Track Planning Services

Create Changes in Height Use a Helix

Both real railroads and model railroads have the same problem when two places are at different heights. In prototypical track planning, the best option has always been to make the distance between two places a reasonable length apart to accomplish change in height.

There are many well know NSW railway locations of significant changes in height such as Cowan Bank, Tumulla Bank, Ardglen tunnel and the Bethungra spiral. These 'climbs' are often short distances of vertical gain which require large horsepower, helper locomotives, great distances to achieve height, or short ascending distances in which super-elevated track crosses over itself.

The rise on the Sydney underground network from Wynyard Station to the Harbour Bridge is a notorious grade, particularly in wet weather for heavily laden passenger trains.

Real railroads generally have the benefit of achieving changes in elevation using long runs. Model railroaders are not so fortunate unless they have enormous layout spaces available - not the case in a typical 3 x 4 m bedroom.

When discussing changes in height the following terms are helpful:

- ***GRADE*** is the expression for the change in height. This can be expressed as a percentage or ratio
- ***RISE*** is the vertical lift in height
- ***RUN*** is the horizontal length to achieve the lift in height

Common expressions for grade:

- A grade or slope of 2.5% is a rise of 2.5m in 100 m run
- A 1 in 75 grade (1 : 75) is 1m rise in 75 m run or a 1.33% grade

One method of achieving changes of height in limited modelling space is the use of a HELIX. A helix is a spiral or corkscrew of track passing over itself as the run gradually creates a rise.

In the diagram the helix has a track radius of 700 mm and a ***rise*** of 350 mm from the bottom outlet to the top outlet. Surprisingly the total ***run*** of track in the helix is 15.217 m for a regular ***grade*** of 2.3% (or 1 : 43.5).

In this helix there are 3.5 turns to achieve the change in height in an anticlockwise direction of travel from the bottom outlet.

Technically this is a centric helix as each turn in the helix is directly above the turn below. A helix can also be eccentric where the modeller wishes the turns in the helix to be variable in diameter, so that some parts of the helix jut into the layout further than others. This is a useful tool for landscaping where train movements around mountain sides disappear in and out of tunnels.

It is critical when designing a helix to allow sufficient height between turns for locomotives and rolling stock to move unhindered in the helix. In the case of this helix each rise is exactly 100 mm providing adequate clearance for HO stock.

Construction of a HELIX in HO

Here is a method for constructing an eccentric helix for a multi level layout in a room of 3.95 m x 4.45 m. This is a typical size of a double bedroom and a reasonable space for a multi deck HO layout.

In the plan (Diagram 1) and 3D view (Diagram 2) of our sample helix the colour coding is:

- *Pink for the eccentric track of the helix*
- *Gold for the bottom outlet*
- *Green for the top outlet*

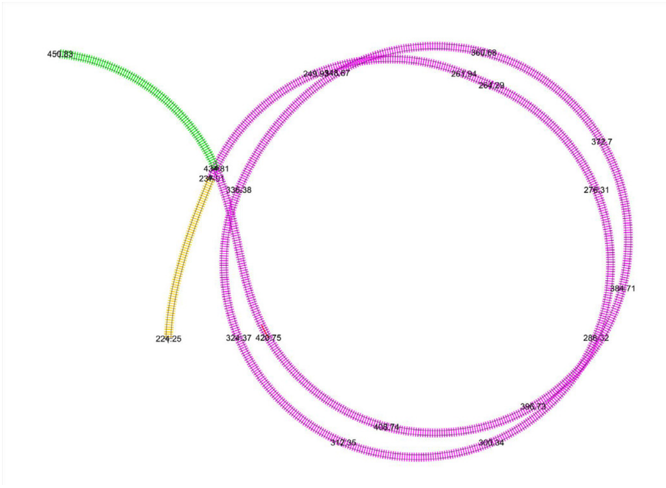

Diagram 1. Plan of the helix to be built in this article.

The helix rotates clockwise from the bottom outlet, rising 226.6 mm for a total run of 9.61 m through two turns. Each rise within the helix is about 98 mm. Constant grade of this helix is 2.35%. Diagram 1 is the plan of the helix with elevations above a base level marked at various points.

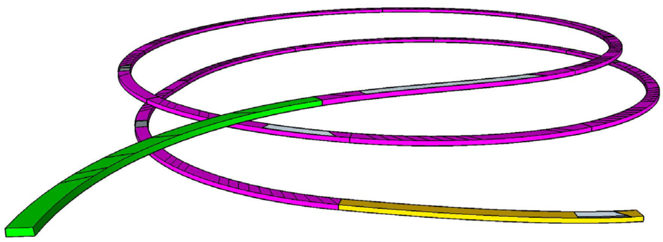

Diagram 2. 3-Dimensional view of the helix to be constructed.

This construction article applies to all types of helix. The example helix demonstrates the principles of construction with just two rotations. A regular (concentric) helix can produce significant rises, joining decks that may be over 500 mm vertical separation.

Construct an Eccentric Helix

List of Materials

- Sheet/s of 5 ply board; 9/10 mm thick
- Softwood building timber 90 x 40 mm and 90 x 18 mm
- Right angle brackets 75 x 75 mm
- Wood screws 20 mm, 40 mm and 65 mm

Various wood working tools, electric hand tools (jig saw, cut off saw, screw driver), drawing pens, large compass [see pictures for home-made compass]

After producing your plan of the helix for your layout, transfer the curvature for the track onto the ply board using a large compass. From your plan locate the centre of the helix curve and position this centre point on the ply board. Try to position each piece of helix section to maximise the use of each ply board.

Depending on whether you plan a single track or double track helix allow for sideways width. In this example draw the track centre first (Pink marker) then mark the inside and outside edges (Black marker) for a 100 mm track base (see Diagram 3).

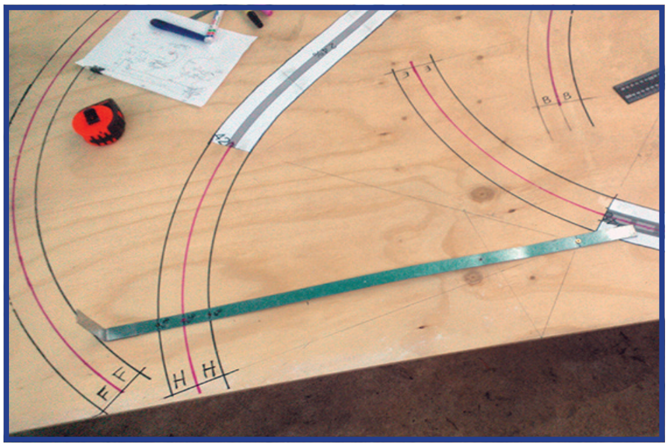

Diagram 3. Portions of the helix drawn on 5 ply. The compass is homemade from metal strapping with holes drilled for each radius.

This is an eccentric helix with multiple radii, which must be drawn carefully and identified for later positioning. All parts of track base were able to be drawn on one board for this example (see Diagram 4).

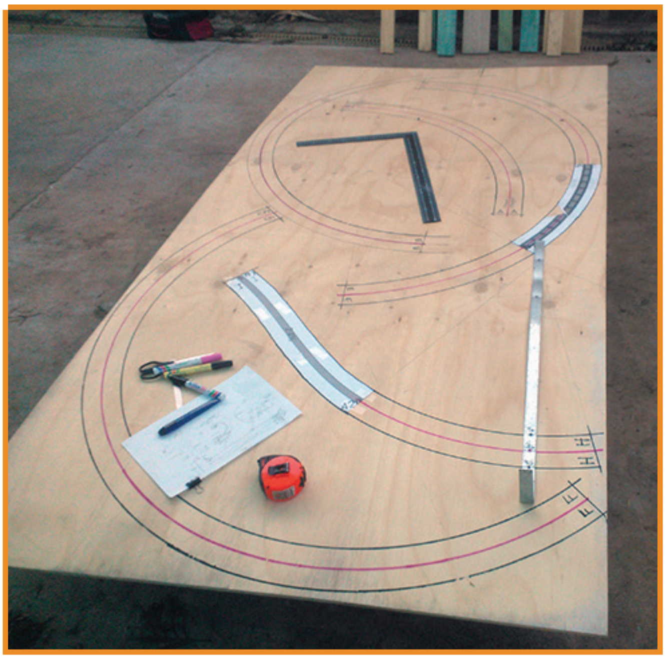

Diagram 4. Sections of the helix base laid out on the ply. All sections of the helix in this example are drawn ready for cutting with a jig saw.

Ideally the helix should be constructed as a stand alone unit within the layout. The helix must be accurately located as part of the overall plan in relation to its place and orientation on the plan, but importantly its height relative to the rest of the layout. To ensure accurate placement the helix needs its own discrete frame.

Using the larger timbers from the List of Materials, build a frame that is at least as wide as the outer edge of track base boards. Diagram 5 shows the simple construction of the frame.

Diagram 5. A strong pine frame to support the helix as a stand alone structure. Risers placed to support track baseboard.

For this helix construct a frame of 1500 x 1500 mm. Even though this is an eccentric helix all parts of the track were contained within its edges except for the bottom and top outlets which must be secured to the general framework of the layout after placing the helix in position.

The track baseboards are supported using timber risers. These risers are attached to the main frame either by screws into the frame or with metal brackets. On the vertical supports mark the height of the track at various places above the frame using heights from the plan in Diagram 1.

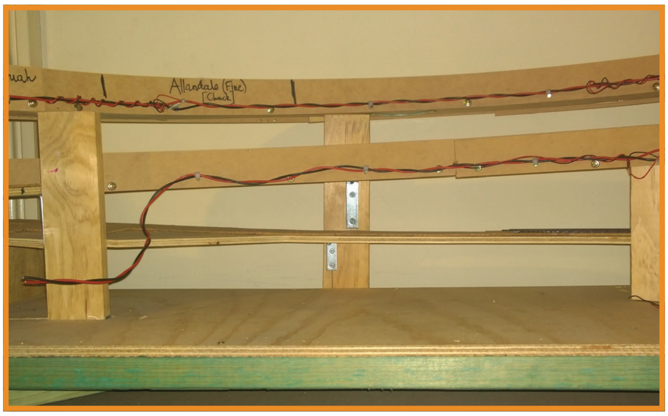

Diagram 6. Metal brackets fixed at slight angle on risers to hold track baseboard.

Fix metal brackets at slight angle on these risers to accommodate the changing height of the track baseboards (see Diagram 6). Screw the track baseboard to the brackets ensuring the grade is even throughout the rise of the track.

After the track baseboard is fixed to the risers, attach strips of MDF or clear plastic (see Diagram 6) to the inside and outside edges of the track baseboard to prevent rolling stock falling. In Diagram 6 the electrical bus for the helix is also visible running inside the helix cavity.

The inside space of the helix is a convenient access hatch. During construction of the layout ensure that you can enter the helix from outside the layout.

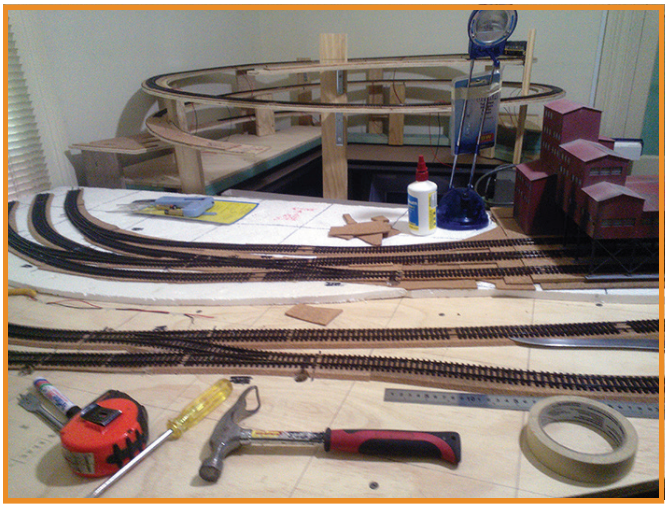

Diagram 7. The helix in its final location. The lower outlet will eventually join the layout behind the red coal mine.

A benefit of the space available within the helix is large areas for coach and wagon storage. In Diagrams 6 and 7 flat ply board will eventually become hidden staging for freight wagons.

Diagram 7 demonstrates positioning of the helix in a room corner before landscaping and full operation. The bottom outlet of the helix is eventually joined to the layout behind the red coal mine.

# # #

Using grade separation in model railroading is another way to bring variety and operational possibilities to a layout. This article has shown that a simple helix can be easily constructed and create multi deck operation even in a relatively small space.

This article was written by **Graeme BARNES** the principal of ***Track Planning Services***. The article is provided to clients of *Track Planning Services* as an aid for the construction of their layouts.