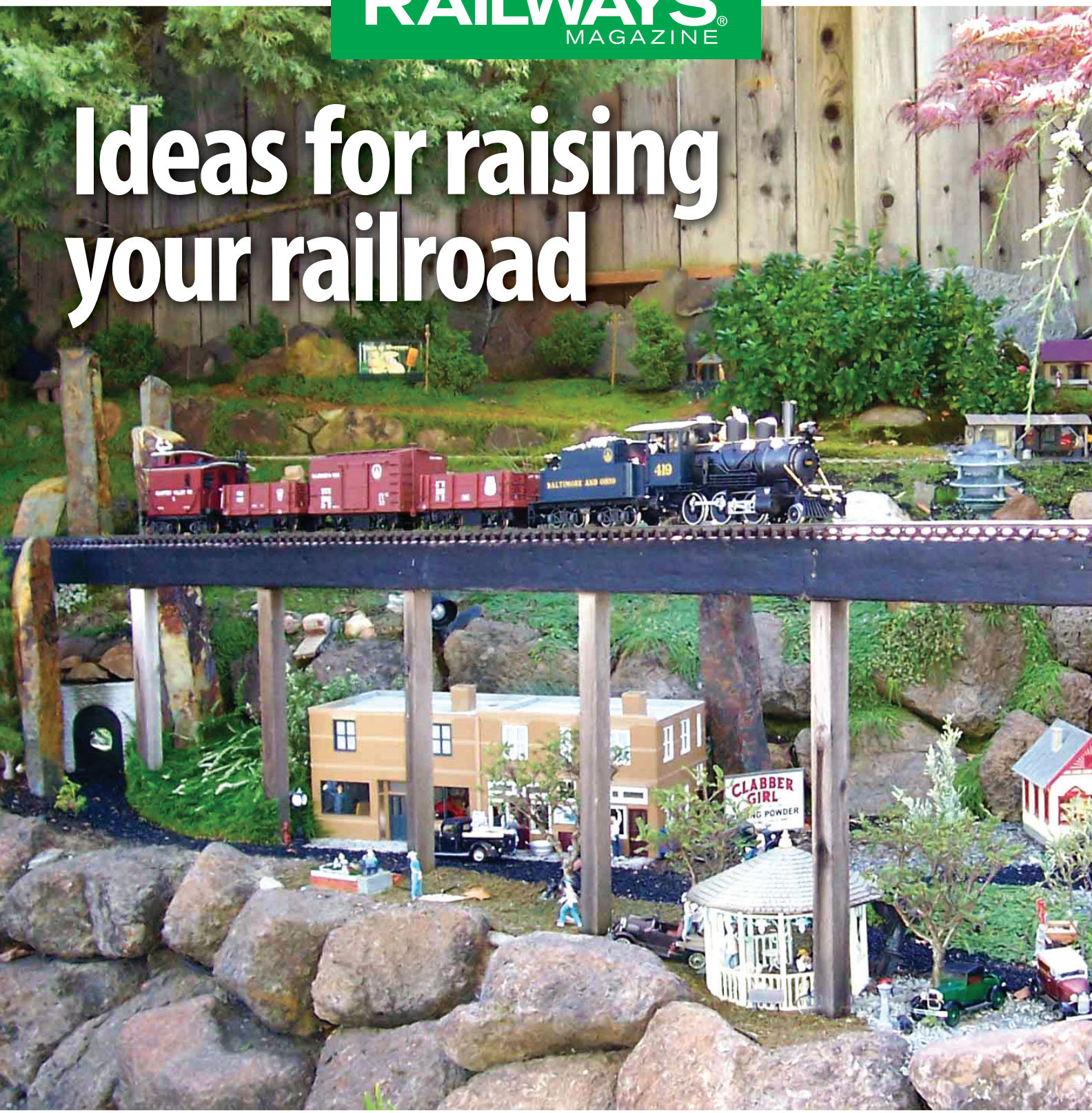
Garden RAILWAYS® MAGAZINE

Ideas for raising your railroad



Garden railway basics: Raise your railroad

Greening: Blend benchwork into your backyard

Build your own pre-cast concrete roadbed

Raise your railroad

On this ground-level garden railway, the train is barely visible above lawn. A raised line solves the problem.

PHOTOS AND DRAWING BY THE AUTHOR

I hope that by now you're starting to feel excited about actually designing your garden railroad. Up to now, our series has focused on giving you useful technical knowledge—learning the tools of the trade, if you will. Most of the how-tos come fairly easily; how to measure your yard, how to lay track, how to wire your railroad. (Some of these we have yet to cover.) But when it comes to how to design a garden railway, many people start to get a little worried. The usual saying goes something like, "Oh, I can't do that, I'm not very creative."

I think one of my old college professors answered that one better than I can. He repeatedly pounded into the thick skulls of his first-year graphic-design students that good design skills are not some mystical, you've-got-it-or-you-don't kind of gift. In fact, he maintained that about 90% of the equation was training and only 10% was talent. Like any skill, design skills can, to a great degree, be learned and acquired. Note that "design" is not the same as "copying" Whatever aspect of design you are talking about, it's not a matter of someone telling you to draw a line here, build a wall there, or lay a track that way for some instant, perfect design. It's a matter of following some techniques and applying some principles, so that you can decide for yourself where the track should go.

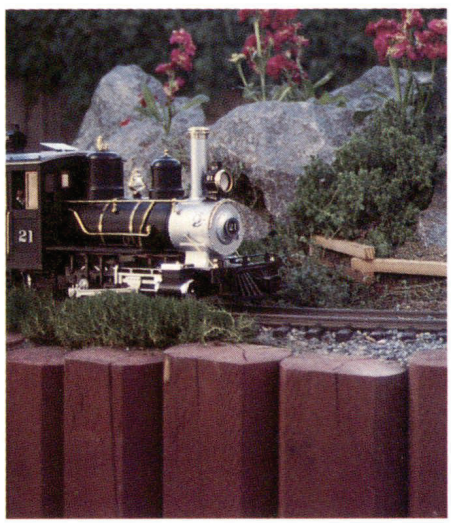
One of the ways designers make themselves appear to be so creative is by making use of the constraints of a given situation. In other words, they turn a negative into a positive. In fact, I think most designers would agree that there is nothing tougher to work with than nothing—a dead-flat building site, a blank canvas, a clean piece of paper, a lonely computer cursor blinking back at an author facing a deadline. A total lack of restrictions leads to a total lack of reason. There is no "cause and effect," no "form follows function," no inspiration.

Please excuse my side journey into design theory, but I think you get the drift. These same basic thoughts apply to designing your garden railway. If you have almost unlimited space, what's to say that one corner of the yard is better than another for your railroad? Philosophically speaking, what's the reason for your railroad? Why should the track curve instead of going straight? Knowing that your track can go just about everywhere is quite different from knowing why it should go anywhere at all. If you have a space that gives you a lot of constraints, count your blessings! If you find yourself lacking in constraints, create some! You may just find a great garden railroad in the process.

Take the high ground

One of the best design constraints you can place on your garden railroad is to raise it up above ground level if at all possible. I say this with apologies to the builders of some very nice ground-level railways. Even my own first garden railway was built right on the ground, and it certainly wouldn't qualify as one of the great ones. I've been lucky enough to see a lot of beautiful garden railways and take photos of many of them. On my own railway, I could put the camera down on the ground and produce a nice picture, but that wasn't very convenient for everyday, real-world enjoyment.

Case in point: There is nothing at all wrong with a toy train circling a Christmas



This garden railway was raised using landscape timbers, cut and set into ground.

tree. After all, that's how many of us were introduced to model trains in the first place. Many a child has dreamed away the hours, chin on the floor and eyes full of wonder at how much a toy train looked like the real thing. Let's face it, model railroading as an adult hobby is really still about the same thing—creating something realistic enough that your imagination fills in the blanks and makes you believe for a moment that it's real.

A proper viewpoint is of prime importance for realism, and for practical purposes, that means moving the trains up from toe level to something approximating eye level. Yes, raising your garden railway can be quite a bit of work, and you'll have to do it at the beginning, when you're really inspired and itching to be laying track and running trains, instead of shoveling wheelbarrows of fill dirt. But I can just about promise that you'll eventually agree it was worth the effort. Imagine yourself saying to your friends "Just lie down on your stomach here on the ground and see how realistic the train looks coming around the bend." You can guess the reply. Now imagine instead that your friends are relaxing in lawn chairs and watching as your new loco bursts out of a tunnel and chugs across a high bridge right in front of them. You won't have to coax the compliments out of them!

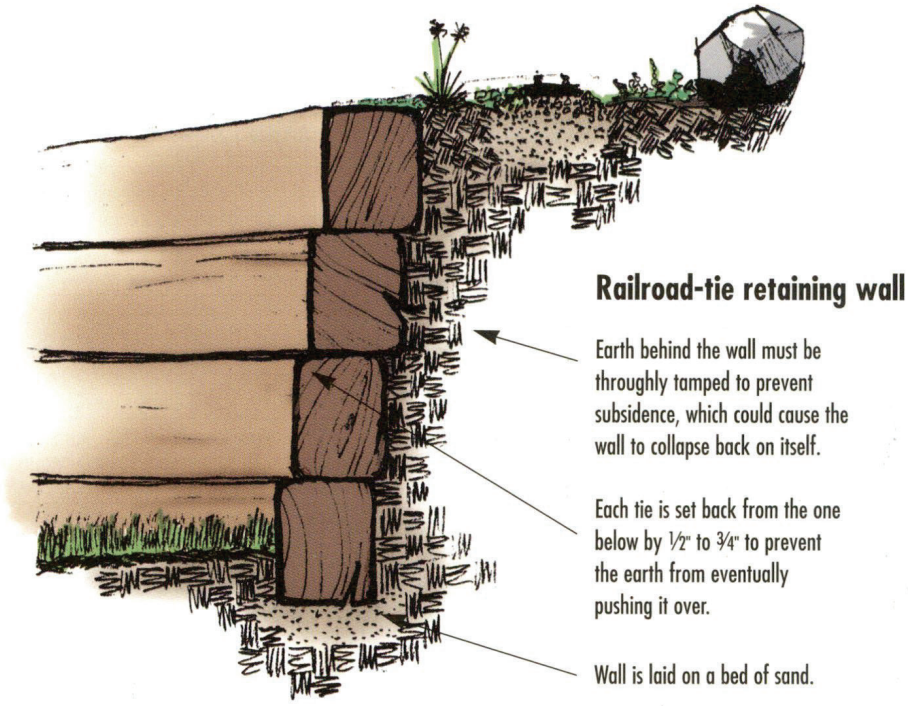
A raised bed for your railway will also be far more convenient for construction and maintenance. In building my first garden railroad, it wasn't long before my aching back was telling me how shortsighted I'd been. Sure, I saved a few weekends of heavy earthwork, but I regretted it every time I bent down to clean the track or rerail a car. And if the lawn didn't get mowed for a couple of weeks, about the only visible parts of a passing train were the smokestack on the loco and the cupola on the caboose. Granted, modeling a rugged jungle railway is a valid theme, but that wasn't exactly what I had in mind.

How high is up?

Just how, and how much, to elevate your railroad is up to you and your resources. The owners of the imaginary yard in our December 1997 installment have it made. The existing retaining wall gives them a great base to start from, at a very handy three feet above the ground. Any mountains built up above this level already have a head start, from the viewer's perspective. Unless you're a pro basketball player, you'll be looking up at the peak of a four-foot-tall mountain, just as you'd look up at a real mountain. Combine the mountains with some two- or three-foot-deep valleys and you have some pretty dramatic topography. All of this may amount to a lot of words for a simple concept, but it's amazing how many otherwise nice garden railways end up lacking impact because the "normal point of view" wasn't a design consideration.

A nice aside is that a railroad at this height would also be an ideal candidate for highly detailed scenes, since it would naturally invite viewers to walk right up for a closer look. Maybe this brings up an interesting counterpoint: If you don't want to go to the effort of putting a lot of detail into your cars, locos, and structures, build your railroad on the ground where most people won't notice the lack of details.

If a three- or four-foot height simply seems like too much to accomplish, consider raising your railroad up just a foot or two. Even that can make a huge difference, and the construction is fairly easy. There are several popular styles of do-it-yourself, mortarless, landscape wall blocks available at most building-supply centers. A few rows of these can be laid up in short order and at relatively modest cost. Two or three old railroad ties placed one atop another also provide a nice height to work from. Peeler logs or landscape timbers can be stacked horizontally or cut and set into the ground vertically.



Concrete block, brick, or stone walls grace many garden railways. The possibilities are almost limitless.

If you can't raise your whole railroad, maybe you can raise part of it. If your yard slopes away from the house to the back fence, your track can start at ground level by the back porch. Then, as the ground gently slopes down, the track can gradually rise. Neither elevation change by itself needs to be very noticeable, but within a few yards the track will be a couple feet above the ground below. This provides a refreshing variety of angles from which to view the trains and it heightens the sense that the railroad is really going somewhere, not just horizontally but vertically.

It might take a little while to get used to thinking in an "extra" dimension. Make use of the technique of building quick paper-and-cardboard models of your design ideas (see "Basics," February 1998) to help you visualize things. Pick each model up and take a look around your proposed railroad from a scale-eye-level perspective. Look at it just as you would if you were standing there experiencing the real thing. There's a definite purpose in going through this process. It should help you change the way you picture your railway. Think about it. How often do you view a real railroad looking down from above? Sure, you can climb a mountain or take helicopter ride, but more likely you'll find yourself looking more or less straight across at a passing train. Why should your garden railway be any different? II

Blend benchwork into your backyard

RUSS MILLER

1. Steve and Darci Smith's VdB Ry takes advantage of a pre-existing hedge and the prehistoric Mount Tamalpais in the background. No miniature plants needed here.

Sometimes the most expedient way to get your outdoor railway from point A to point B is on benchwork, so called because the height of the roadbed is similar to that of a workbench and facilitates the handling of trains and track. The many styles of benchwork construction seem to correspond to the skills of each builder, but here we'll focus on how to fit the snaking man-made tables into a pleasing landscape. After all, the successful acquisition of real estate for the railroad's right-of-way depends on a plan the whole family will like.

Hide the mechanics

The surveyors and civil engineers of the Vista del Bahia Railway (photo 1) rose to the challenge of respecting the integrity of the natural setting and lush gardens already in place. In fact, when trains aren't running, it's difficult to find the roadbed or see where its owners, Steve and Darci Smith, installed 300' of track. Much of the dual-track mainline seems to float along the top of a hedge.

Where the dogbone trackplan opens up to a loop, he needed another technique. On the bottom of his roadbed bench of ripped bender board (plastic lawn edging), mounted on metal fence stakes, he drills holes for wires to support clinging vines (photo 2). Along a fence, he arched a chicken-wire frame to support a tunnel of vines.

As our bodies age, our railways can evolve to keep us active in the hobby. By

PHOTOS BY THE AUTHOR EXCEPT WHERE NOTED

2. When you're passionate about running trains in your family's beautiful gardens, it helps to hide the mechanics of the benchwork. Steve shows how to make trackwork disappear amid passionflower vines.

Regional gardening reports

Zones listed are USDA Hardiness Zones

Question: What techniques help to keep the mystique alive when hiding the mechanics of your non-scale roadbed?

Doug Matheson
Manotick, Ontario, Canada, Zone 4
Multi-engineering

My prior experience of regularly running trains on a mostly elevated railroad influenced my decision to build elevated track—it makes operating and working on the railroad so much more pleasurable. But I also wanted a garden, to increase the pleasure of being in my own little world. Because of the rather ponderous look of pressure-treated 2 x 8" roadbed on 4 x 4" posts set into deck blocks within the garden, I've evolved four strategies for integrating the railroad:

- **Lattice.** In areas where the track must be handily reached, I've used a wooden lattice, often hiding parts or all of it with ferns (I garden in the shade, hence the choice of planting).
- **Terracing.** In other areas, I've raised the garden using walls, rockeries, or earthern berms.
- **Grading.** I've sloped the railway roadbed up on a more gentle angle where there is enough space.
- **Spanning.** Lastly, to avoid really extensive earthen berm-like gardens, I have spanned raised gardens with some lengthy bridges. In one place, a 16' span of four deck-girder bridges crosses my garden 30" above ground, while, in another place, a bridge made of three trusses spans 24' at a height of 20".

Ultimately, the goal is to provide a pleasing garden space in which to enjoy operating trains, hiding the unsightly heavy construction needed to achieve it.

DOUG MATHESON

A truss bridge spans two gardeny raised beds, then benchwork takes over (upper left), but it's surrounded with greenery.

Ray Turner
San Jose, California, Zone 9
It takes thyme

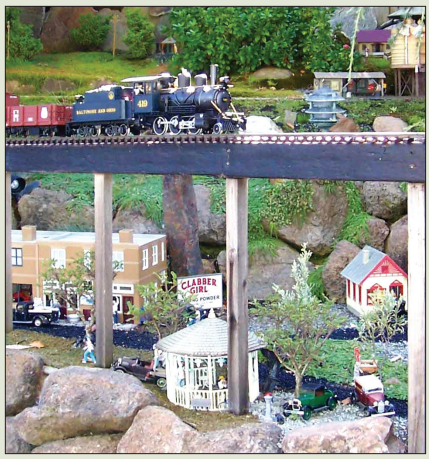
Mystic Mountain Railroad gains elevation on a steep part of my yard via a 4½-turn double helix in an area about 12' x 15'. I covered the visible part of the helix with concrete rock castings. While this is a point of high interest on the MMRR, it does create a large area of bare rock, and I wanted to soften it a bit. I chose to mount a planter on the backside (interior) of the rockwork, where it can't be seen from the front. I planted thyme, which will eventually hang over the edge of the rockwork to break it up with some green. The planter is fed from a drip-watering line with another tube for a drain to the ground, so it doesn't water the tracks below.

RAY TURNER

Thyme looks forward to draping over the vertical geodesic cliff on Ray Turner's line. Note the tracks inside the helix (top right).

Frank Lucas
Pleasant Hill, California, Zone 9
It takes two

I must admit that I was impatient to get a train running when we built our garden railroad, so I took many shortcuts (which I must now do over, the right way). I laid the track with little thought to greenery or scenery but I did get my little Mogul running around just 12 months after we started. One day, while I was happily doing this, Donna appeared with a paintbrush in one hand and a can of black paint in the other, and attacked the bender-board (plastic lumber) garden edging that I used to create the elevated section above the village. Voila! It is now a girder bridge that spans the open space and disappears beneath our Japanese maples.



FRANK LUCAS

The Lucases' scale village and pastoral scenery distracts from the benchwork but Donna's idea made a big difference, too.

Bill Hewitt
Mansfield, Massachusetts, Zone 5
Hedgerows

We used dwarf barberry to line the sides of our raised line in the European section of the Southpark & Dogbark Garden Railway. It requires frequent trimming to maintain but works beautifully to hide the raised roadbed. In other areas, a perimeter hedge of this thorny plant keeps our dogs at bay.

Christina Brittain
Washougal, Washington, Zone 6-7
Veering vines

Many annual vines, like nasturtiums, grow too large for our Quinn Mountain Railroad. However, there are a few with good scale proportions. Some climb with their own supports—twining stems or tendrils that easily ascend bare, vertical, metal and wood surfaces and trellises, or

BILL HEWITT

Dwarf crimson barberry (*Berberis thunbergii* 'Atropurpurea', Zones 4-8) is regularly clipped to a height of 18-22" to hide low benchwork on the S&DGR.

cascade down benchwork and rock walls.

Our favorite small vine is black-eyed Susan (*Thunbergia alata*, Zone 9-10), which produces black-centered yellow flowers until the fall frost. It takes heat well, full sun to part shade, and moderate water. Seeds can be started indoors in early spring or sown outdoors after the last frost; they may self-seed in zones warmer than Zone 5.

We discovered this vine after installing a unique curved stone as a short tunnel. We supported it over the tracks by drilling two holes (1" deep, 10" apart) into one end of its underside, driving ½" rebar into the ground, then setting the drilled holes onto the rebar. A narrow, vertical rock now disguises one rebar and a black-eyed-Susan vine the other.

CHRISTINA BRITTAIN

Black-eyed Susan vine hides the metal bars holding up a rock tunnel on the QMRR.

3. RIGHT: John and Janet Morrison re-landscaped their yard to include walkways along a raised-benchwork railway. Without landforms, making natural view blocks can be an awkward task on benchwork railways. Mature cutleaf Japanese maples, with the help of wire mesh and portals, create tunnels through green mountains.

4. Intricate details on the Morrisons' DNRy would be missed at ground level. At this height, viewers luxuriate in finding the whole story.

necessity and for the love of running trains, John and Janet Morrison retrofitted their gardeny, ground-level Dunckley Northern Railway (*GR*, June 2008) into a beautiful, all-benchwork railway. Shrubs and taller plantings replaced their low garden, although groundcover still flourishes between posts and pathways. Now Japanese maples, with their lacy leaves, provide a canopy over the roadbed in several areas, forming green tunnels (photo 3). Even their rail yard got a makeover on a chest-high platform (photo 4). It makes sense to place industries where plants can't grow. By consolidating the rail yard near the house, the busy scene captivates our attention and provides a handy transition from their indoor rail yard. As a bonus, the scale, post-raised office, water, and fuel tanks camouflage the fence.

After completing a miniature town for their Heavy Metal Railroad, Gary and Carol Garnas circled their yard with a long "fence" doubling as roadbed. You could say they hid the benchwork in plain sight because trestling fills the gaps between every post (photo 5). The fine trestlework scales down this rugged large-radius benchwork, and trains are assured a fast ride back to town.

Different like snowflakes

The regional gardening reports and photos 6 and 7 depict some of the many

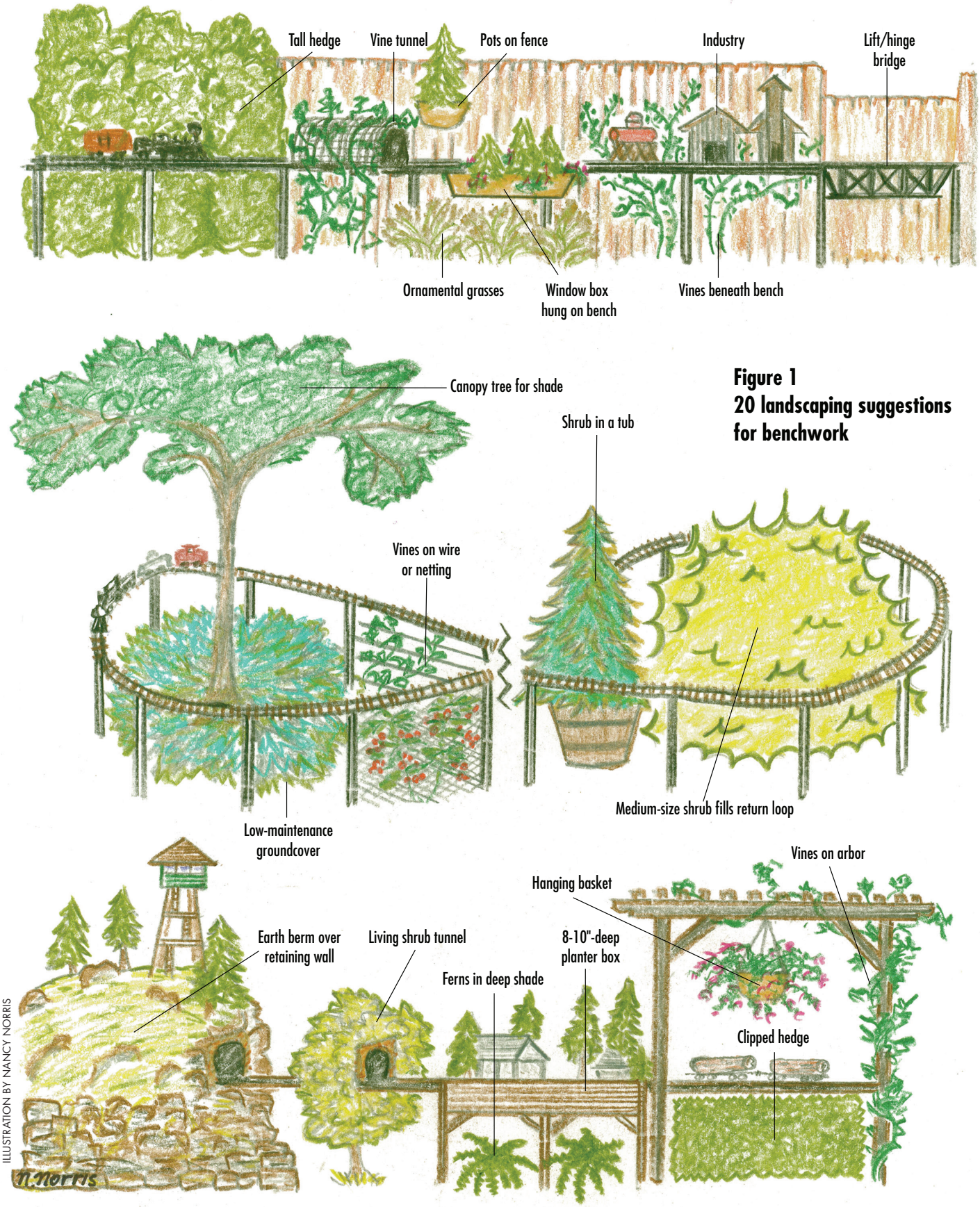


Figure 1
20 landscaping suggestions for benchwork

ILLUSTRATION BY NANCY NORRIS

5. Gary and Carol Garnas disguised their benchwork with trestle work. Or did they beef up their trestle with 4x6s?

6. The Sunset Valley Railroad runs long trains on large-radius curves. Pete and Carol Comley mix up the benchwork look with several ideas found in Figure 1.

construction/planting choices, also sketched in figure 1. For example, Pete and Carol Comley's mostly benchwork railway needed access for the lawn mower, so they built an arched bridge over that opening in the lawn (photo 6). Then they planted their arborvitae hedge just behind the benchwork in this sunny spot and grew ivy vines on a shaded fence.

Conversely, Pat and Jo Ann Peterson run trains just behind their clipped hedge (photo 7). From that benchwork, curved girder bridges turn the trains past a wooded garden on the way to more benchwork along the house, where trains travel through the guest bedroom.

Dave Hartwig needed a spur to show off his detailed logging industry, so he built a raised planter box along a walkway (photo 8). With no room for an earthy landmass, the gardener in him built the box strong enough to plant trees around the sawmill and greened it underneath with ferns.

Plumbers will use PVC pipe for posts, carpenters will choose pressure-treated wood, welders like metal, and the handyman will find something stashed in the shed on which to run trains. It's up to you—hide the sub-roadbed or flaunt it. Take a look at your specific needs and where the train has to go, to make it as accessible and pleasing, as your purse allows.

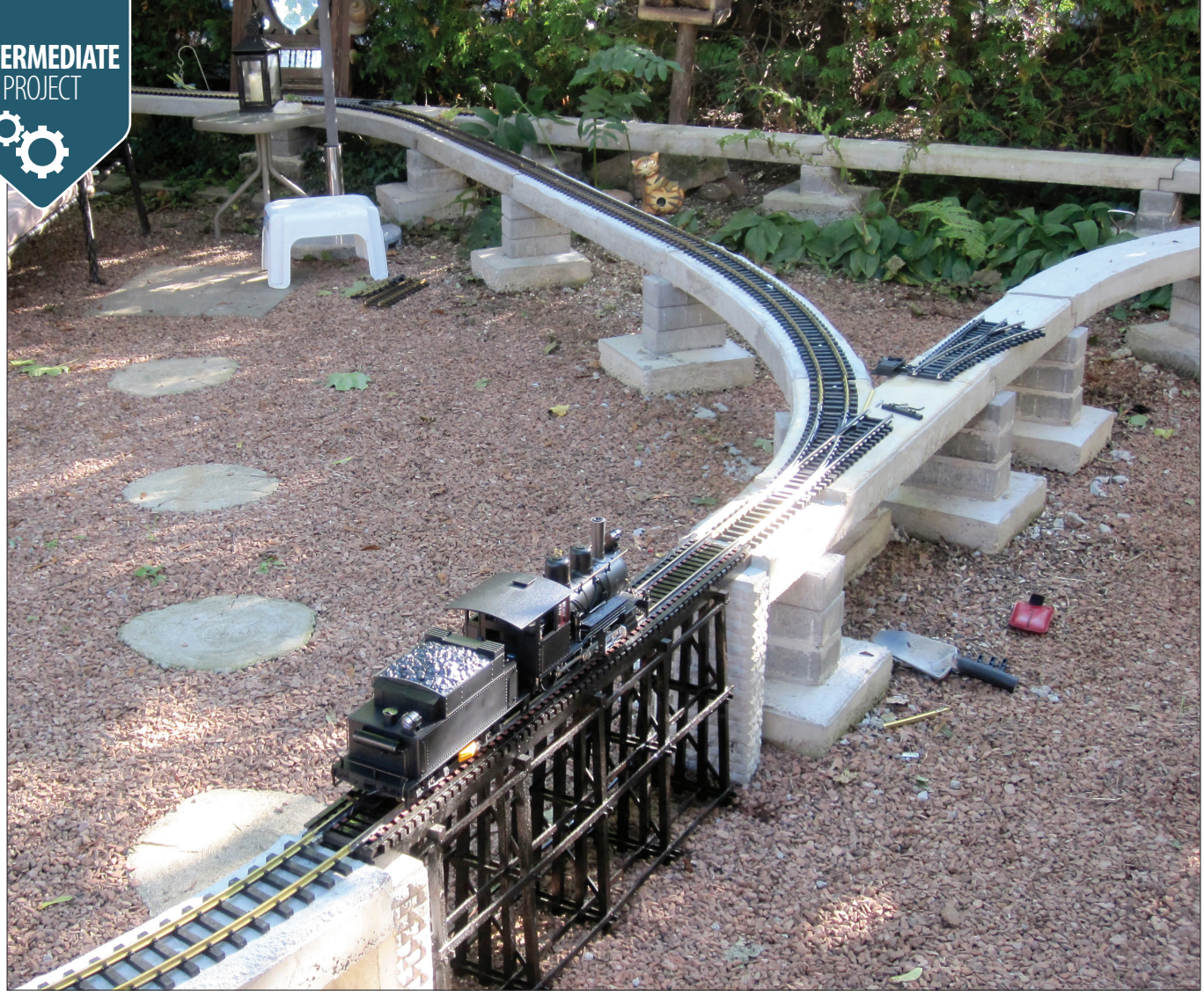
7. ABOVE: Pat and Jo Ann Peterson's O-scale railway travels along a 60' (or so) stretch of benchwork hidden by a long clipped hedge. Benchwork can become good girder bridges with details, like vertical bolt plates and the railway's name—here Pacific Rim.

8. RIGHT: Dave and Peggy Hartwig's Hilary Logging Company branches onto a box made of pressure-treated plywood and 2 x 4s. The soil measures 7" deep. A guest tests its 1:1 strength.

Earth islands

View a gardeny railway of raised planter "islands" growing miniature scenery. Larry Staver's Steamup hosted dozens of steamheads. They ran their live-steam trains from indoor benchwork onto outdoor benchwork, which bridged mountain scenes built on affordably constructed retaining walls.
http://youtu.be/_9ashTZMVoo

INTERMEDIATE PROJECT



An LGB Mogul tests a new trestle on the author's precast-concrete railway.

Build your own precast-concrete roadbed

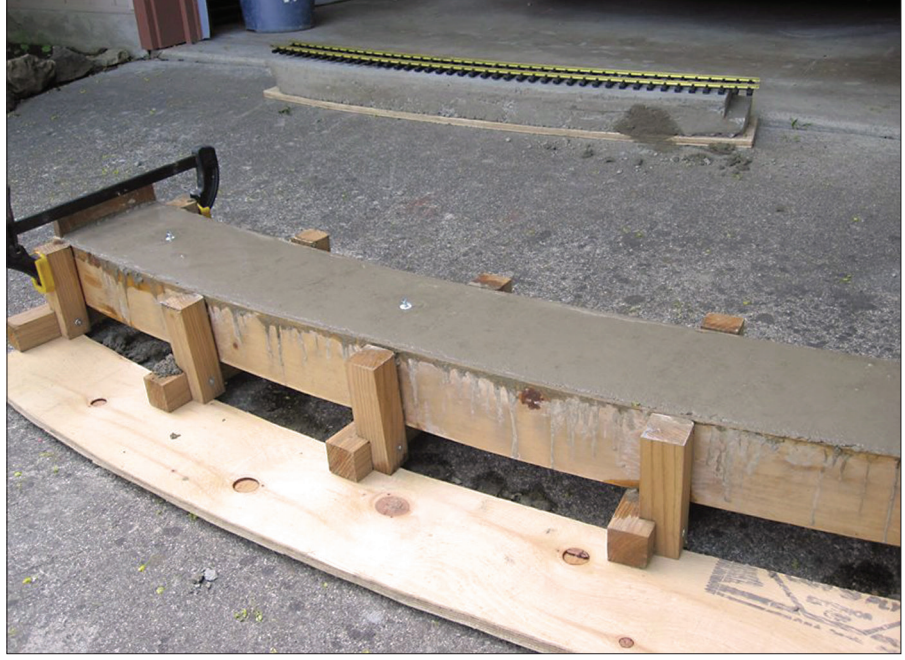
A durable system for a raised railway

by Eric Repaci | Guelph, Ontario | PHOTOS BY AUTHOR, ILLUSTRATIONS BY MARC HOROVITZ

I've always had a love of trains. I grew up adjacent to a railway station and witnessed the transition from steam to diesel. It is now a comforting thing for me to replicate those experiences through model railroading. I have had train sets of sorts most of my life and have spent a lot of time modeling HO. Now that I am older, with eyesight not as acute as it once was, the smaller gauges are becoming more difficult to work with. My decision to enter large scale was influenced by seeing an outdoor railroad on a trip to Florida. I was completely awestruck by it. Now that I have a small home with a backyard, large scale makes a lot of sense.

I live in Ontario, Canada, in the heart of the Great Lakes region, where winters can be cold and snowy and summers hot and humid, so building a permanent outdoor railway would have its challenges, maintenance-wise. I decided that my railway would run along the perimeter of the property and, since my property is a corner lot, a dog-bone with a 90° bend in it could be operated as a continuous loop or could offer the appearance of point-to-point operation. Another decision to be made concerned the roadbed, which is important to longevity and problem-free running. Roadbeds on indoor railways are a piece of cake: build it in wood or Styrofoam, and that's about it—no worries about rain, snow, frost, leaves, etc. Outdoors, that is not the case, as those with garden lines know.

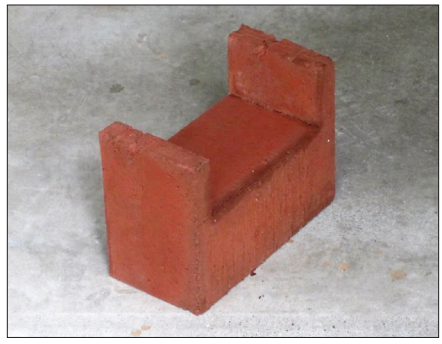
When I was planning my railroad, I decided to elevate my track a minimum of about a foot, so as to not have to work directly on the ground and also to keep the track from low areas where water might pool after rainstorms or freeze during the winter. I also needed to decide what material to use to elevate the track. My research of current railroads indicated that wood was predominantly used. Just about everything else had been tried but there were always some issues. I came up with an idea one day as I was driving on the highway, where there were a lot of overpasses made of precast-concrete components. Why couldn't smaller versions of these precast components be used for the outdoor railway?



1. A span being cast in a first-generation form. The first series showed areas that could be improved.

The first generation

I chose 20'-diameter Aristo-Craft track that I had purchased earlier, and started to construct a roadbed to suit. I decided my roadbed spans would be about the same length as one section of the curved track, have overlapping joints, and be thick enough to support their own weight without reinforcement or the use of rebar. The result was a module 42" in length, 6" wide, and 3" thick, but I had no way to anchor the track. Having this prototype without any proven result was a risk because of the amount of work involved and no trial bases to see how it would work. My first precast-concrete form can be seen in **photo 1**.



2. A concrete retainer "clip" used on the first-generation test sections.

3. The assembled first-generation test unit. All pieces are mortared together.

The first year became my test period. I built a short section of this roadbed and left it exposed to the Canadian elements to see if there would be any concerns with that design. **Photos 2** and **3** shows my first generation of precast-concrete roadbed as I built it: three sections of precast spans, three sets of risers with three retainer clips to hold the roadbed together and, of course, the track, with my first ever locomotive on top. The footings for this trial section were 24" x 24" patio squares purchased at my local building store.

After the trial sections spent a year outdoors, I learned a lot. We endured one of the coldest, long winters that southern Ontario had ever recorded and, to my delight, after the spring thaw, that section of roadbed did not shift, crack, or anything else imaginable, but was exactly as I had left it. This provided the proof I needed. With some modifications, I could now

4. Plywood form bases for 5'- and 10'-radius track.

5. All of the bases have been treated with urethane to make them moisture resistant.

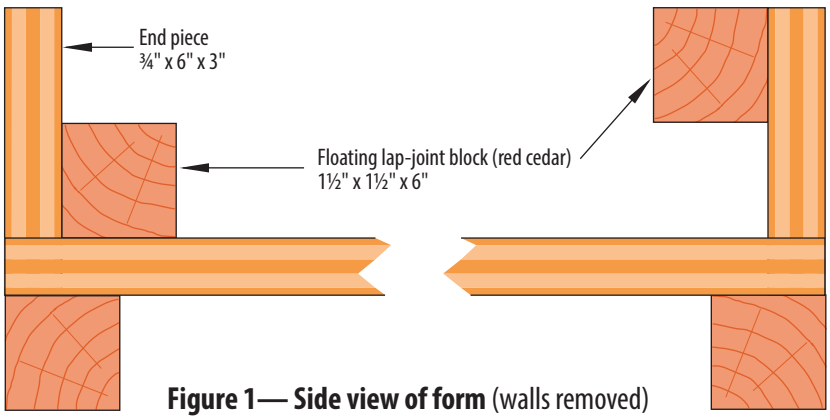


Figure 1— Side view of form (walls removed)

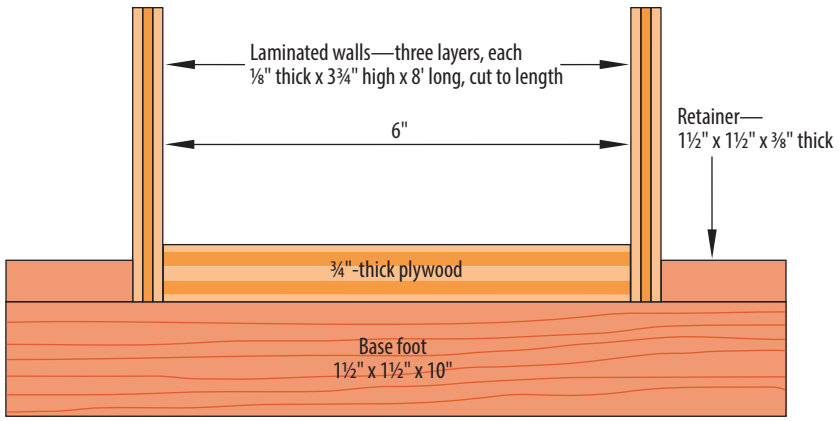


Figure 2— End view of form

get down to the business of proceeding with construction of the second-generation system.

Form construction for precast roadbed

To construct the curved form, I started with a 20'-diameter Aristo-Craft track section. Using the track as a template, I cut out the base of the form with a jigsaw, using ¾" finished-one-side plywood. I increased the base width to 6" so that it would be wider than the track profile. Once the bases were cut out (**photo 4**) I sealed all of the plywood pieces with urethane to make them water resistant (**photo 5**). Wet concrete will sit in these forms for a couple of days and water and bare wood do not do well together.

After allowing the urethane finish to fully cure, cedar blocks were installed beneath the bases (**photo 6**). These gave further strength to the bases and allowed retainers for the form walls to be screwed in place, giving the forms their shape.

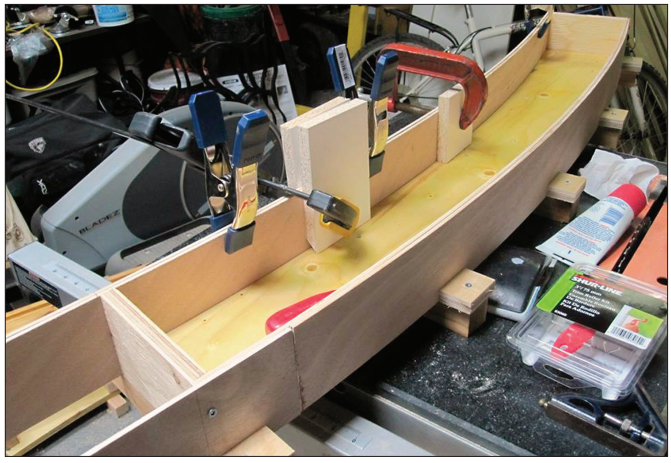
The walls of the forms are constructed of ⅛" laminate plywood, which I cut into 8' lengths, 3¾" high. For assembly, I used several good-quality spring clamps, waterproof wood glue, and patience. Building the forms was a lengthy procedure that took days to complete.

Each wall was built up of three laminates, glued together and clamped until the glue was fully set. I placed each laminate against the form to get the required contour, then applied glue with a small roller, sandwiching the laminates in place with the clamps as I went. **Photos 7** and **8** will give you an idea of how it was done. All wood components were treated with urethane to protect my investment in these forms; they can be reused for a long time to come.

The end pieces for the forms were also cut from ¾" plywood, 6" wide x 3" high. The reason the ends were not 3¾" is so that, if I needed to make a precast piece shorter than the full length, I could move the end piece to suit and clamp it in the desired position.

I also cut lap blocks for each end of the form. I used red cedar for this for further water resistance. I cut my blocks from a 4" x 4" cedar post and ripped them into 1½" x 1½" sections, trimming them to 6" long. These were also finished and placed at each end to form the lap joints in the

6. Wooden feet have been added to the bases.



7. Laminated plywood sides are being added to the bases. They are glued in place and clamped until set.

concrete (see **figures 1** and **2**).

Before pouring the cement, I brushed all of the contact areas with regular automotive motor oil. This provided the forms with further protection and allowed the concrete to be removed with ease. The precast track spans need at least four days to cure before I remove the forms.

Track anchors are simply drywall screw anchors with #8 Robertson (square recess) screws in them, both inserted into the fresh cement, which was then allowed to set. Once the cement had cured, I could then just back out the screw and use it to secure the track to the roadbed.

Construction of the roadbed risers

My raised, precast roadbed needed risers of some sort and, because the spans are made of concrete, it was a logical choice to use concrete as well for the risers. My initial design used custom-made risers with a cast-concrete U-clip to keep the precast sections together but, after a year in use, I realized that this was not necessary and too complex to produce. Since there was no shifting of the roadbed without the clip, it was easier to go with materials that were readily available at most building-supply stores.

The previously used 24" x 24" patio stones, purchased for about $12, were replaced with a 12" x 12" x 3" footing form (**photo 9**) that I could pour myself with half a bag of fast setting, ready-mix concrete. This saved about $8 for every two footings and because I was pouring the mix on top of the ground, I didn't need to pre-level the ground for a patio stone, then level the risers again. The forms were

8. The finished sides are nicely curved. Form walls are held in place with wall retainers, screwed to the feet below.

9. Forms for the footings are made from four pieces.

10. Footing forms in the foreground are held together with spring clamps, ready for the pour. A string is in place where the roadbed will go. A straight span is on its side at the right.

11. A mason's line is used to guide the placement of the risers. Mortar is used to bring the risers to their proper height. A line level can be seen at the far right of the picture.

12. Spans rest on the risers without actually being attached.

13. The finished system provides a firm and attractive roadbed.

constructed in four pieces. I use spring clamps to hold them together—no screws or nails. **Photo 10** shows the forms aligned with a mason line. Once the concrete is in, I smooth the top with a trowel, wait 40 minutes, remove the clamps, and allow the concrete to set for a full cure of 24 hours before working on them. Leveling of the forms is simple: just pour and set, then move on. Coincidentally, the form for the precast-concrete span and the one for the footing each used one 66-pound bag of ready-mix cement so calculating the cost of concrete was easy, as each span form was same length as a section of track.

The next step was to determine the height of the risers. Using two wooden stakes and a mason line, I determined the height and position of my track and pulled a tight line between the stakes. I leveled the mason line with a line level. I used ready-mix mortar mix, a pointed hand trowel, a pail, a garden hose for water, and a wheelbarrow for mixing. I used standard concrete paver stones for the actual risers, which are also readily available at any building store (**photo 11**). The line level can be seen at the far right side of the picture.

I dry-stack the paver stones as close to the mason line as I can get them, then I measure the difference. For example if I was using two pavers and there was a 1" gap between the top and the string, I would make two mortar joints, each ½" thick, to bring the pavers up to the proper height. I repeated this method as I moved on to each footing. I allowed a day to let the mortar set fully before attempting to place the spans on the risers.

This is a floating system, so the spans don't need to be mortared in place—they just sit on top, with the lapped joint directly over top of the risers. **Photo 12** shows the risers and footing, with the level spans resting on top.

Risers are basically floating, with some mortar to achieve proper heights to level. The precast system is a floating system, which allows it to expand and contract without cracking or heaving. It is reusable or movable. Because of the weight of these pieces, their placement on the ground does not appear to be affected by the frost, which is advantageous.

This method of roadbed might be for a more experienced builder. I learned construction early in my working life, along with woodworking and machining, but with the knowledge you will gain here, I believe that anyone can replicate this system for their own use. **Photo 13** shows it in place, with track laying under way.