

HOW TO DESIGN A HELIX FOR YOUR OPERATING LAYOUT?

After reading many track design books, I was not able to find information that would assist me in laying out a helix and how much space (footprint) is required if you have one on your layout.

I developed the attached worksheet to help me in designing my track layout. The worksheet is a look up-table to assist you in determining the physical size of the helix. The key concepts that I had to understand about a helix and their uses are as follows:

They are bigger than you thought.

The maximum grade has to be less in the helix than on the main layout.

One full 360-degree turn will give you a rise of the gross clearance height.

Roadbed, track, train and free space profiles need to be kept to a minimum.

What is the maximum grade (%) that you will accept?

What is the maximum footprint that you can provide for the Helix?

What is the gross clearance required from railhead to railhead?

I would like to take a few minutes to review the effects of the above questions. The lower the gross clearance between railhead to railhead, the easier it is to keep the grade low. The effect of just a 1/4 inch in clearance can change the grade by 0.2%.

When operating in a helix, we must overcome two problems; 1) elevation and 2) curves. Both will reduce the performance of your motive power. The effect of reduced motive power is the train length has to be shortened. The lower the grade, the longer the train length. There are two ways to lower the grade. They are as follows:

Reduce the railhead to railhead gross clearance.

Increase the radius of the helix which in turn increases the length of track in one full turn.

Once the grade and gross clearance has been determined, we can use the attached worksheet to help us with the geometry of the helix. Let's use the following example to understand how-to-use the worksheet:

Gross Clearance: 4.75 inches

Percent Grade: 2.8 %

Find the intersection of 2.8% and 4.75 inches in the top section. We will find a radius of 27.00 inches. Look to the bottom half to find that this is a diameter of 54 inches, a perimeter of 170 inches or 14.1 feet. This last figure is helpful when it comes to buying track.

The last calculation that has to be determined is how many turns does your helix have to make to give you the total rise that is needed. Again for example, if your top deck is 16 inches higher than your bottom deck, then take 16 inches and divide it by the 4.75 inches gross clearance in one full turn. Your helix would require 3.4 turns to make the rise to the upper deck.

If you have any questions, please feel free to contact me at david.avedesian@comcast.net

Helix Design Worksheet

Boston and Maryland Railroad
 Final Selection of Helix Grade
 Track Work Worksheet by David Avedesian
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CLEARANCE GROSS INCHES

PERCENT GRADE	4-1/2	4-5/8	4-3/4	4-7/8	5-0	5-1/8	5-1/4	5-3/8	5-1/2
5.00	14.32	14.72	15.12	15.52	15.92	16.31	16.71	17.11	17.51
4.80	14.92	15.34	15.75	16.16	16.58	16.99	17.41	17.82	18.24
4.60	15.57	16.00	16.43	16.87	17.30	17.73	18.16	18.60	19.03
4.40	16.28	16.73	17.18	17.63	18.09	18.54	18.99	19.44	19.89
4.20	17.05	17.53	18.00	18.47	18.95	19.42	19.89	20.37	20.84
4.00	17.90	18.40	18.90	19.40	19.89	20.39	20.89	21.39	21.88
3.80	18.85	19.37	19.89	20.42	20.94	21.46	21.99	22.51	23.04
3.60	19.89	20.45	21.00	21.55	22.10	22.66	23.21	23.76	24.32
3.40	21.06	21.65	22.23	22.82	23.41	23.99	24.58	25.16	25.75
3.20	22.38	23.00	23.62	24.25	24.87	25.49	26.11	26.73	27.35
3.00	23.87	24.54	25.20	25.86	26.53	27.19	27.85	28.52	29.18
2.80	25.58	26.29	27.00	27.71	28.42	29.13	29.84	30.55	31.26
2.60	27.55	28.31	29.08	29.84	30.61	31.37	32.14	32.90	33.67
2.52	28.42	29.21	30.00	30.79	31.58	32.37	33.16	33.95	34.74
2.40	29.84	30.67	31.50	32.33	33.16	33.99	34.82	35.64	36.47
2.39	30.00	30.84	31.67	32.50	33.34	34.17	35.00	35.84	36.67
2.35	30.48	31.32	32.17	33.02	33.86	34.71	35.56	36.40	37.25
2.30	31.14	32.00	32.87	33.73	34.60	35.46	36.33	37.19	38.06
2.20	32.55	33.46	34.36	35.27	36.17	37.08	37.98	38.88	39.79
2.00	35.81	36.80	37.80	38.79	39.79	40.78	41.78	42.77	43.77

RADIUS – INCHES

RAD/IN	DIA/IN	PERI/IN	PERI/FT
15	30	94	7.9
16	32	101	8.4
17	34	107	8.9
18	36	113	9.4
19	38	119	9.9
20	40	126	10.5
21	42	132	11.0
22	44	138	11.5
23	46	145	12.0
24	48	151	12.6
25	50	157	13.1
26	52	163	13.6
27	54	170	14.1
28	56	176	14.7
29	58	182	15.2
30	60	188	15.7

RAD/IN	DIA/IN	PERI/IN	PERI/FT
31	62	195	16.2
32	64	201	16.8
33	66	207	17.3
34	68	214	17.8
35	70	220	18.3
36	72	226	18.8
37	74	232	19.4
38	76	239	19.9
39	78	245	20.4
40	80	251	20.9
41	82	258	21.5
42	84	264	22.0
43	86	270	22.5
44	88	276	23.0
45	90	283	23.6
46	92	289	24.1

GROSS CLEARANCE CALCULATIONS

FREE SPACE	0.25	1/4	0.13	1/8	0.25	1/4	0.25	1/4
FRANKLYN TRAIN	3.75	3-3/4	3.75	3-3/4	3.75	3-3/4	3.75	3-3/4
TRACK HEIGHT	0.25	1/4	0.25	1/4	0.25	1/4	0.38	3/8
ROAD BED	0.25	1/4	0.50	1/2	0.50	1/2	0.50	1/2
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GROSS CLEARANCE	4.50	4-1/2	4.63	4-5/8	4.75	4-3/4	4.88	4-7/8