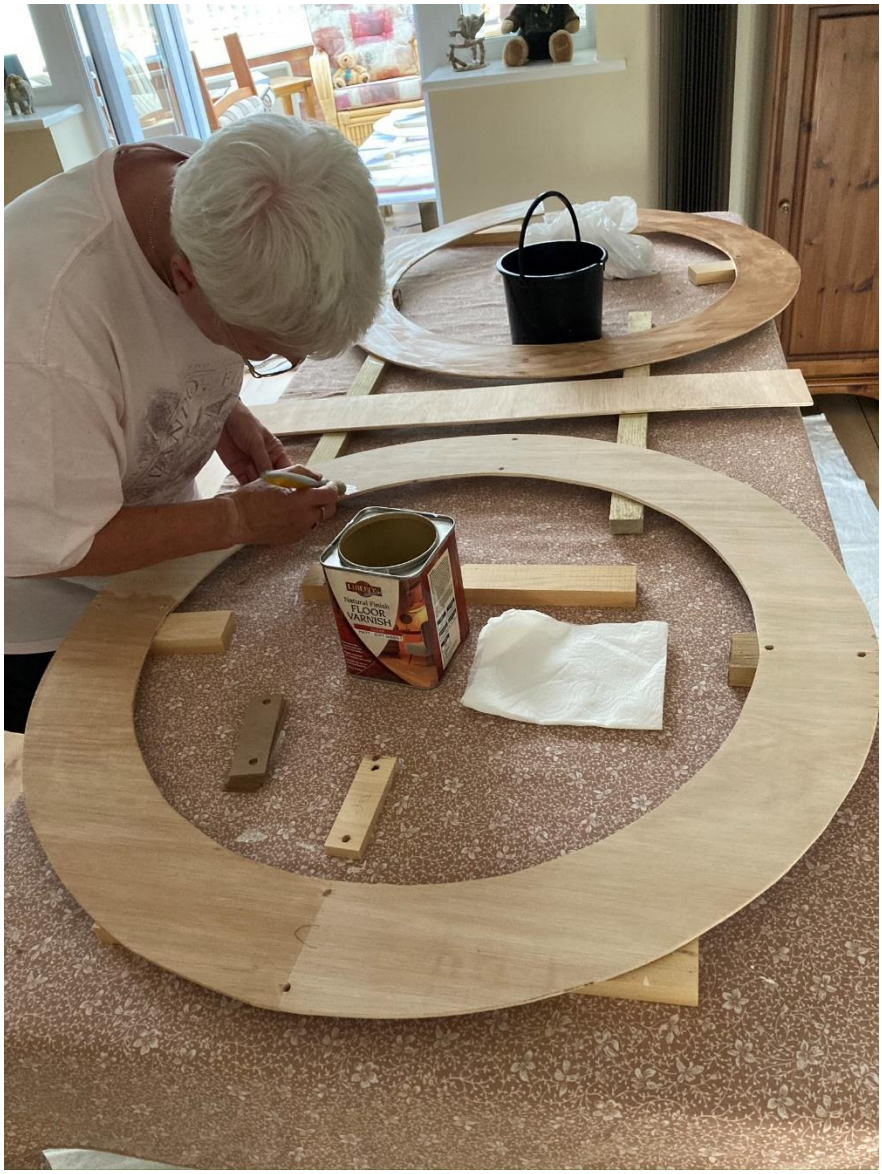

Figure 16 - Sealing Before Painting

Figure 17 - Crown "Taupe" Colour Wall Emulsion

Once sealed, all of the wood is painted with wall emulsion as illustrated in Figure 17 and Figure 18. The colour “Taupe” was used to represent a concrete effect, I hope!! All of the wood had 3 coats on all surfaces (Figure 18).

We did not think that there would be enough paint to complete all surfaces but, on looking, Crown did not make that colour in “Silk” anymore so we went to B&Q where their paint mixing service sorted out the colour (we took a piece of pre-painted wood for scanning, and produced a 1 litre pot that exactly matched the original colour.

Figure 18 - Painting the Wood

Constructing the First Helix

For me, it was important to get the 1st 2 layers constructed to test the construction method, test the stability, test the gradient and ensure that the track could be fitted properly. The initial part was to construct the track bed joining method. Ground level was actually 8 mm to the top of the track due to the lower nut and washer beneath the Joiner. The track was placed on the lower joiner and the bolts were hand tightened. The same was done to the 1st layer join. Figure 19 illustrated the initial set up for the 1st joining section.

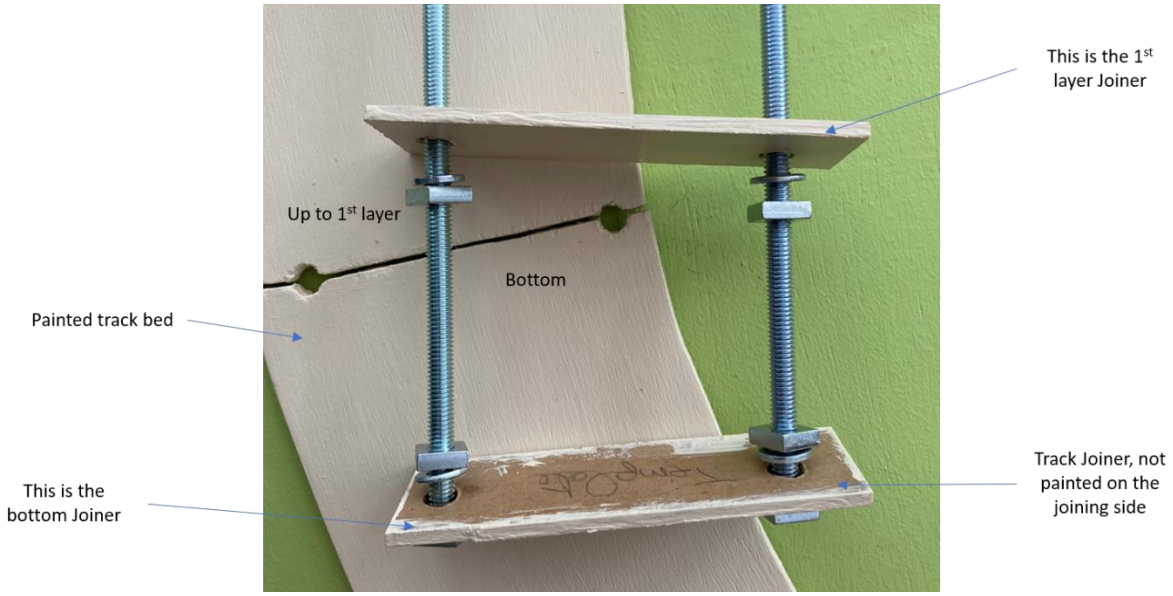

Figure 19 - Constructing the Track Bed Joiners

Figure 20 shows the 1st layer together with the upper track join. At this stage, the joints are not glued in case additional "manipulations" are needed. When they will be joined, PVA is used.

Figure 20 - Constructing Layer 1 & Showing the Track Join

Figure 21 - Winding the Nuts

At this constructing stage, all nuts are hand tightened. As you will see from the pictures, the nuts need to be wound down the threaded rods which is quite laborious. Figure 21 also shows the spacer on the track bed. This is used to ensure all layers are equally spaced. The threaded rods are placed in the feet and, once completed, the feet will be glued to the base board using Copydex. Copydex is used because it is easy to lift at a later date without causing any damage.

Figure 22 - Adding the 2nd Layer

The second layer was added (Figure 22) using the spacer. The 1st layer join is not yet glued.

Figure 23 - Laying and Testing the Track

All of the track was cleaned using a Peco track cleaner before laying it on the track bed (Figure 23) and was manually tested by pushing a wagon up and down both tracks. This ensured that all track joints were smooth, and the wagon ran freely in both directions.

At this stage I decided to introduce a camber in the track bed so increased the outer height by 2 to 3 mm at the 1st layer and used the spacer propagate this through. It is the intention to have several coaches on the outer layer so want to avoid centrifugal forces whiplashing the coaches off the track. I'm not sure if it's needed but it's built in just in case.

Happy that all is well at this stage, the 1st layer track joint was glued.

The rest of the 4 layers were added (Figure 25) with each layer being glued at the time of construction and the tracks settled in place.

Figure 24 - Using Whitemorph to Close the Gap

As you can see from Figure 24, my measurements were a little out and there was a gap at the last joint. I wanted something very strong and stable to fill it so used Whitemorph https://thermoworx.com/products/whitemorph%E2%84%A2). I have used this before to make rocks, it sets solid. It is supplied as small balls which become molten in very hot water and can be manipulated by hand. Any unused pieces can be re-used so there is no waste.

Figure 25 - Completed to Layer 4

The wagon was again used to ensure free running in both directions.

At this stage all of the nuts were tightened using spanners. When tightening the layers, the spacing became irregular so, using the spacer, all were individually checked to ensure consistency. You will note that all of the nuts are aligned.

The 5th ½ layer will be used to ensure that both the entry and exit ramps are on the same side of the base board.

Figure 26 - Entry & Exit Ramps

The entry and exit ramps (Figure 26) are created by cutting in half one of the 800 mm x 100 mm sections of wood illustrated at the top right of Figure 1. Threaded rods were cut to 33 mm secured to the exit ramp and placed in one of the feet that was glued to the baseboard. The entry ramp was also glued to the baseboard.

At this stage the track was “electrified” and tested with trains. Each track was tested separately with a single locomotive both forward and in reverse to test the track in both directions. Both tracks were then utilised; one with 5 coaches and the other with 6 goods wagons (Figure 27).

Figure 27 - Testing the Track

You can see the trains running here : https://youtu.be/Q94hf1P3pxo.

There was plenty of room and head-height and the coaches were well spaced, so no buffer lock. The circumference of the centre of each circle is 2300 mm and the height 63 mm so, using the calculator in Figure 28, the gradient is 2.74% which is 1 in 36.483 according to Figure 29.

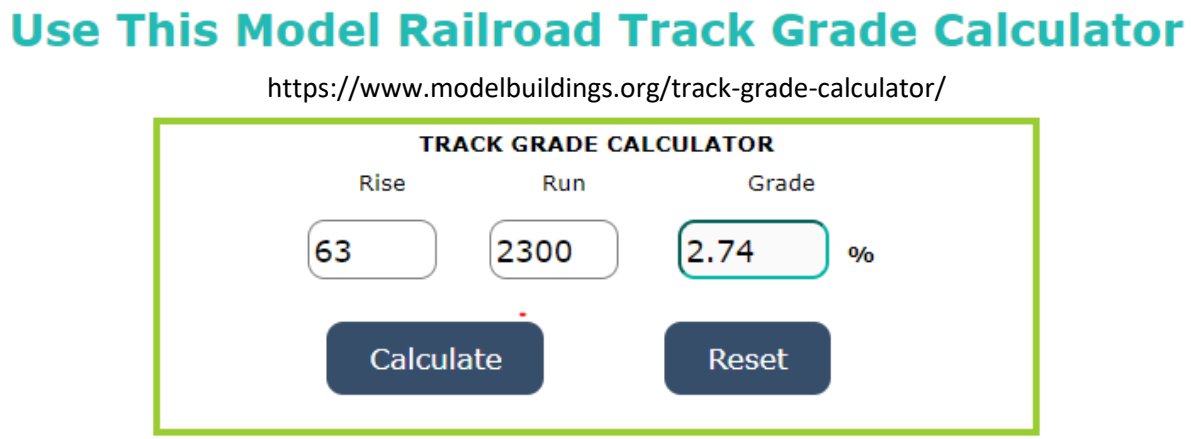

Figure 28 - Calculating the Gradient

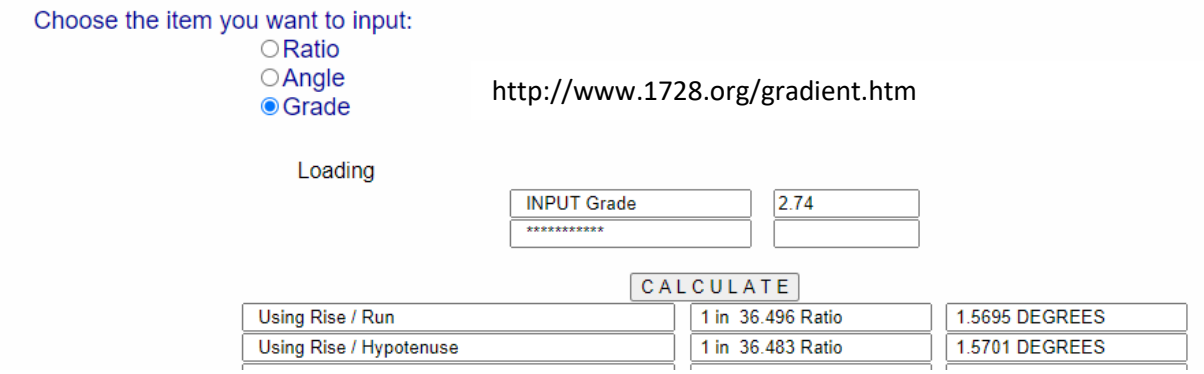

Figure 29 - Gradient Conversion

Yes, the gradient is steep, but I like the way it looks, and the trains run well. As threaded rods have been used, it could be very easy to alter the gradient by adjusting the nuts to lower the track rise.

Now it was time to glue the track to the track bed using Copydex, Figure 30. As previously stated, Copydex can be lifted and easily peeled from both surfaces.


Figure 30 - Gluing the Track

As you will see, we decided to run a track around the outside of the helices so that has been glued in place as well.

Figure 31 illustrates the staining and painting of both roofs. These will be further developed at a later stage to create some kind of "scenery." I anticipate one will be industrial and the other more residential containing a hospital with a Heli-pad.


Figure 31 - Both Roofs Stained and Painted

Back to Figure 1, at the bottom, the bridging track beds. I originally thought that 2 would be required; one for each of the exit and entry ramps. Now that there is an outside track, the 2 bridging track beds will be used at the height exit ramps and immediately below for the outer track. These can be connected by the threaded rods. This leaves the bottom entry ramps bridging track. To encompass the outer track another section of track bed was cut, this time it was 145 mm wide so that all 3 tracks will be on the same bed (Figure 32). I will use the Kato double cross over track units (20-210) to ensure that the trains can move between each of the different tracks.

I usually purchase my Kato track products from Train Trax (https://www.traintrax.co.uk/). I have nothing to do with the company, we just get good service at a good price.

Figure 32 - Constructing the Bottom Bridging Track Bed

During the building we need to use doweling which needs to be sealed and painted before use. Being quite small and round it would be difficult to handle, so I constructed a unit to handle such wood. 4 x 16 mm holes were cut into the 2 plywood ends and these were screwed and glued to each end of the long wooden spacer. The spacer can be cut to any size, this one is 1 metre long, capable of holding 4 lengths of doweling.

Figure 33 - Staining & Painting Doweling

After this it was time to fit the roof. 2 nuts and a washer were screwed to each of the threaded rods to a height of 440 mm from the baseboard and slotted the roof in place and, as you can see from Figure 34, it is completely level.

Figure 34 - Roof Securely in Place

Once level the lower nuts were tightened together to lock them (Figure 35, thus preventing them from moving in the future, the top nuts were only finger tightened as the roof will be removed at a later stage for scenery etc.

Figure 35 - Locking the Bottom Bolts

Electrifying the Track

Now to settle the electrics. This was going to be accomplished at the lower entry ramp on this helix, it will be completed at the top exit ramp on the next helix.

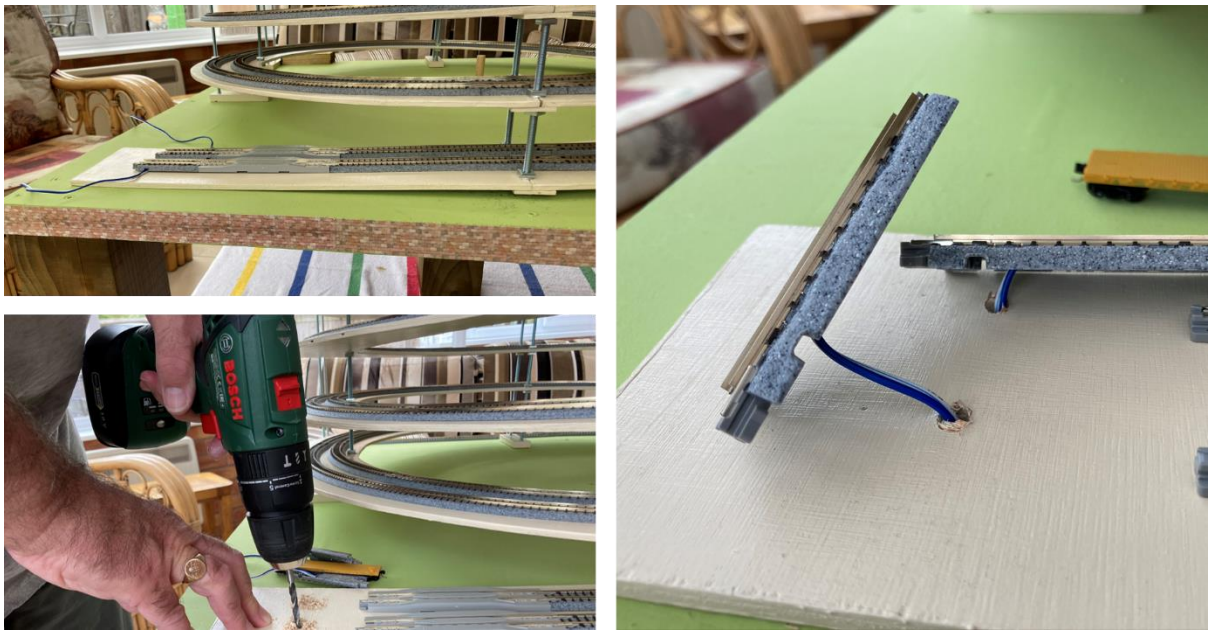

Figure 36 - Wiring the Helix

Figure 36 shows the wiring stages. The 2 power tracks were removed, and the wire positions were measured from the end of the track that connects to the re-railing tracks. At 45 mm from the re-railers a point was scribed onto the track bed and a 5 mm hold drilled through the base board through which the power track wires were threaded.

Figure 37 - Wiring Beneath the Baseboard

Figure 37 illustrates the wiring beneath the baseboard which has its own mains wiring loom that connects into the main wiring circuit in the “Station House.” At an early stage in our modelling we were advised to use In-Sure wire connectors for small wires. The wires are inserted into the container

and the blue lever locks them in place. The wires coming through the baseboard are stuck to the underside of the roof using the 3M self-adhesive clips. I have used different makes, but they seem to dry out and fall off, the 3M stay in place.

Once all of the wiring was completed, the re-railing tracks were glued to the track bed with Copydex.

Building the 2nd Helix

The second helix was constructed in the same way as described above and illustrated in Figure 38:

Figure 38 - Building the 2nd Helix

Both helix base boards were side-by-side to ensure that all items were aligned. The two sets of track were joined at this stage to test the running of trains ensuring that they could cope with the gradient and that the track was flat and level. You will see in the right photo Sandra holding a length of track bed, that is the distance apart both helices will be when finally placed in the Station House.

Figure 39 - Re-Lifting the Glued Track

There were a few issues with the track, 2 of the curves were too sharp and one section of small track pieces were not level. As they were pre-owned, the joints did not smoothly align so were replaced by new track.

Figure 39 shows how easy it was to re-lift the glued track by inserting a blade between the track and the track bed and slowly twisting it. The Copydex is removed just be rubbing it with your finger.

It took a while to test the track in both directions to ensure smooth running. You can see the outcome here: https://youtu.be/VNRIWL-cVto - 5 trains running around both connected helices.

Figure 40 - Track Supports Cut and Glued in Place

I wanted to add supports between the threaded rods to try and prevent warping. Figure 40 shows the painted doweling mentioned in Figure 1 which have been glued in place using PVA (noting the overnight "weights" 😄).

Figure 41 - The (almost) Completed Helices

Figure 41 shows the final stages of the build. I am laying a shunting yard track set in the middle of both helices that is why the "roof" is not on the left one. We will be adding grass, trees, scenery etc to the parts of the baseboards that will be difficult to reach before we install them in the Station House.

Figure 42 - The Completed Helices

Figure 42 shows the completed helices. I will update this document when the helices are in situ and the bridging units have also been completed but that will be done over the winter. The next stage before moving them is to construct some scenery items on parts of the base board that will be difficult to access when in situ. I will document that work separately.

Comments

1. The gradient, as previously stated, can be easily altered by adjusting the nuts on the threaded rods. Figure 28 and Figure 29 shows the web pages where you can calculate your required gradients.
2. Always use Copydex to lay track as it can easily be altered.
3. I would suggest that the helices can be constructed at any scale by altering the measurements in the first three figures, the method of construction remains the same.
4. We use gauge/scale as a guidance, not to be followed conscientiously.
5. We made a conscious decision that, as far as possible, we will build from scratch …and that includes scatter etc.
6. My wife and I are beginners in railway modelling. We are approaching our retirement and want to take this forward to keep us occupied. We have no relevant skills as neither of us have been involved in anything like this since school.

The above represent our thoughts and methods, all I can say is, they work for us.