

PLANNING AND BUILDING YOUR GARDEN RAILROAD

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This information is from my experiences and observations, it is by no means the only way and may not be the best for you, and is offered for your information and consideration in building your Garden Railroad. This is not a detailed description, but general information, books with more information and different ideas are available.

See references at the end of this document

First Steps

1. Get a general idea of what you would like to do.
 - a. A rough sketch or just well thought out. Check out the different methods listed below.
 - b. Get the entire family involved, this is a family hobby.
2. Check the elevations in your yard to determine grades, it may look flat, but most times it is not.
 - a. Use the liquid level gauge method with yard sticks.
 - b. Use Laser Level and height sticks, yard sticks will work for this.
 - c. Use surveyors transit.
 - d. Be sure to locate a fixed base reference point that can be used later if required.
3. I put small flags (like those used to locate sprinkler heads) to create a 5' spacing grid and measured the elevation at each point with a water level, and put this on a paper plan so I could lay out track plan and plan the grades. (see separate info on water level)
4. Maximum grade for reasonable operation is 4%, although you should try for 2 or 3%. If you want to run long trains go for 1%.
5. Grade is measured as inches of rise per 100 inches, 2" would be 2%. A shortcut to this is 1/8" per foot is approximately 1% (it is actually 1.04%), so it is close and easy to work with.
 - a. I use a 2' level. Get a 1/2' or 3/4" plywood board or plywood about 30 to 36' long, get some material that is 1/8" thick, make an 8 stair step with 1/8" increments and mount it near one end of the board, (put a stop above the highest level) attach a 1/2" or 3/4" thick board across each end of the bottom of the board, this gives you two end points of reference. Put hooks for a rubber band to hold the level on the board. This will give you about a 1/2% grade for each step, the highest step is 4%. See pictures below. A block above the highest step keeps the level from sliding over the end.



Method one, the quick start.

1. Just get some track put it on the ground and get it running.
2. This is great if you're not sure what you want to do right now and you can get something running right away. It is very easy to get it running quickly and is great for a temporary setup and to get the feel of what you may want to do later.
3. For this you need to use sectional track.
4. You need to be very careful not to get grades too steep for the trains.
5. You can always pick it up and move it or change it.

Method Two

1. Lay out your plan on paper to scale and check your grades.
2. Use largest radius possible. Try for at least a 4' radius (LGB 16000 curve). A larger radius, possibly 10' or larger, will be required for some of the larger loco's and rolling stock (check before you build or buy). Almost all LGB standard production equipment will work on 2' radius, most other equipment will run on 5' radius, a larger radius looks and works better.
3. Make sure all track is accessible for cleaning and maintenance.
4. Tunnels: you must have access to remove derailed cars. I recommend a maximum length of 5'.
5. I do not recommend putting track under low bushes or shrubs, maintenance is very difficult. Large trees require more maintenance due to leaves, twigs and even branches dropping in the RR, but do provide shade.
6. Maximum track grade should be 4% or less, 4" rise per 100' track or prox. 1/2" per foot. 1/8" per foot approximates a 1% grade. Keep maximum grades to 2% or 3% if possible.

Method Three

1. Get a general idea of what you would like to do.
2. A rough sketch or just well thought out.
3. Use 3/4" or 1" PVC pipe with stakes to lay out your track plan in place.
4. This will give you smooth curves and works well when using flex track.
5. You can directly check your grades.
6. It is easy to visualize your track and how it fits into your yard.
7. It is harder to lay out and visualize areas where it is necessary to remove dirt and /or create a tunnel without actually creating the effect as you go. One way to do this may be to raise this portion of the pipe up a uniform amount that will keep it above the ground for this portion of the track (raise it 12 or 18" above actual track height). For elevated areas, put a screw in the stake under the pipe to support it and use wire ties to hold in place.
8. Build up the ground or plan on bridges to bring the grade up to the bottom of the PVC pipe.
9. We used a combination of methods two and three to design and layout the railroad for Hudson Gardens.

Getting on with the rest of it

1. **Decide on a power supply and control system.**

1. DO NOT use a 110-volt power pack outside unless it has a ground fault interrupter in the power circuit. Do not leave your power pack out in the weather. Rain will damage it, if it is in the sun it may overheat and trip the internal breaker. If you want to leave it outside near the RR, it must be in a weatherproof enclosure, it must have good ventilation when operating.
2. Preferably, use a power supply that you can have the transformer inside and safely grounded with the low voltage only outside. Some power supplies have a remote control available or you can add a separate remote control for your track power.
3. You will probably want at least a 4-amp, 18 to 24 volt power supply, plus power for accessories (lighting, turnout control, etc.). A 10amp power supply is recommended. Larger may be required for some applications.
4. A ground fault interrupter is recommended for all power supplies.
5. At a later date you may want to consider a more sophisticated remote control system that allows individual control of each locomotive.

2. Plan for your wiring needs now.

1. How and where are you going to run your wires?
 - i. In plastic or metal conduit?
 - ii. And/or direct buried wires.
 - iii. Use quality **stranded** copper weatherproof wires. I used trailer wire available with 3, 4, and 6 conductors in 14 and 16 gauge and single conductor automotive wire. LGB also has some very good flexible wire available in limited sizes and colors. Tinned copper wire is much stiffer and harder to work with; it also is difficult to keep straight in the ground.
 - iv. Stranded primary automotive wire is available in 50 to 250' spools and gauges from 18 to 10 gauge. I recommend at least #14 wire for your primary feed to the track area, smaller wire can be used for short feeders (16 or 18)
 - v. Above wire (except the LGB) is available from J.C. Whitney, P.O. box 8410, Chicago, Ill. 60680. Phone (312) 431-6102, www.jcwhitney.com, Call or write for catalog. You can check around local sources for this type of wire.
 - vi. Plan and install more wires than you think you'll need. Run all those wires at the start with several extra for future use.
 - vii. When connecting wires underground with wire nuts, fill the wire nut with tub & tile caulk before putting it on the wires, do not use a silicone for this, it will corrode the wires
2. Typical number of wires needed.
 - i. Track power: 2 wires
 - ii. Reverse loop: 2 wires, at each end, plus 2 power wires. Special track power switching is required for reverse loops. There are automatic controls available for this.
 - iii. Switch machines: 1 ground plus one additional for each LGB switch machine; i.e. 3 machines need 4 wires. Other Switch machines will require more, at least 3 wires and some may require 4 or more. If using a radio control for switches you will need at least two separate wires for each switch machine.
 - iv. Lighting and accessories: 2 wires for each lighting circuit, probably at a different voltage maybe 12 volts.

3. What kind of track are you going to use?

1. Brass: good electrical characteristics for track power, better operation.
2. I recommend LGB, Piko 5' brass flex track. It conducts well and turns a dark bronze after a year or so outside. Train-li, AMS, Bachmann, and Aristo (currently closed) also have a brass track.
3. Aluminum: good appearance, higher expansion rates, lower cost. Good for steam and battery power. The code 250 Aluminum is not very strong more susceptible to bending. Use rail clamps or SS screws through the rail joiners.

4. Stainless steel is very corrosion resistant, more expensive and harder to work with. Also more expensive. Definitely worth considering. You must use rail clamps for good conductivity.
5. Nickel Silver: this is a very good track and is many times the price of brass. Nickel plated brass is not recommended, the plating wears off and then is the same as brass.
6. Steel: this is good for steam and battery power. It is cheaper and rusts out in the weather. NOT recommended for track power.
7. Pre-formed track, such as LGB, Piko, sectional track. Disadvantage is many more track joints with related problems. Also limited flexibility for curves.
8. Long lengths of flex track bent to fit your needs with a rail bender. Definitely my recommendation and use good quality rail bender. I highly recommend Train-Li's dual rail bender.
9. You can use plastic tie strip or you can hand spike it down. I use LGB or Piko plastic tie strip, except for bridges and trestles. You can also use the plastic ties on bridges and trestles, I like the appearance of the hand spikes ties better on bridges and trestles.

4. Rail joining method; both electric and mechanical.

1. For track power you must have a good electric connection at rail joints. Use a conductive grease in all rail joints when using track power.
 - i. Solder jumper wires to each rail and connect with wire nuts and a latex sealant (such as tub and tile caulk) or screw jumper wires to each rail. This is what I started with and it works well.
 - ii. Use S.S. screws through the rail joiner into the rail. I am currently using this method and it is much faster and easier than soldering the wires onto the rail. This also provides a good mechanical joint, but track must be installed so that it can move. The screws can be added later. If you make sure your rail joiners are tight to the rail and they usually will work for about two years before your start having problems. The SS screws are #2 x 5/16" round Phillips head. I currently have these available, email info@mhgrs.com if interested, I can send you an instruction sheet.
 - iii. Use a commercial type of mechanical squeeze joint, (rail clamps). These are much more costly and tend to need re-tightened periodically and may not be as good as the above items. They are easy to remove and rearrange track if needed. They also make ones for lift out sections such as bridges where needed.
2. For all types of operation (steam, battery, or electric) you must have a joiner that provides good rail alignment. I used all LGB or Piko brass rail joiners. Squeeze rail joiners to fit very tight on the rail before installing.
3. File bevel on all sides of rail ends to ease installation of rail joiners and prevent wheels from picking the track joint.

5. Track support and ballast.

1. Remember temperatures on your rail will go as low as the lowest temperature in the winter (20 to 30 below zero in some areas) to a blistering 150+ degrees in direct sun with no breeze.
2. This requires room for expansion. If you solidly anchor both ends of a rail it will buckle or bend and break loose from the ties.
3. Lay track loose in ballast.
4. The road base under your track should be a solid foundation. This can be cement, pavers, cinder blocks, Hypertufa, or a good compacted base. A compacted base can be any type of material that will compact solidly and stay put, one thing that work is a material called "road base", it is comprised of 3/4" rock down to fines, your sand and gravel supplier probably has something similar. Use 3 to 5 inches below the track.

5. I recommend laying track in a ballast of crushed rock, do not use round river rock or Squeegee. I use crusher fines (also called breeze) or 3/8" granite or something that is sharp edged so it will pack and stay in place. Some areas use chicken grit. I recently have been using 3/8" granite. Under the crusher fines. Switches must be supported for their length plus at least 6" beyond for good operation. I do not recommend any kind of wood product. One item that appears to work well is a cement backer board used for shower walls. Cement or some type of plastic (UV protected) is recommended.
6. Long straight runs or hand spiked rail on bridges or trestles in excess of 5' may require expansion joints to avoid track bowing sideways. Use 3/32" to 1/8" per 5' of track. When hand spiking rails, only spike often enough to maintain the proper gauge, I have found that spiking to frequently will not allow the rails to slide for expansion in hot or cold weather, this is more of a problem on curves and the track will pull up the ties in cold weather, giving you a highly super-elevated curve.
7. If you mount track solidly on boards, supports, or concrete.
 - i. You must provide about 1/8" for expansion for every 5' of rail.
8. Another method is putting your track on "Hypertufa" road base. This is a semi- permanent base made up of cement, sand, and peat moss. It also works well for embankments. I have a separate document on Hypertufa road base.

6. Bridges, Tunnels, and Trestles.

1. Make sure you have ample clearance if trains are to run under any bridges, I use a bare minimum of 8-1/2" ht. and prefer to have 10" from railhead to bottom of structure and 3.5" from track centerline, more on curves (these will need to be increased about 1" for 1:20 scale equipment).
2. You can put in a redwood, cedar, or treated lumber plank for temporary bridges until you decide what type you want, or until you can build it. Bridges can be purchased or you can build your own. For building your own I recommend using redwood (preferred as it has a finer grain) or Cedar 2x4 lumber and sawing it to the proper size. For truss bridges with actual tension rods, I recommend Teak, it is much more stable than most other woods.

7. **Remember to build it so it suits you!! Most garden railroaders go by the 10' rule. If it looks good at 10' its good enough!**

References:

Garden Railways Magazine www.grw.com, highly recommend you subscribe to this one.

Books I am aware of:

Garden Railway Basics by Kevin strong. www.grw.com

Garden Railways, Getting Started in Garden Railroading, The Large scale Garden Railroading Handbook.

Garden Railways Magazine also has other related books available on their website.

If you have questions, ask at your local dealer, or email me info@mhgrs.com Byron Fenton