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2016

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Baltimore harbor
layout. See
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**8 ways to
hide the end
of the line** p.10

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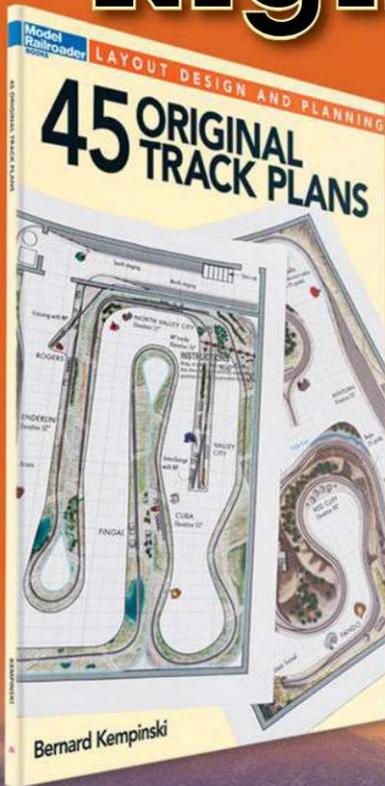
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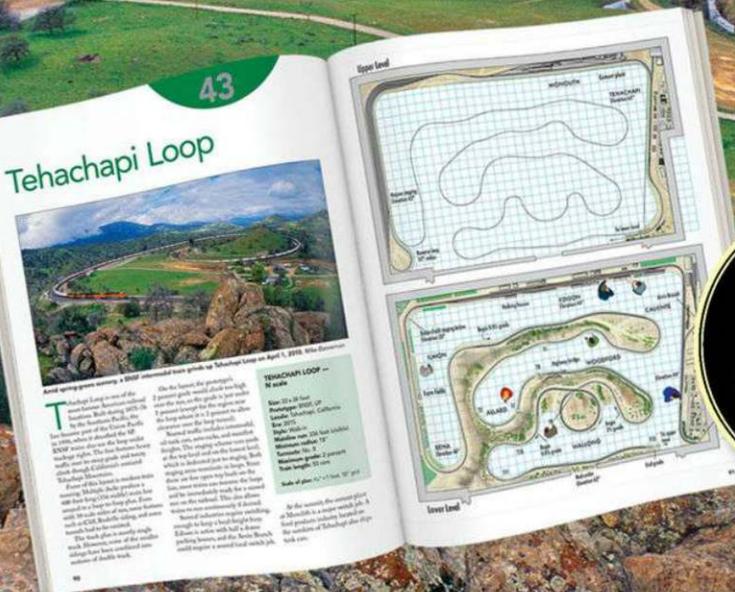
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2016

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MODEL RAILROAD PLANNING (ISSN 1086-5586) is published annually by Kalmbach Publishing Co., 21027 Crossroads Circle, P.O. Box 1612, Waukesha, WI 53187-1612.

Single Copy Price: \$8.99 U. S., \$9.99 Canadian, payable in U. S. funds. (Canadian price includes GST.) BN 12271 3209 RT. Expedited delivery available for additional \$2.50 domestic and Canadian, \$6 foreign. ©2016, Kalmbach Publishing Co. All rights reserved. Printed in USA.

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//Editorial

Fiddling around while waiting

I suspect that most *Model Railroad Planning* readers are familiar with the term “staging yard” and its implications. The idea is simply, “Railroading is based on the concept of being able to forward freight and passenger cars from the point of origin on one

railroad to a connecting railroad and so on to the final destination.”

To simulate this on our model railroads – that is, to explain how a BNSF Ry. covered hopper from Montana winds up on CSX in Georgia – we’ve learned to add passive staging yards to our track plans. These often-hidden yards provide a place “beyond the basement,” as Allen McClelland put it, for those foreign road cars to come from and go back to.

The term “staging” implies the cars and trains that will magically appear on our railroads are pre-set – that is, staged prior to an operating session.

There’s a second type of usually hidden yard, known as a fiddle yard, that serves the same purpose but allows more flexibility. It functions in real time during an operating session. A “mole,” a colorful term coined by Lee Nicholas, operates the fiddle yard. As a train enters the fiddle yard, the mole rearranges its consist into a new train, often removing cars by hand and putting them on storage shelves while also adding cars from those shelves. The locomotive and caboose are usually also changed.

The result: There is no staging-limited length to an operating session, nor – perhaps more importantly – a need to restage trains between sessions. Consists that entered the fiddle yard will not appear intact leaving the other end of it, as they would with a through or return-loop staging yard. The railroad is ready to operate again the moment the clock is turned on, as Paul Dolkos and Lee Nicholas explain starting on page 44.

I’m not so much enamored with the possibility of indefinitely long operating sessions as I am the fact that



restaging the railroad would, at most, require cycling some waybills. I can restage the Nickel Plate in a long afternoon, but not having to devote any between-session time to turning or re-blocking trains is appealing.

Betting on the future

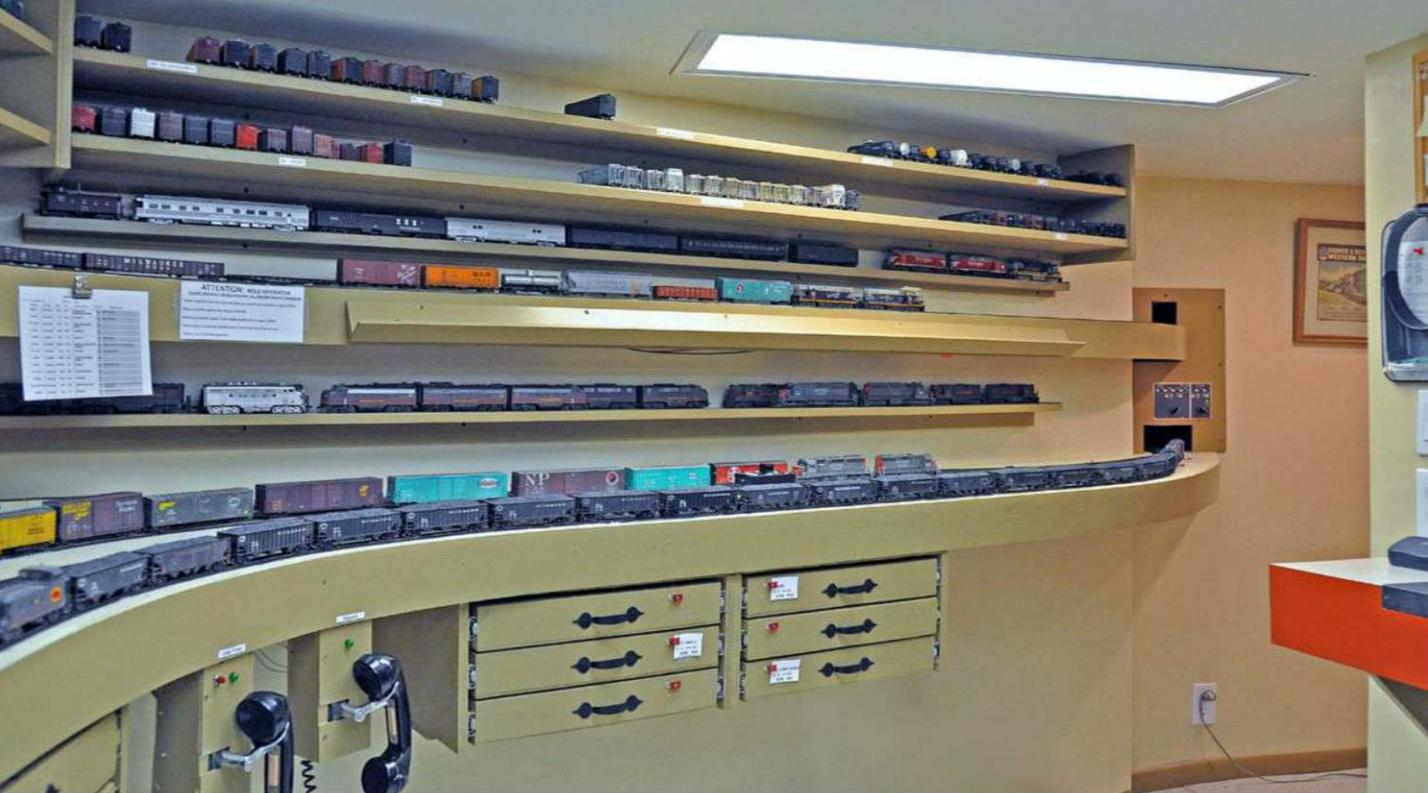
I’m usually pretty good at planning ahead. Maybe it’s an artifact of having a pilot’s license or living in snow country, but I almost always have a very good picture of the weather forecasts, traffic alerts, and so on before I head out the door. In short, I hate surprises, especially bad ones.

I also like to be pretty comfortable with the path forward before starting to build or update a model railroad. I discovered early on that some really untoward, and possibly expensive and time-consuming, surprises lie in wait for the unwary.

On my current railroad, I still remember being unpleasantly surprised at how few cars it took to stall my prized steam locomotives on a modest (under 1 percent) grade – far fewer than the 25- to 30-car trains I had planned. I could add weight to the brass engines (not so the others), but equipping the freight car fleet with free-rolling metal wheels was the primary solution.

Some projects seem to gather a lot of dust. I don’t fight that, as many years’ experience has shown the lack of forward thrust is because I don’t know what I’m going to do or how best to do it. Maybe a key product hasn’t even been invented yet.

I remember Bill Darnaby, a close friend dating back to Purdue days, telling me about pressing ahead with the design and construction of his highly regarded Maumee Route (see page 38) despite the lack of some key piece of technology. I believe it was command control with radio throttles and sound. Command control was in its infancy back then and not yet capable of handling the intense operations the Maumee would require.



Lee Nicholas was one of the pioneers of the hidden active staging yard (or “fiddle yard”) to feed a large layout during an operating session. This is the fiddle yard on his Utah Colorado Western; for more, see page 48. Lee Nicholas photo

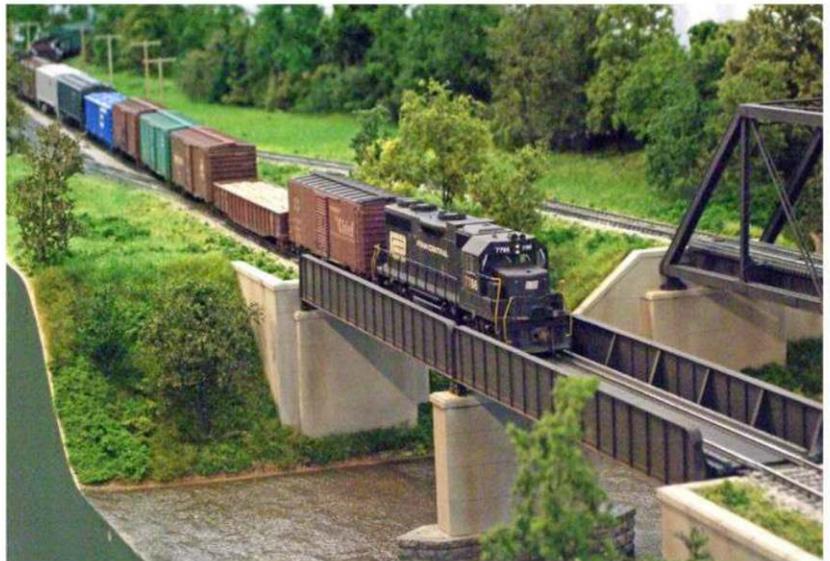
However, it seemed logical to Bill that such an obvious need would be filled by the time he needed it. Sure enough, Berndt Lenz invented Digital Command Control and, through the National Model Railroad Association (www.nmra.org), shared it with the modeling community as a whole.

The bottom line is it's silly to make a major investment in time and money without a good business plan. You do need to understand what resources you have at hand and how you plan to employ them.

That said, I'm sure a number of what would have been worthy model railroads never got built because the builder-to-be spent too much time planning, or worrying. At some point, sooner rather than later, we need to climb out of our comfy chairs to cut lumber and lay track. That's why *Model Railroad Planning* exists, and if we're not meeting your needs in that regard, tell us in considerable detail why.

Sad news, good news

Many readers will recall Dave Fodness's article, “Branch line meets short line on a narrow shelf” in MRP 2013. This well-designed and superbly scenicked HO railroad, based on Penn Central's Niles Branch near South Bend, Ind., was constructed on a narrow C-shaped shelf around the basement perimeter walls.



A Penn Central GP38 rumbles over the St. Joseph River on Dave Fodness's HO Niles Branch railroad. Most of it is now at a friend's home. Dave Fodness photo

As is often the case, the railroad has succumbed to other priorities. “The layout is almost gone,” Dave reported last spring. “It was loaded into a truck this past Saturday by Dan Lawecki and Dennis Ziolkowski.”

The good news: “It's headed to Denny's basement in South Bend,” Dave said. “All that is left is a small switching section to occupy my time until the next pike is born.”

Aha – more good news indeed: “...until the next pike is born.” We eagerly await an update. **MRP**

Tony

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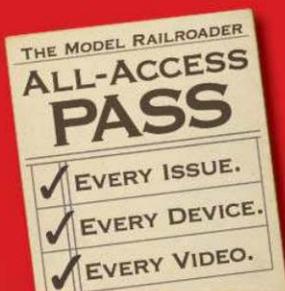
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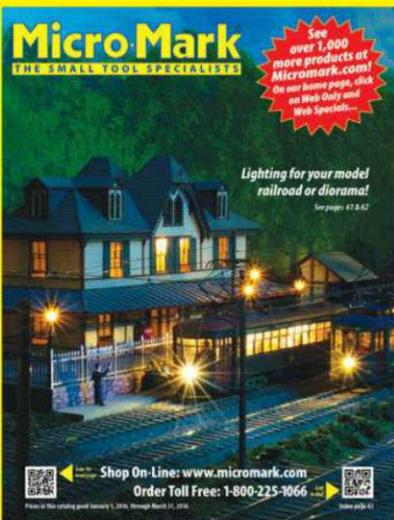
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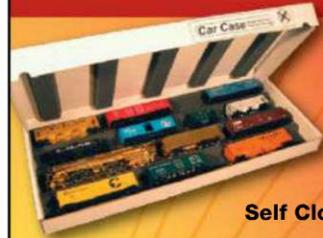


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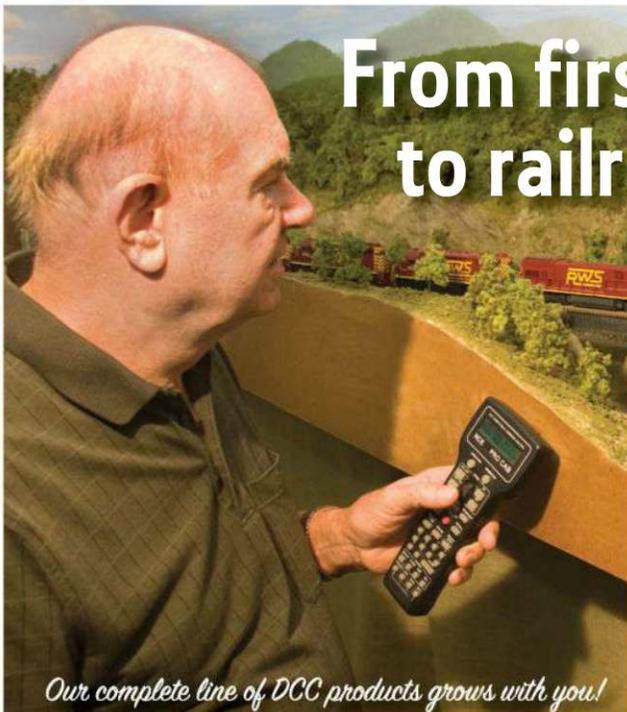
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On Paul Dolkos's current HO scale layout, traffic to and from staging runs under his basement stairs. The overhead bridge and ample lighting behind the wall help the visual transition to the semi-hidden staging yard. Paul Dolkos photo

8 ways to hide the end of the line

Where good things come to an abrupt end

By **Tony Koester**//Photos by the author except where noted



Paul Dolkos photo

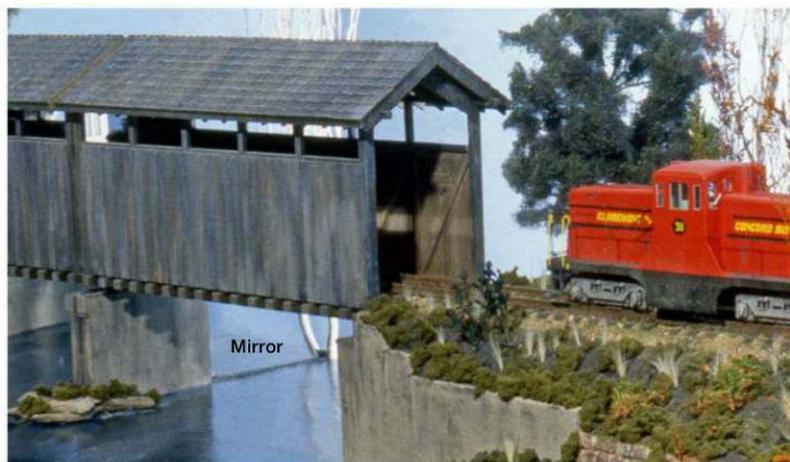
1 Overhead bridge

The cover of *Model Railroad Planning 1998* featured an overhead bridge scene on Paul Dolkos's former Boston & Maine layout. In "Making tracks disappear gracefully," Paul recommended that the off-stage area behind the bridge be scenicked and lighted to suggest the railroad continues indefinitely.

As is evident in the lead photo to the left, Paul's current Baltimore-based layout uses the same technique to suggest that the scenicked portion of the railroad doesn't end at a wall.

On my old Allegheny Midland layout, seen above, I added an overhead road bridge to obscure three tracks disappearing into a tunnel portal at the mouth of the north-end staging yard.

2 The bridge-and-mirror trick



I built a 1:29 scale project railroad based on New Hampshire's Claremont & Concord RR (*Model Railroader*, August through November 2005). I built the railroad on four pieces of 30 x 96-inch extruded-foam insulation board. Three of the four pieces represented the downtown Claremont area, but there was a covered bridge scene a few miles out of town that begged to be included.

Here, the problem wasn't having the railroad disappear into staging, but rather separating a very rural setting from an urban one. Between the 8-foot rural section and the other three sections, I inserted a rectangular mirror. Glass would have been too heavy and dangerous, so I had the local glass shop cut the piece from flexible plastic "funhouse" mirror material. I also had them cut a hole large enough for track and trains to pass through in roughly the center of the mirror.

On the reflective side of this divider, I butted a plastic covered bridge against the mirror, doubling its length and the width of the river. On the back of the mirror, I used densely packed trees to disguise the edges of the hole.

All good things eventually come to an end, as the saying goes. Pessimistic though that may sound, it's literally true where model railroads are concerned. No, I'm not thinking about what to bequeath in your will, but how your railroad gracefully exits the stage – that is, how it goes from the modeled portion to the off-stage areas that represent the rest of the rail network.

Here and on the following pages are several examples of how that can be accomplished.

Other ideas?

Perhaps you've discovered other ways to disguise the transition between modeled and un-scenicked portions of your railroad. If so, please share them with us. **MRP**



Paul Dolkos photo



3 Tall buildings

A **mine tippie**, grain elevator, cement plant, or any other tall structure may allow the train to gracefully exit the railroad by hiding the hole in the wall that leads to staging.

Industries with structures on both sides of a railroad track often linked the buildings with covered walkways and material conveyors. This offers the same potential as an overpass. The photo at top shows how Paul employed this technique on his former HO scale Boston & Maine railroad where the main line penetrated a wall.

On my former HO scale Allegheny Midland layout, in the second photo, the Otter Creek Branch continued through a wall into an adjoining room, but the opening was screened by a coal preparation plant and trees.

4 Around the bend



A **mountain or even a high hill** will provide a means to screen a train's entry or exit to a hidden staging yard. The yard lead at the north end of Sunrise, Va., on the Allegheny Midland, curved around the end of the central peninsula and out of sight. This allowed me to treat it as the beginning of a branch line and use it to stage an inbound local freight as the day began.

5 Grove of trees



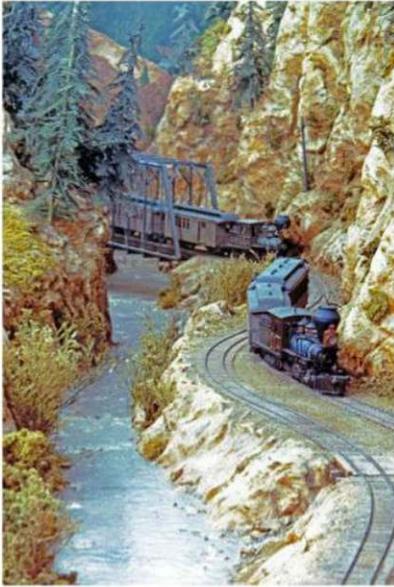
I **faced this situation** when I wanted to hide one end of the long interchange track connecting the unmodeled Milwaukee Road with my Nickel Plate Road main line. I wanted to prevent crews from seeing the contents of the MILW staging track. Aerial photos and site visits proved there were no tall buildings or overhead bridges in the area. Instead, I grouped a dozen or so Scenic Express SuperTrees around the end of a low view block.

6 Snowsheds



Mark Dance photo

Snowsheds and tunnels usually went hand in hand as the railroad's engineering department coped with rocky slopes. A snowshed, like this one on Mark Dance's N scale tribute to the Canadian Pacific (see page 56 and also *Great Model Railroads 2016*), could hide the entrance to a hidden staging or fiddle yard. To extend a shed and even suggest its unmodeled far end, it could abut a mirror, as in method 2.



Andrew Dodge photo

7 Deep cut

In country where the hills weren't high enough to require tunnels, railroads often resorted to digging substantial cuts. Their engineering departments tried to equalize the amount of material dug out of the cut with that required to fill depressions on either side of the cut.

For our purposes, anything that allows a train to duck out of sight will suffice. Even in the flattest of flatlands, glaciers often left piles of gravel in drumlins or moraines, frequently more than deep enough to hide a train's disappearing act.

In mountain country, like this scene on Andrew Dodge's former On3 tribute to the Denver, South Park & Pacific, canyons offer abundant means of hiding the end of the scenicked portion of a railroad.

Learning points

- Effective transitions between modeled and unscenicked areas of the layout will help to disguise the presence of passive staging or active fiddle yards.
- The method used to create the transition should be appropriate to the area depicted.
- Continue lighting and scenery beyond the "hole in the wall."
- Prototype modelers may be restricted by the structures and terrain that actually were at the modeled location.



Paul Dolkos photo

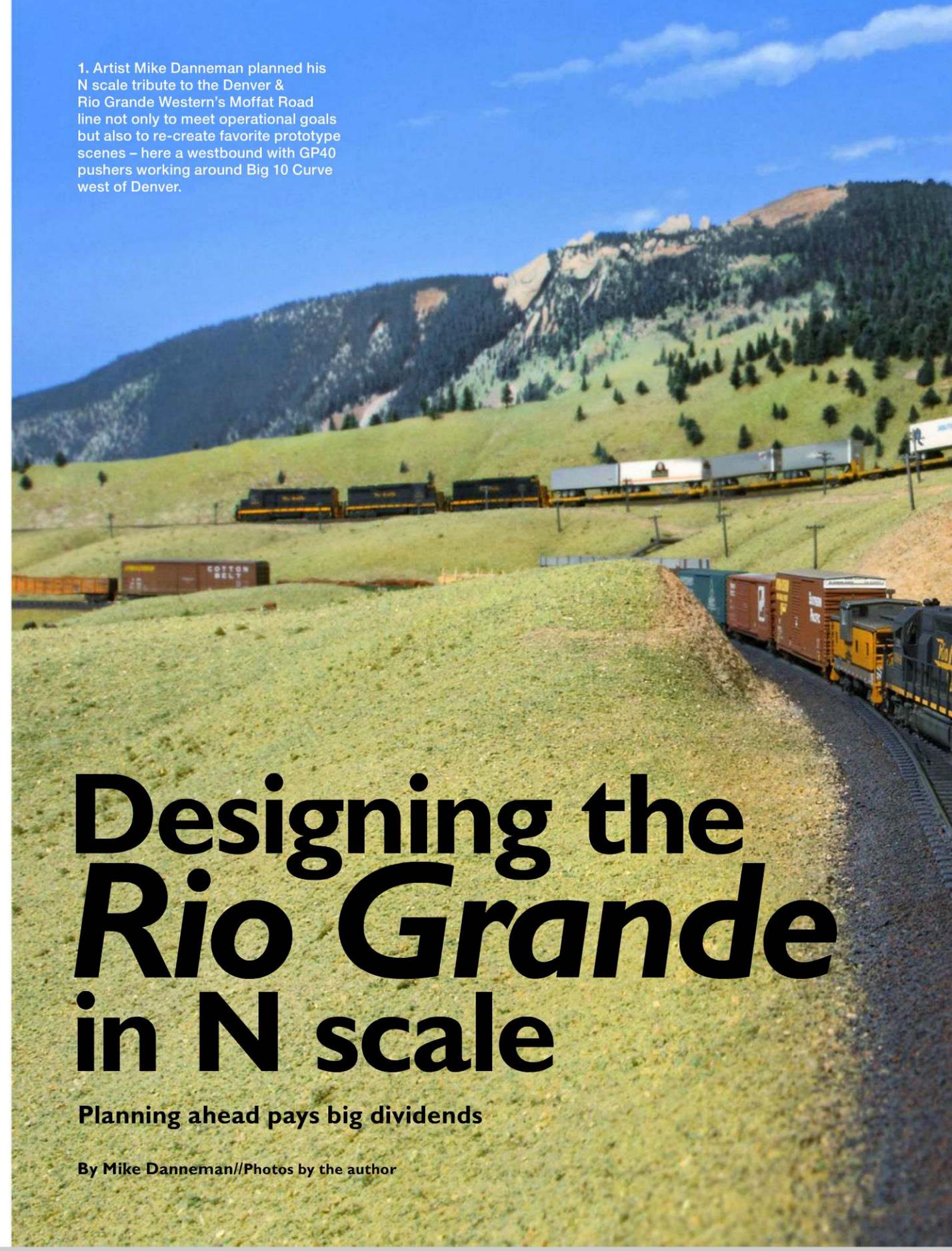
8 Tunnels

The most commonly employed solution is to have the track disappear into a tunnel, never to come out the other side – at least not in a scenicked part of the railroad. A train-length tunnel midway along the main line can also provide a place for a train to pause for, say, 30 to 60 fast-time minutes to effectively extend its run.

I've seen a lot of poorly modeled tunnels on model railroads. It's hardly sufficient to glue a tunnel portal to the face of the opening and declare victory. Line the sides of the bore with concrete or a rock face as far back as a casual viewer can see. Flexible rock castings make this easy to do, even on a curve.

This scene on Allen McClelland's second edition of the Virginian & Ohio Ry. shows how a tunnel could mark the end of the scenicked portion of the railroad (although that was not the case here).

1. Artist Mike Danneman planned his N scale tribute to the Denver & Rio Grande Western's Moffat Road line not only to meet operational goals but also to re-create favorite prototype scenes – here a westbound with GP40 pushers working around Big 10 Curve west of Denver.



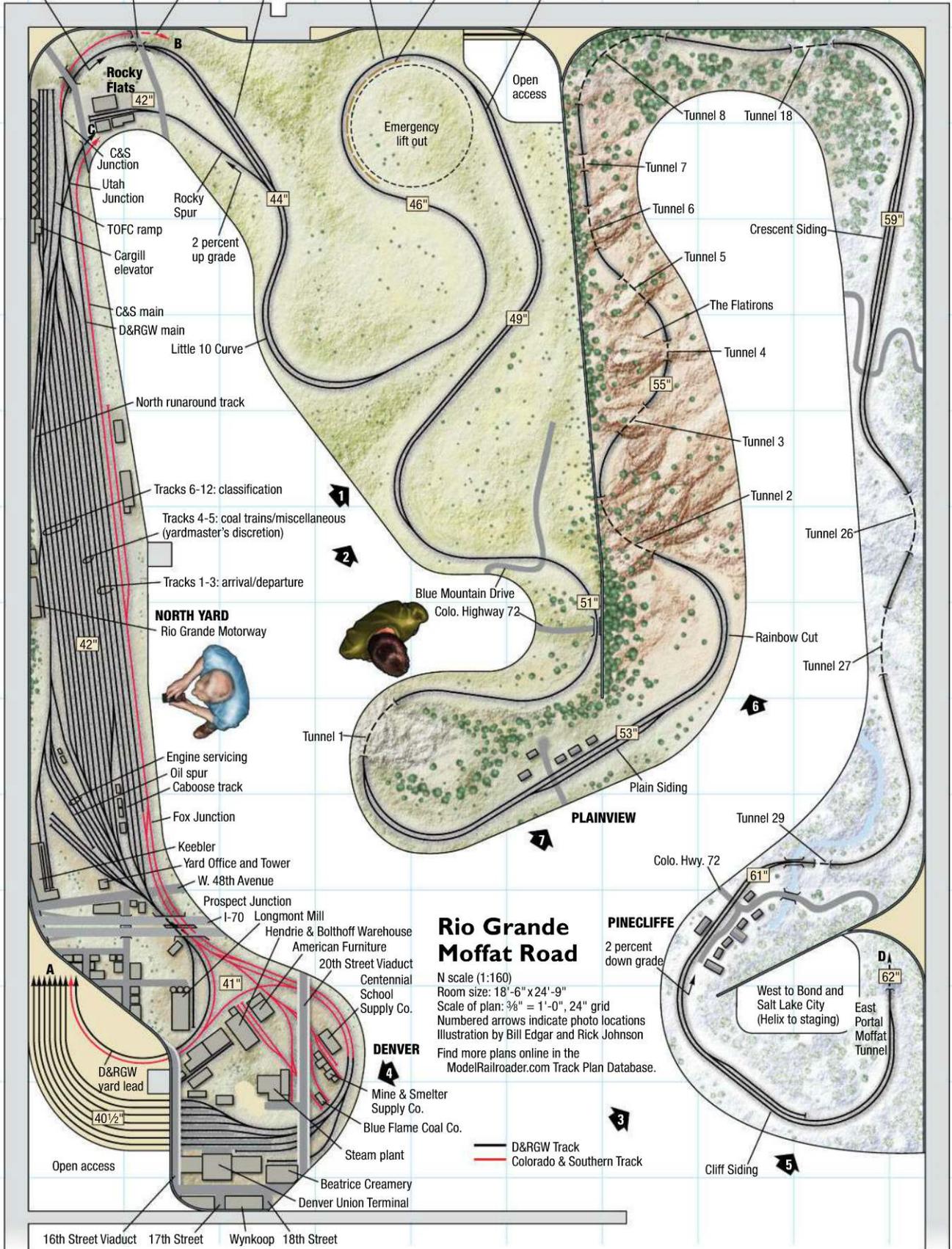
Designing the *Rio Grande* in N scale

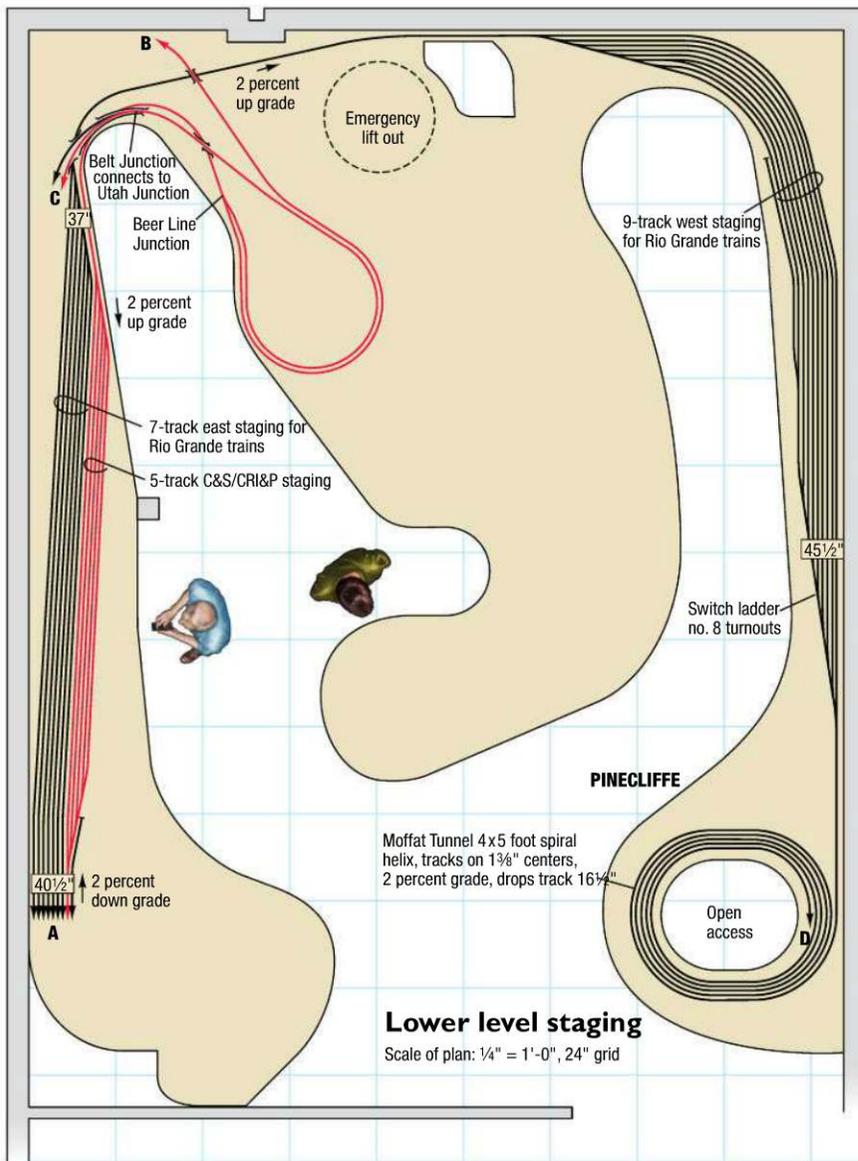
Planning ahead pays big dividends

By Mike Danneman//Photos by the author



2 percent up grade Colo. Hwy. 93 Beer Line Rocky Siding Big 10 Curve Hopper car wind break Clay Siding





The layout at a glance

Name: Denver & Rio Grande
 Western Moffat Road
Scale: N (1:160)
Size: 18'-6" x 24'-9"
Prototype: D&RGW Moffat line
Locale: Colorado
Era: early 1960s or early 1980s
Style: walk-in
Mainline run: 133 feet
Minimum radius: 18"
Minimum turnout: Peco no. 8 (main),
 no. 6 (yards)
Maximum grade: 2 percent
Train length: 10 feet
Benchwork: open-grid on brackets
Height: 42" (37" staging) to 62"
Roadbed: cork on 5/8" plywood
Track: Peco code 55 visible, Atlas
 code 80 staging
Scenery: extruded-foam insulation
 board
Backdrop: painted hardboard
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Denver was located where it is on the railroad.

An anchor on the east end of the railroad was Denver Union Station, which also happens to be milepost "0" for the Moffat Tunnel line. I also wanted Denver's North Yard as both an origin and destination for a lot of the freight traffic.

Next up was designing the railroad west out of Denver. I began using 24" radius curves, but that soon was reduced to 20" and then finally to 18", mostly because of the width of the room and the desire for a central peninsula in the around-the-walls design. After making a short list of some of the highlights of the prototype I definitely wanted to keep, I quickly realized some features had to go out the proverbial window.

The crew change at Bond and, for that matter, all of the railroad on the West Slope west of the Continental Divide were soon left to those pie-in-the-sky track plans that required too much real estate. With the space I had, it became obvious that I should concentrate on the dramatic climb of the Rockies from Denver to the Moffat Tunnel.

I still couldn't fit everything I wanted into those 50 miles of rugged mountain railroading, but I did try to convey the essence of it in what ended up being 4 scale miles – 132 actual feet in N scale. Between North Yard and the Moffat Tunnel, I selected five sidings,

We all dream big when we're younger and a large layout is still in the future. For several years, I doodled track plans of the Moffat Road, specifically the Denver & Rio Grande Western's 1960s-era main line between Denver, Colo., and the first crew change at Bond. This line, now operated by the Union Pacific, operates through the famous Moffat Tunnel.

After my wife and I moved to Colorado and purchased our first home in 1997, reality sank in. The basement had a finished "great room," which was designated as the new location of a future Moffat Road. Although the room was slightly larger than 18 x 25 feet, and N scale makes it easier to fit more railroad into a smaller space, I saw my

dream of modeling the entire crew district quickly dissipating.

Initial planning

I carefully measured the room, noting horizontal or vertical obstacles. As I drew track plan after track plan, I noticed a trend: I usually located Denver on a specific side of the room. This made sense, as this side of the room had a lower ceiling due to heating ductwork, and Denver was at the lowest elevation of a railroad that uses a 2 percent grade to climb the Front Range of the Rocky Mountains. It seemed unwise to have a model railroad climb a grade that could reach several actual feet to a scenic Continental Divide, only to get crowded out by a low basement ceiling. So the ceiling ended up being the reason



2. An under-construction photo of the Big 10 Curve area shows progress on the hand-painted backdrop and the line of hoppers permanently spotted on a side track to deflect the high winds that sweep down off the Front Range.

all in correct geographical order: Rocky, Clay, Plain, Crescent, and Cliff. I now had many of the scenic highlights I wanted to include – Big 10 Curve, the Flatirons, and the Tunnel District – woven together with the sidings that were in close proximity.

To choose a siding length, I set up a couple trains to see what train length looked right. A train of three locomotives and 25 cars looked pretty good. I then designed all the sidings around this train length, ending up between 9'-9" and 11 feet long.

Another important aspect of train length, especially to someone who is a railroad artist, is how the train will look in the scenery. The train size I chose looks similar to a prototype Rio Grande scene when, for example, a train is stretched out in the modeled scene of Big 10 Curve with 18" radii. Besides not fitting in sidings, a much larger train would stretch out too far, perhaps overlapping single track and sidings, and looking much longer than a prototype train in the same scene.

I plan to alternate between two eras on my railroad – the early 1960s and the early 1980s. Right now, I run a mix of both eras, as I don't have enough equipment weathered to do justice to either alone.

Design aspects

Once I had a plan, I looked carefully at the width of each scene and adjoining

aisles. I wanted wide aisles but didn't want to sacrifice too much scenery.

I can't overemphasize how important wide aisles are. Wider aisles make it easier to follow your train when operating, ease photography, and lessen scenery damage. They let you step back and take the layout in! Moreover, as we get older, it seems that we get a bit wider, too.

As for layout height, I had some railroad memorabilia that I wanted to display underneath the benchwork, so I kept the layout as high as possible without compromising scenery. I also wanted the area under the layout to be open.

To that end, much of the benchwork is supported from the outer walls using simple metal shelf brackets and cantilever wood brackets. The rest of the layout, including the center peninsula, is supported by only six 2 x 3 legs.

I built Denver's North Yard 42" off the floor. This is a bit lower than I would like, but I had to allow for a 20" climb of the railroad to the Continental Divide. The Moffat Tunnel is at 62", which is almost too high for easy uncoupling of helpers and so on. But with most of the railroad set between 42" and 62", it's at a comfortable viewing height for most people.

Scenic vistas

I designed much of the layout scenery to match views that I enjoyed

of the prototype when I photographed Rio Grande trains west of Denver. Many of the same angles are worked into the scenery so I could enjoy the scenes again in the basement and share them with others.

I tried to keep the fascia out of the picture frame, with as many "clean" angles as possible. Most layouts aren't designed with photography in mind, but if shooting realistic model photos is one of your hobbies, it's important to plan for that during layout design.

The viewing angle chosen put most of the aisles on the "north side" of the railroad. This orientation allowed familiar prototype viewing angles like seeing Big 10 Curve from Highway 72

Learning points

- At some point, grand schemes evolve into practical plans.
- Even a sizable layout space and N scale allow modeling only small segments of a given prototype.
- Key scenes should be chosen to meet both aesthetic and operational objectives.
- If shooting realistic model photos is one of your hobbies, it's important to keep that in mind during layout design.
- Direct-current (DC) power remains viable.

as well as equally common views at Crescent and Pinecliffe.

Ready access

Another layout design aspect that I kept a close eye on was access to the track. Although I included some hidden track, I was careful to keep all turnouts accessible.

Behind Union Station and the backdrop is stand-up access. There's also an open area inside the helix near the Moffat Tunnel. The Big 10 Curve scene is very wide and has an open area against the backdrop for access to Clay's east turnout. I also built a large access hatch inside Big 10 Curve, which I haven't had to use – yet. And there is a removable scenery hatch to reach some staging yard turnouts at the east end of North Yard.

All of these access areas were carefully designed to make them difficult for a viewer to notice. The backdrop hides the access behind Union Station, and I used scenery to carefully disguise open areas around Big 10 Curve and the Moffat Tunnel. Open access doesn't have to mean a gaping hole visible in your scenery.

Staging yards

The Rio Grande was well known as a bridge route for tonnage, so I have staging yards at both ends of the railroad to facilitate through traffic. I would prefer staging yards in the open, perhaps in another room, but I ended up “folding” the two staging yards underneath Denver and the western portion of the layout. There's a limited amount of clearance over portions of these yards, but this hasn't been an issue. Convenient? No.

Both staging yards are on constant 2 percent grades. I did this to allow the yards to clear the upper deck as well as to get as much vertical space above them as possible. East staging begins dropping down as soon as the tracks pass Union Station, and it reaches the lowest track level on the layout at 37" off the floor after passing the last turnout.

Both of these double-ended yards are connected with a “back track” that allows continuous running. More importantly, this allows me to quickly re-stage east- and westbound trains between operating sessions.

A 2 percent climb on the back track begins soon after leaving the east staging yard, and it continues through west staging all the way to the helix. I did this to gain some elevation before reaching the helix, lowering the height of the helix and eliminating several



3. Mike assured ready access to the helix, which transitions between the top deck at Moffat Tunnel and west-end staging 16½" below it, by building it like a layered wedding cake. He added white mat board to protect rolling stock.

additional turns, thus shortening the run in the helix.

The grades in the staging yards have not been a problem. They are used only for staged trains with locomotives attached, so free-rolling runaway cars hasn't been an issue. These yards aren't used for “fiddling” consists, as this is done with my custom-built rolling storage case placed in front of North Yard, a much more accessible location.

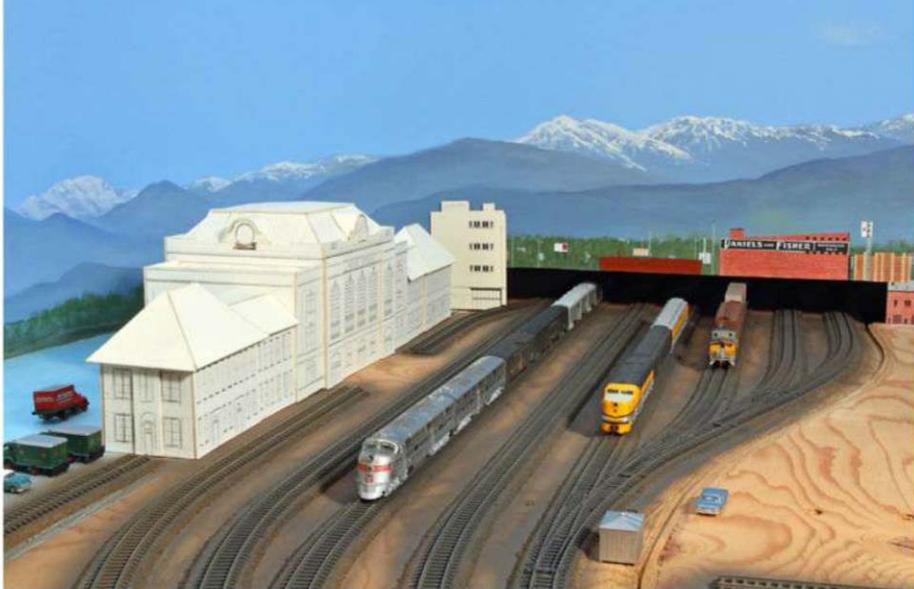
The helix

Once a train enters the Moffat Tunnel on the far western modeled

portion of the layout, it immediately begins descending a 2 percent grade on a spiral helix to west staging. My goal when designing the helix was to stay with my standards of 18" radius and 2 percent grade. As with any hidden or semi-hidden track, I wanted it to be as accessible as possible.

Had I made the helix a series of circles, achieving the needed 16½" of rise would have created a grade steeper than 2 percent. To lengthen the run, thus staying below the maximum grade, I designed a 4 x 5-foot oval helix.

I shaped the subroadbed for the helix in one continuous saber-saw cut



4. When planning for Denver Union Station, Mike built a simple mock-up to see how the building fit in the location provided. The mock-up is constructed of scrap pieces of white mat board. The head house is to scale, but Mike shortened the length of the two outer wings just a bit.

from a sheet of plywood. As photo 3 on page 19 shows, each turn of the helix is stepped inward like a wedding cake. I got five turns in the helix by spacing track centers $1\frac{3}{8}$ " apart.

This subroadbed was then supported from the inside with scraps of 1 x 2 and 1 x 4 lumber. I lined the inside of each layer with white mat board to protect equipment and give the helix a finished appearance. The rear of the helix is open but hidden from normal view, while the front portion is easily accessible from the aisle without any supports in the way.

After my track plan was published in the December 2011 *Model Railroader*, someone commented that the helix would surely become a bottleneck, and that it should have been "fixed" by double-tracking it. To some extent it's a bottleneck, but also realistic: Moffat Tunnel is 6.21 miles of single track with a speed limit. Moreover, after the passage of each train, it takes time to purge locomotive exhaust out of the confining bore. Trains often have to wait on either side of the tunnel for this operation to be completed.

When the prototype railroad was at its busiest, a maximum of about 24 trains could pass over the Moffat Tunnel Route in a 24-hour period, mostly due to capacity concerns with the tunnel. So on my layout, the helix nicely represents the run through the Moffat Tunnel and does slow traffic at times, just like the real thing.

Construction details

I built a small N scale layout before building this one, and I tested a lot of

techniques. This process helped me decide what methods – whether old-school or newfound – I could use with assured results.

I decided to use cookie-cut $\frac{5}{8}$ " plywood subroadbed on 1 x 4 open-grid benchwork. This subroadbed is supported every 8" to 12" with 1 x 2 or 1 x 4 supports, making it very sturdy. In the 15 years since track and roadbed went down, I haven't had any warping whatsoever. The backdrop and fascia were made with $\frac{1}{8}$ " hardboard. All of these materials and methods were very tried-and-true, but they really worked for me.

Construction began in 1999 with the lowest portions of the layout, the lower-deck staging yards. I finished and test-ran these staging yards before moving to the upper decks. This was very important, since I wanted perfectly operating track in my staging yards, and I had plenty of room to get this accomplished without the upper decks in the way.

I used Peco no. 6 and no. 8 code 55 turnouts and Atlas code 80 flextrack in the staging yards. All visible track is Peco code 55 due to its smaller, hence more realistic, rail size. Peco is a British company and my track raises some eyebrows for its "non-North American" look, but it's very sturdy, and I would still consider using it today if starting over. All track was laid on cork roadbed.

Once I had both staging yards fully operational, I moved on to the rest of the benchwork. I began at Union Station, which is also the west end of my east staging yard, and proceeded



"westbound" with the benchwork. Not far behind the benchwork construction was roadbed, track, and wiring for North Yard and the main line west.

Soon after the track was in place, I installed the hardboard backdrop. The backdrop was primed and painted blue before I began initial backdrop painting based on a multitude of photographs. Painting the backdrop before any scenery was begun allowed for much better access, a lot of it through openings in the open-grid benchwork. But it required planning the subsequent 3-D scenery in considerable detail.

At this point, I wanted the backdrops to be "complete" but not necessarily finished. After the scenery was in place, I further refined the backdrop



painting, blending the interface where the modeled scenery ends and painted backdrop begins.

The very deep Big 10 Curve scene required that I paint the backdrop first. Moreover, I built the scenery not unlike a floor painter working himself to the exit – in my case, the aisles. To ease access, I built and scenicked several rear sections of the Big 10 Curve scenery off the layout and installed them when finished.

Scenery highlights

All of the scenery on my layout has a sub base made of extruded-foam insulation board in 1" and 2" thicknesses as required. This material worked perfectly for me. I carved it with a foam knife and hot-wire tool,

shaping the scenery forms much like sculpting. It can be a bit messy, but keeping a shop vacuum close at hand took care of that.

The plus side of using foam is its light weight and durability. "Planting" trees or a pole line is as easy as poking a hole with a sharp tool and doesn't weaken the scenery. I found that emulating the cut-and-fill method of railroad construction, as well as modeling right-of-way access roads, was much easier to model using carved extruded-foam insulation board.

The carved foam scenery base was covered with various thicknesses of Sculptamold, sometimes interspersed with thinly cast Hydrocal rocks hot-glued to the foam. I added some yellow carpenter's glue to the

5. Flat lighting around Moffat Tunnel's east portal reinforces the realism of the Hydrocal plaster "snow." The need to "clear the air" in the long tunnel, which serves as the helix entrance, between trains acts as a traffic limiter.

Sculptamold to help the material adhere better to the foam surface.

After the Sculptamold dried, the entire scenery base was covered with a tan-gray latex paint, with the tint depending on how the actual scenery looks in the area being modeled. This provides a nice base without annoying white spots of raw plaster showing.

I then added ground foam, tinted sawdust (yes, I used some sawdust grass made by Highball in my scenery!), and other materials, all glued in place with thinned matte medium.



6. Uplifted and tilted sedimentary rocks along the Front Range form the distinctive Flatirons formation. Electro-Motive Division F units ease an eastbound manifest down the grade toward Big 10 Curve.

Rock areas were tinted with washes of artist acrylics before drybrushing.

The tilted sedimentary Flatirons rock formations between Tunnels 2 and 8 required some modifications to my scenery techniques. I built the scenery base up to track level by stacking the extruded-foam insulation board. At this point, all tunnels were ballasted, lined, and finished with Sculptamold-textured and painted interiors. Another level of foam "capped" these tunnels. Access to these tunnels is from outside the portals, making a track-cleaning

pad on a stick a great tool to keep tracks clean.

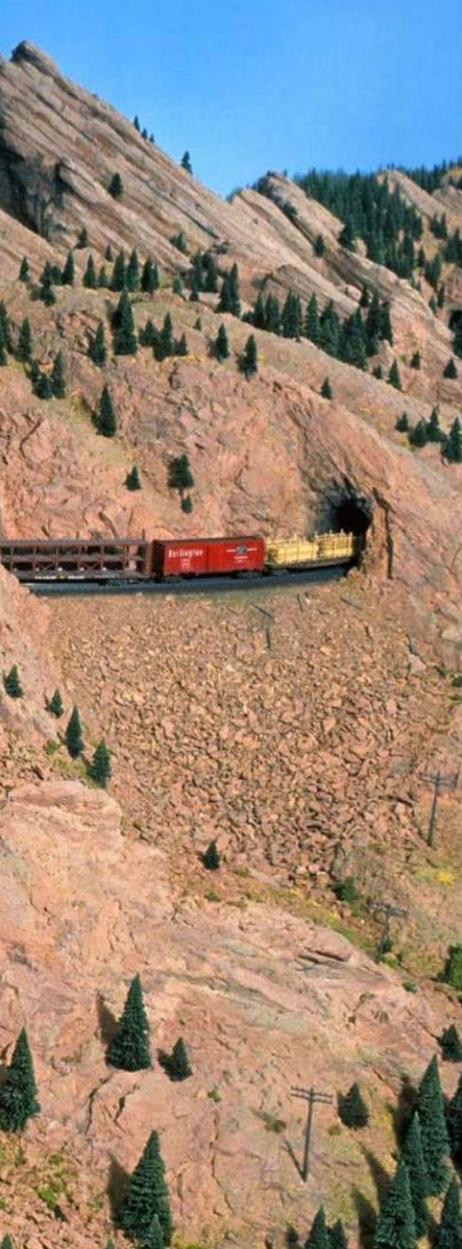
From this level on up, I ended up stacking the foam board on the same angle as the strata of the Flatirons. These formations were carefully carved to represent the actual location. Many sections were built at my workbench and later installed on the layout, which made the carving process much easier. Scenery construction through the Flatirons rock formations was sometimes painstakingly slow, but the unique look to the area, with trains threading the numerous tunnels, made it worth the effort.

When I first designed the track plan, a scene surrounding Moffat Tunnel's East Portal was planned to be the only snow-covered area on the layout. As

the scenery progressed, however, I moved the "snow line" down between Crescent and Pinecliffe. The scenery over at Pinecliffe is now in full sun, lit with incandescent spotlights, with dark clouds painted on the backdrop to the west to represent a snowstorm in the high country.

I decided to model something a bit different around the corner at the tunnel. I painted over the initial blue-sky backdrop with a cool white color, then painted the scenery to represent falling snow! Lighting was also changed to a cool-white fluorescent fixture over the area, which provides a nice shadow-free, cold look to the scene.

At this high elevation, snow covers everything, almost creating the



appearance that trains will have to plow snow. Friends have suggested that I relocate an air-conditioning vent to blow cold air on the back of your neck while viewing the Moffat Tunnel scene to further reinforce the scene's frigid theme.

Snow was modeled with Hydrocal sifted over wetted scenery, with repeated steps to increase the depth of the snow where desired. Trees and buildings were "snowed on" at my workbench for more control. The track was "ballasted" with marble dust from Arizona Rock & Mineral, shaped with various handmade wood tools to groom the shape of the snow before gluing it like conventional ballast.

The marble dust wasn't always truly white after installation and sometimes



7. GP40 no. 3051 leads an eastbound coal drag through Plainview, Colo. Note the distinctive black slag ballast, a trademark of the Rio Grande.

ended up a yellow shade. We all know yellow snow isn't good, so I used artist gesso (any flat white latex paint would do) thinned with water to carefully recolor the tinted snow.

To make the Hydrocal snow more durable, especially around track and edges of the layout, I added a diluted matte medium solution to these areas. This helped make the snow scene permanent and strong, almost more so than regular scenery. While it took more effort to model snow between west Crescent and the tunnel, I feel the results are worth it.

If I were starting over...

Were I building a new layout, I would do some things the same way, but in other cases I'd take a different approach. I would spend as much time planning as I did the first time.

Since construction, I added only one unplanned crossover and a stub track for the Grand Junction wreck train in west-end staging. Neither required any changes in benchwork or roadbed.

Accurately modeling a prototype helped quite a bit here.

I would still use the same methods for benchwork and roadbed construction, as well as the same scenery methods and materials.

I might reconsider the two double-ended staging yards. They work fine, with a matrix control for lining routes. But considering the high cost of turnouts and associated controls, I might eliminate the back track and yard throats, extend the staging tracks all the way through, and make one long staging yard. That would require a lot of serial staging, something I'd have to think long and hard about.

I built a "temporary" CTC panel to make it easier to effect any needed changes. Fifteen years later, I still have the temporary board controlling the railroad! As with the cardboard mock-up of Union Station sitting in Denver for about the same amount of time, I should have been more careful of what I considered temporary. This is one on those lessons I should've learned from reading *Model Railroader* and *Model Railroad Planning!*

All in all, building the Moffat Road has been a great experience, and like most layouts, it's not finished. I still have the urban areas around Union Station and North Yard to finish, with plenty of structures to build. Building a large (to me) layout was daunting at times, but once I was over the hump, it became a joy that's hard to explain. Thorough planning, mixed with tried-and-true construction methods and new materials and techniques, has proven to be a recipe for a lifetime of hobby fun. **MRP**

Mike Danneman has had a lifelong interest in railroading. He worked as an illustrator for Model Railroader and as art director for Trains magazine before pursuing a career as a freelance photographer and artist. Mike and his wife, Katie, also an artist, live in Arvada, Colo.

On our website

Watch a video of trains running along Mike Danneman's N scale Rio Grande Moffat Road. Click on the video link under Online Extras at www.ModelRailroader.com.

Elevating the right-of-way

A method to add visual variety to otherwise flat scenery

By Dominic Bourgeois

Photos by the author

Model railroaders are eternally confronted with a limited amount of space. When representing larger cities, we often cram the available real estate with track and fit buildings into the intermediate spaces as best we can, often to the point of just having flats against a backdrop. Those among us who wish to include more structures will sometimes resort to separating the street and track levels. More often than not, however, we will put the city above and the tracks below. But why?

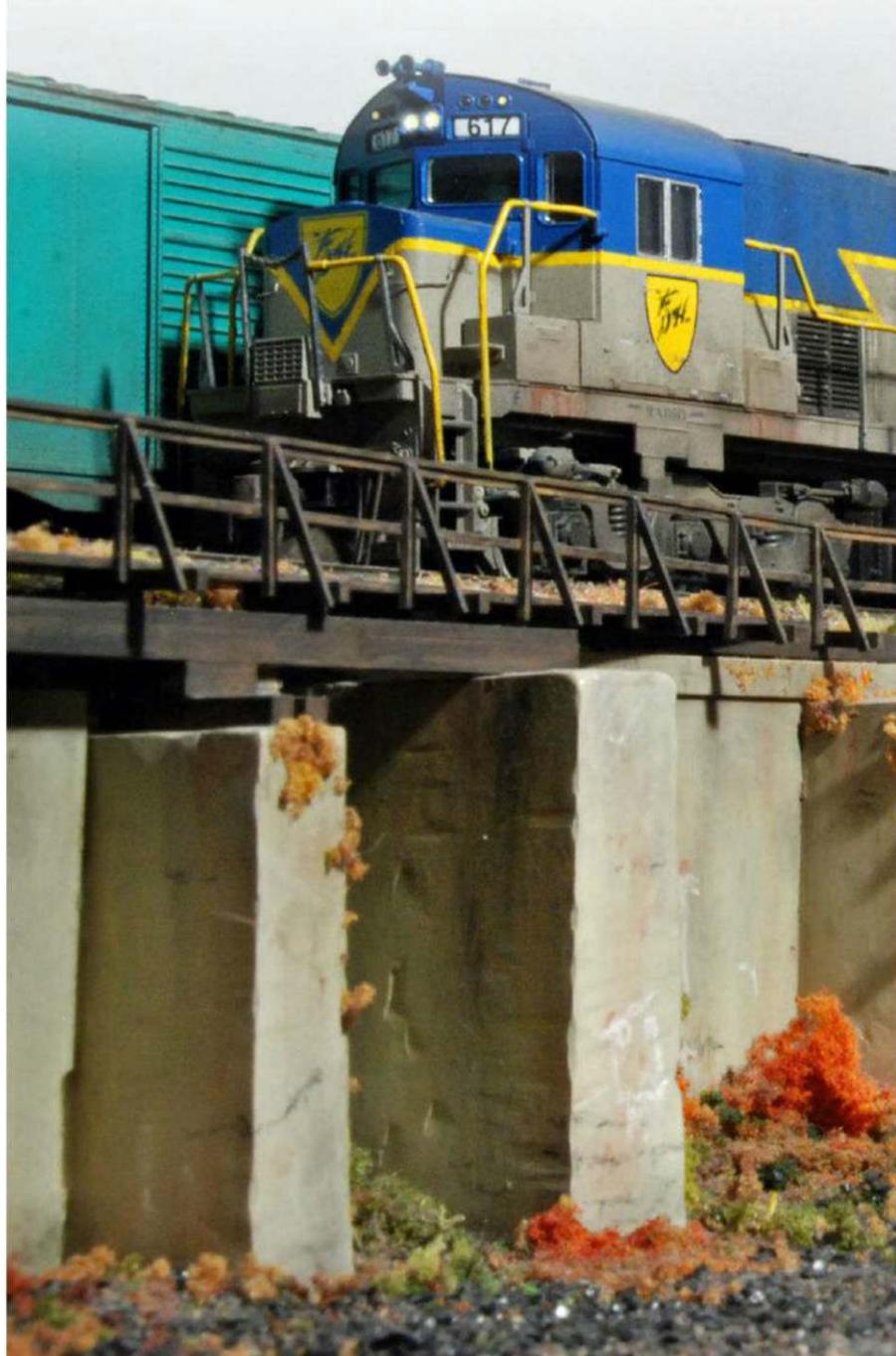
Two suspects: The first is convenience, which goes hand-in-hand with a lack of planning. We build the benchwork, lay the track, wire it, and start running trains. Cities? Well, there's still room above the tracks over there ...

The second is less obvious: We simply don't know better. As modelers, we should always spend time studying the world around us and the way it works to better represent it. We would learn, for instance, that grade separation projects in urban areas almost always result in elevated tracks.

Unless the topography is quite abrupt, in which case there would be a roughly equal amount of cut and fill to take advantage of earth-moving economies, it's easier to elevate a railroad right-of-way than to raise a large number of streets, complete with ramps and changes to nearby buildings. Worse still would be excavating a trench and dealing with drainage issues, sewer modifications, underpinning and support of nearby structures, and tunneling.

Schenectady, N.Y.

Schenectady, N.Y., once home to the American Locomotive Co. (Alco), is a

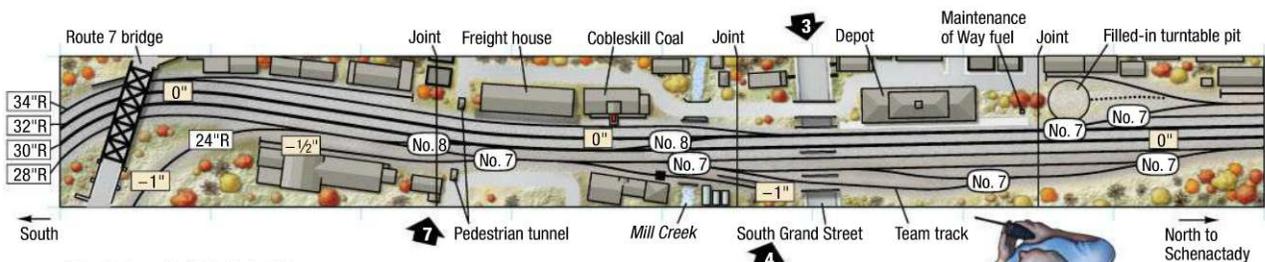




2. Northbound AM-1 behind Lehigh Valley run-through power rumbles over State Street in downtown Schenectady. The road is dropped below grade for clearance, and the buildings at left were progressively foreshortened as they got closer to the backdrop.



1. A pair of HO scale Delaware & Hudson Alco Century 628s heads south over the Liberty Street overpass in Schenectady, N.Y., on a bright autumn day in 1975. Dominic Bourgeois explains how he elevated the D&H right-of-way through his model of Schenectady's downtown.

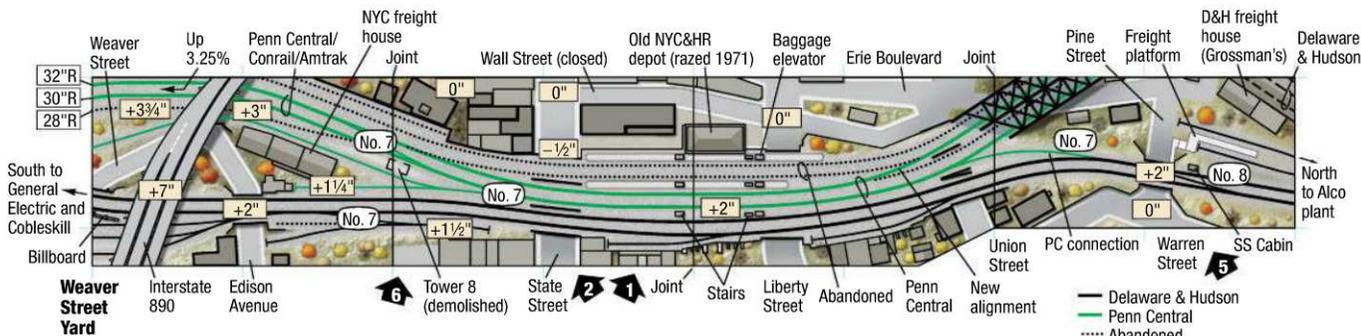


Cobleskill, N.Y.

HO scale (1:87.1)
 Section size: 2'-0" x 16'-0" (Individual pieces are 4'-0" long)
 Scale of plan: 7/16" = 1'-0", 24" grid
 Turnouts no. 6 unless noted
 Numbered arrows indicate photo locations
 Illustration by Rick Johnson
 Find more plans online in the
 ModelRailroader.com Track Plan Database.

Schenectady, N.Y.

HO scale (1:87.1)
 Section size: 2'-0" to 2'-6" x 16'-0" (Individual pieces are 4'-0" long)



The layout at a glance

Name: Delaware & Hudson
 2nd Subdivision
Scale: HO (1:87.1)
Size: 2'-0" (or 2'-6") x 16'-0"
Prototype: Delaware & Hudson
Locale: New York State
Era: 1975
Style: sectional
Mainline run: not applicable
Minimum radius: 30"
Minimum turnout: no. 8 (main),
 no. 6 (others)
Maximum grade: D&H 2
 percent, PC 3.25 percent
Train length: 18 feet

Benchwork: 1/4" plywood
 subroadbed on 1 x 2 grid
 (Schenectady), 1/2" plywood
 on 1 x 3 joists (Cobleskill)
Height: variable
Roadbed: cork and Homabed
 over plywood
Track: handlaid codes 70 and 83
Scenery: extruded-foam insula-
 tion board, corrugated cardboard
 and white glue
Backdrop: digital prototype
 photos
Control: MRC Prodigy wireless
 Digital Command Control



3. The plywood base was cut away at South Grand Street and the road, sidewalk, and abutments were installed as a complete assembly.

good example of a typical grade separation project in an urban context. Both the New York Central (NYC) and the Delaware & Hudson (D&H) railroads had their rights-of-way elevated through the city's downtown between about 1906 to 1909 as a joint project.

The D&H entered Schenectady at grade, climbed along a fill punctuated by occasional viaducts, and finally arrived at a shared passenger station via a series of viaducts and concrete retaining walls before exiting town in similar fashion.

The NYC came off a hillside, stayed above street level through downtown

and the station, then headed off on a fill toward its bridge across the Mohawk River. There have been some track reductions, and the station was demolished in 1971 (a standard Amtrak design replaced it in 1979), but the rest of the infrastructure remains relatively unchanged to this day.

Most of the street viaducts, predictably, were built of similar and rather simple plate girders. Nevertheless, each one presents a distinct personality: The girders are of deck or through type, sometimes skewed, and may feature smaller girder or beam end spans over the sidewalks supported by

a row of cross-braced columns between the street and the sidewalk. They culminate at a massive skewed four-track NYC through-truss bridge over Erie Boulevard (formerly the Erie Canal) next to the station area. The NYC also used a concrete arch for one of its spans near the hillside.

While most buildings on the outskirts tend to be far enough away from the tracks, downtown structures are often situated right against the retaining wall. Many were modified as part of the project to incorporate track-level loading docks. An unloading trestle once existed across from the

station. Its concrete piers have survived, as have many other vestiges of now-defunct rail activities.

Imagined constraints

In addition, both railroads' alignments are quite curvilinear: The track was raised well after downtown Schenectady had already been built, so existing buildings, streets, canals, and other facilities had to be avoided. One can only imagine the complexities of planning and executing such a project while maintaining vehicle and railroad traffic through a highly congested area. Period photos show a lot of temporary track and wood trestlework. Modelers don't face the same constraints, but implying that such prototypical constraints exist should yield a more interesting result.

There are other circumstances that may dictate a raised right-of-way. Even in smaller towns more typical of our model railroads, the necessity to cross a navigable river or canal will force a railroad to raise its approaches. Both the NYC and D&H cross the Mohawk River in Schenectady, although only the NYC needed a raised approach. In some cases, railroads may raise their rights-of-way to ease the grades out of a town in a valley. While railroads most often elect to use fills and retaining walls, as we have seen in our example, trestles are sometimes necessary.

Other interesting possibilities present themselves. The Interstate highway system is often elevated through cities. Where highways cross railroads, the heights reached can be impressive. Schenectady has one modest example near the General Electric plant, where the former NYC crosses over the D&H, and Interstate 890 spans both.

Modeling opportunities

For modeling, elevated track offers many advantages. Foremost is economy of space. An elevated right-of-way is expensive to construct, and every effort is made to keep it as narrow as possible. Customers are crowded around the track, and their spurs are generally parallel to the main line instead of going off at an angle. A rail line a few tracks wide will still allow room for many buildings, even on a minimum-width shelf-style layout.

Visually, elevated track puts the trains on center stage, where they can readily be viewed and appreciated. When a train rolls through downtown Schenectady, everybody notices it.

Where a little more room is available and more visual interest is desired,



4. Low-nose Alco RS-36 5015 and RS-11 5006 pause on the South Grand Street overpass by the D&H depot in Cobleskill, N.Y. Elevating the right-of-way gives bridge fans an excuse to break out the girders, beams, and columns.

some spurs and branch lines can and do ramp down to grade to reach customers and facilities. Schenectady had many examples, one of which even crossed under the D&H main line to reach part of the Alco plant. The grades could sometimes be spectacularly steep, such as those reaching the D&H's freight house. Bridge builders will appreciate the opportunity to indulge themselves.

Embankments also offer interesting modeling opportunities. Sometimes there's not quite enough room for a full embankment. In those cases, a low retaining wall is erected at the base of the fill and a natural slope (at the "angle of repose") extends from the top of the wall up to roadbed level.

Over time, some settlement and erosion of embankments invariably occurs, and such problems are countered by maintenance-of-way crews by adding wood tie cribbing to raise the roadbed surface or retain ballast. This was done in many places in Schenectady. Steel beam or tube piles or old rails may also be driven vertically at close intervals near the top of an embankment to stabilize it, and steel sheet piling may also be seen.

Pre-cast concrete cribbing or large concrete blocks may be added at the bottom of a fill over time to help contain it. Signal installations often exceed the normal roadbed outline, so wood or galvanized steel walls may surround signal bases at the roadbed shoulder. In multiple-track territory, it's

usually preferable to erect signal bridges rather than widening the roadbed to provide extra clearance between tracks for signals.

Representing a grade-separation project that's under construction with its inherent operational complications would make an interesting modeling project. Such a scene might include constrained and tightly curved temporary tracks, temporary trestles or walls, and steep grades, all resulting in speed restrictions and traffic congestion.

Cobleskill, N.Y.

Not all grade separation programs need be as involved as the one in Schenectady. Twenty miles south of

Learning points

- Looking to the prototype for interesting modeling features can pay big dividends.
- Grade-elevation projects were common in many cities as rail and road traffic increased.
- Considerable planning is required to properly locate turnouts and other features.
- Building layout sections before permanent space becomes available ensures progress.
- Referring to prototype drawings of track arrangements eases design chores and adds realism.



5. A General Electric U30C and a U33C rumble over Pine Street as they team up to shove freight BNV-3 (Boston–Norfolk & Western) out of Schenectady. The elevated right-of-way adds considerable interest to the scene. The NYC bridge is visible behind the trees.

Schenectady along the same D&H main line, Cobleskill, N.Y., was the stage for another grade separation project some years later. Though far less ambitious, this project did feature many interesting elements worthy of consideration by modelers.

As it arrived from the north, the main line was raised on fill and bridged New York Route 7 on a ballasted through-plate girder bridge. It then dropped into town, where each street crossing seemed to be dealt with in a different manner.

Several crossings were simply closed, but one street was given a pedestrian overpass of light steel-truss construction with a stairway at each end. South Grand Street, a main artery near the passenger station, was excavated to duck under the D&H's shallow deck plate-girder span.

To minimize the excavation's impact on adjacent buildings, the railroad was itself raised about 3 feet, which

required some modifications to the station and nearby spurs, including the installation of concrete crib walls. Another closed street was replaced with a pedestrian tunnel. At the south end of town, Route 7 again crossed paths with the D&H, but this time it was the road's turn to leap overhead on a through-truss bridge.

Modeling Schenectady

I modeled downtown Schenectady on a set of sections for a future layout representing the D&H Second Subdivision's path through the city as it existed in 1975. While compressed, all of the important features were incorporated into the model.

I had not initially planned to do so, but I eventually incorporated a model of the grand Beaux Arts-style station because it was more worthy of representation than the parking lot one would have found in its place in 1975.

I planned the module framework for lightness and flexibility. It consists of 1 x 2 joists glued under a 1/4" chipboard base representing the natural grade. Continuous 1 x 2s, set parallel to the track, support the 1/4" plywood roadbed from each side. The roadbed supports were interrupted at each viaduct, but overall the grade/support/

roadbed structure forms a rigid box-girder assembly.

I know what you're thinking – 1/4" roadbed is way too flimsy. And so it is. I placed additional 1 x 2s where the roadbed is more than two tracks wide, never leaving more than a few inches unsupported.

In addition to its lightness, the assembly allowed me to easily make modifications to the elevated roadbed when adjustments became necessary, such as when I cut openings for stairways down from the station platforms. A utility knife readily cut through the thin plywood, avoiding the use of a saber saw; the vibrations would have undoubtedly damaged the completed scenery. It also represented the prototypically shallow bridge decks better than 1/2" or thicker material would have.

The track had to be carefully laid out during initial construction, since it was also necessary to cut a square hole in the chipboard base at every location for Tortoise by Circuitron switch motors. It was also necessary to ensure that no switch points sat directly atop a bridge or viaduct.

Occasionally, I had to cut away a slice of roadbed when trying to fit some retaining walls or structures into

the scene. While they're all selectively compressed to some degree, I wanted to keep as many of the structures as possible three-dimensional rather than representing them as flats. I resorted to foreshortening in a few cases.

Buildings so treated look fine from the aisle, but the walls perpendicular to the layout edge are compressed horizontally, but not vertically. It's more difficult to do that with kits, but I scratchbuilt nearly every building, so my options were open. To me, this technique is visually less obvious than the more common forced perspective practice of using smaller-scale models in the background.

While the construction method provided the necessary overhead clearance for secondary streets, major streets required more headroom. At State Street, for example, I cut a long slot in the baseboard to allow the pavement to drop below the natural grade level, as does its prototype. The sidewalks required less headroom and remained at grade level.

All of the viaducts were either scratchbuilt from styrene or heavily kitbashed from Micro Engineering and Central Valley Model Works components. The retaining walls and bridge abutments consist of .040" sheet styrene, but some of them around the station were also faced with some out-of-production brick sheet and some trim to match their prototypes.

The styrene walls are randomly gouged at the edges with a knife to represent chipped concrete, and some cracks were carved in where appropriate. They were painted with now-discontinued Polly Scale acrylic paint (Concrete, lightened with Reefer White) [Testor's Corp. offers similar paints in its Model Master line. – Ed.] and weathered with black, brown, and gray powdered pastels. I rubbed on white streaks of pastel and pulled them down with a brush to represent efflorescence: the salts and other minerals leaching out of the concrete. Wooden and metal guardrails were fashioned from strip styrene and appropriately painted.

I made some segments of earthen embankments from extruded-foam insulation board, but I later switched to other materials because I was concerned about toxic gases should the foam board ever burn.

Modeling Cobleskill

I built the Cobleskill sections using a more conventional cookie-cutter technique: 1/2" plywood on closely spaced 1 x 3 joists. The joists are



6. A parking lot along the D&H in Schenectady affords railfans a place to watch the action. Wood cribbing helps hold up the embankment that supports Penn Central Electro-Motive Division E8 267, now in Amtrak service, taking a train east to Albany-Rensselaer on PC rails beyond the D&H main line.

notched along the front at the tops, because the ground tends to drop away from the tracks on that side. They're also notched at the bottom to provide extra clearance for lighting because these modules are planned for an upper deck.

The front framing member is a 1 x 4 that's cut as necessary along its top to conform to the various grade level changes. There's no rear member. Instead, I glued and screwed a 1 x 2 under the back end of the joists, leaving a 3" gap for future wall-mounted brackets to slip directly under the plywood instead of under the joists, thereby saving headroom underneath. In some locations where the ground is lower, I mounted the plywood between the joists, flush with their tops.

For the South Grand Street viaduct, I cut away the plywood entirely and glued in a piece of hardboard to support the track. A 1 x 3 was secured under, and perpendicular to, the joists below roadway level to stabilize the assembly.

The span's styrene plate-girder and floor assemblies were installed above the hardboard, while a simplified version of the deck's underside was glued underneath. The overall floor sandwich is slightly thicker than its prototype, but that isn't noticeable. Thinner sheet steel or aluminum might have worked better as a base for the deck.

The roadway and the abutments were so complex that I built them at my



7. Dominic has included finely crafted lineside details such as the brick walkway entrance that allows pedestrians to cross under the busy D&H right-of-way at the former Grove Street crossing in Cobleskill.

workbench and slipped them in under the bridge after they were assembled, painted, and weathered. They were fashioned from 1/16" illustration board instead of styrene.

A lot of advance planning and measuring was necessary, given the slopes, stairways, upper-level sidewalks, and the slightly skewed configuration of the span. The scenery was then built up to the abutments after installation.

Although there's a little more work involved with elevating the track, the textures and materials, not to mention the change in grade, add considerable interest to a model railroad, and help tell the story of how the prototype fits into the scene. **MRP**

Dominic Bourgeois, who with wife, Christine Robinson, resides in Montreal, Que., is vice president of an architecture firm. He also wrote Delaware & Hudson – Bridge Line Freight 1960-1983, Vol. I and II (Railroad Explorer). He can't remember not being interested in trains.

Georgia short line on my mind

A move leads to a small prototype-based layout

By Thomas Klimoski//Photos by the author

Three little words that model railroaders dread – “We are moving!” – can offer opportunities to refine what they enjoy about model railroading and enhance their modeling skills when they build new layouts. When the time came for us to move from Florida to the Georgia mountains, my old layout, the CSX Hawksridge Division (featured in the *Model Railroader* special issue *More Layout in Less Space*), was dismantled. I donated the modular portions to my former club in Miami. Rather than think about what I was losing, I focused on what I wanted to improve and on what I enjoyed on my old layout.

I kept most of the structures, locomotives, and rolling stock to reuse on my new layout, although I wasn't sure exactly what I wanted to model. After we moved into our new house, I conducted some research to find a prototype to model. Contemporary switching operations are what I enjoy the most, and I wanted that on my new layout.

I joined a local model railroad club, the Tri-State Model Railroaders. They model the Louisville & Nashville's Old

Line from Marietta, Ga., to Etowah, Tenn., in the early 1950s. A portion of the Old Line is currently operated by a short line, the Georgia Northeastern (GNRR). Once I learned more about its current-day operations and its use of secondhand Electro-Motive Division (EMD) locomotives repainted in a sharp red-and-silver paint scheme, I'd found my prototype.

The Hook and Eye Division

The GNRR operates a line with an interesting history. Several railroads tried to develop the line north from Marietta beginning in 1854, but construction didn't begin until after the Civil War in 1874. To keep the cost down, the line followed the contours of the land, which led to steep grades and tight curves. In 1902, the L&N took over the line to keep it from falling to rival Southern Ry.

The L&N named the line the “Hook and Eye Division” after two of its unique engineering features. The “hook” portion was just north of Talking Rock, Ga., where two tight curves were used to negotiate a steep grade around Tate Mountain. The “eye” portion came from

a loop where the line crosses back over itself in Bald Mountain, Tenn., which replaced a troublesome switchback that limited train length and took considerable time to traverse.

The L&N soon realized the tight curves and steep grades from Etowah to Marietta took a toll on the equipment. In 1906, a “New Line” from Etowah to Cartersville, Ga., was constructed farther west, and the “Hook and Eye” became known as the “Old Line.” The Old Line served the industries between Marietta and Etowah with interchange service at each end of the line until 1983, when CSX purchased the L&N and operated it for a few more years.

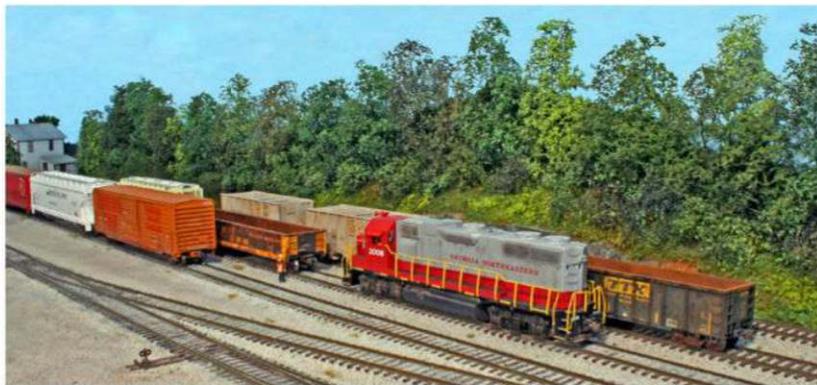
History and operations

In 1987, CSX sold 41 miles of track from Marietta to Tate, Ga., and leased the track from Tate to Ellijay, Ga., to investors from Tennessee. The investors named the new railroad the Georgia Northeastern. The line north of Ellijay was purchased by the Georgia Department of Transportation (DOT).

The current owner purchased the GNRR in 1990. In 1996, the railroad leased the remainder of the line from Ellijay to McCaysville, Ga., on the Georgia-Tennessee state line, from the Georgia DOT and began the Blue Ridge Scenic RR. The railroad, a subsidiary of the GNRR, operates a scenic excursion train trip from Blue Ridge, Ga., to McCaysville, Ga./Copperhill, Tenn., between March and December.

The GNRR operates from its headquarters in Marietta, where it interchanges with the CSX at Elizabeth Yard. A small locomotive servicing terminal is in Tate, where a branch line heads east to serve a pair of marble heads in Marble Hill.

Georgia Northeastern locomotives are an assortment of EMD units



1. Georgia Northeastern GP38 no. 3008 works the compact Tate Yard. The action takes place on Thomas Klimoski's 9 x 10 foot HO scale layout.

2. With the yard switching complete, GNRR 3008 crosses the Etowah River with empty CSX Ortnor hoppers for loading with marble chips at Georgia Marble in Marble Hill.



acquired from other railroads (see “Georgia Northeastern roster” on page 34). Numerous industries served by the GNRR are located around Marietta and cities north along the line, which include building materials, plastics, metal coating, grain, chemical processing, and marble products. Each of these industries requires different car types, enhancing operations and providing interesting consists for a model railroad.

A Verbal Block System (VBS) is used by the GNRR to control the movement of trains and on-track equipment (OTE). Block limits are designated by signs displayed at the beginning of each block. A control station will grant one of the following types of blocks for trains in a VBS:

- Absolute Block: A block that may be occupied by only one train or OTE at a time.
- Occupied Block: A block clear of opposing trains or OTE, but not necessarily clear of preceding or standing trains or OTE.

An Absolute Block authority will be granted for movements in both directions, while an Occupied Block authority will be granted for movements in one direction, which must be specified. This type of block control system adapts well to model railroad operations and eliminates the need for track signals.

Layout design

Now that I’d settled on a prototype, it was time to design a track plan that would support the operations I desired in the space allocated for the layout. Our new house had an unfinished basement, a unique experience for me after living in Miami all my life. We divided the basement into several areas: a recreation room, bathroom, craft room, and a model train room.

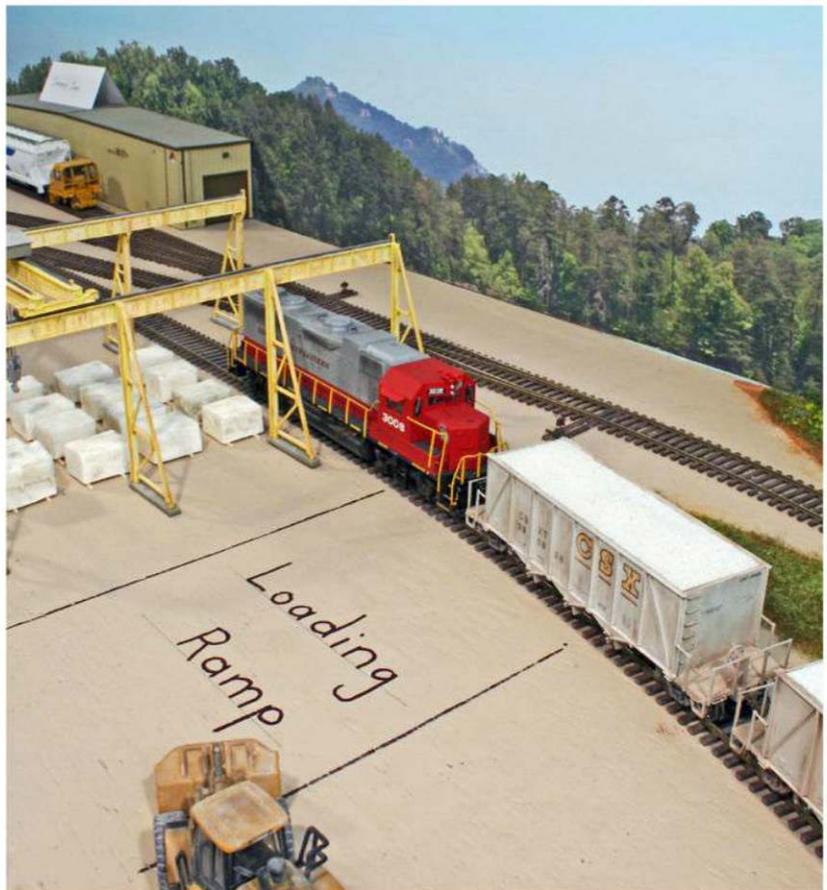
As the floor plan was being drawn up, I had to determine what would be an adequate space for the layout. Factors I considered were the availability of operators and the ability to hold solo operating sessions. After much thought, I decided that a 9’-2” x 10’-6” room would be sufficient to achieve the type of operation I desired.

I’ve always admired the work of Lance Mindheim, Pelle Sjøeborg, and David Barrow with their realistic track plans and modern operation themes. Keeping their track plans in mind, I designed a layout with what seemed like reasonable minimum standards: 24” radius, no. 6 turnouts, and 2” track centerline spacing for reliable operations.

After several revisions, I developed a proto-freelanced track plan that



3. Tom operates the GNRR using Digitrax radio Digital Command Control throttles. The paperwork is based on actual GNRR forms, shown in the inset image at upper right. Let’s not think there’s little to do on a bedroom-size layout, note the list of cars that need to be switched.



4. The Imerys Corp. at Marble Hill, Ga., shown in the background, ships out marble dust in Pressureaide and other covered hoppers and is a major source of revenue for the GNRR. Marble slabs are loaded onto gondolas or flatcars using the overhead crane; a front-end loader dumps marble chips into open hoppers.



These two photos show the basic construction Tom used to build the GNRR: conventional grid benchwork with wiring holes overlaid with 2"-thick extruded-foam insulation board. The notched areas are for the creek and river sections.

included a small yard, locomotive service terminal, several prototype industries, and a marble industry that reflected operations on the GNRR.

The layout is designed as an around-the-walls plan with a center peninsula. No complex track arrangements or hidden track was included. Designated scenic areas break up the scenes and give some visual space between the industries. Bridges crossing the river and streams give a feeling of moving between towns along the line. I chose a couple of industries that take 40-foot or shorter cars, which make the trains with only a few cars seem longer.

The GNRR only operates four-axle diesels, which translate well to a small layout. All curves on the layout are viewed only from the inside and enhance the look of equipment as it rounds the many curves.

To verify that my design would work, I transferred the track plan full scale onto kraft paper and used cardboard boxes to mock up the benchwork. The 28" wide aisles are adequate for two operators, and the 54" layout height allows for storage and a collapsible workbench below the layout.

Negotiating trackage rights

The only concern I had was including a staging area inside the layout room. The train room is adjacent to my wife's craft room, which had the potential to solve my staging issue. After negotiations that involved specific design criteria and the building of a greenhouse for her plants, I was able to secure the needed space.

Among the stipulations: The staging cassette would be installed only during operating sessions, and the hole in the wall through which it passed would be covered by artwork when not in use.

I designed an 8" x 5'-6" staging cassette that would be attached to the wall using long bolts and T-nuts; a set of removable legs would support the other end. Additional cross-bracing was installed between the studs prior to hanging drywall to accommodate the attachment of the staging cassette.

This staging cassette has scenery applied and can be used for outdoor photo shoots. A Cinch-Jones two-pin connector carries power to the staging cassette. I also installed a switch in the layout fascia to shut off power to the lead to staging when it's not in use. The

staging cassette is stored on a shelf under the layout when not in use.

Operator interactions

While designing the track plan, I considered how the operators would interact with the layout. The layout has manually lined switch points, and uncoupling is performed with bamboo skewers. I was careful to place turnouts where operators wouldn't have to reach over tall structures.

One industry I included has a tank car unloading rack. I placed the industry and tank rack on the back of the siding so that operators wouldn't have to reach over the unloading rack and risk damaging the structure.

Lighting a layout is an important factor to consider prior to construction. I included separate lighting circuits for fluorescent and incandescent track lighting. The 6500K daylight fluorescents give the room an overall cold, slightly bluish look, while the incandescent track lights warm up the space and highlight the scenes. This combination of lighting gives the room a nice blend of light that is easy on the eyes and adequately lights the models.

A continuous-run option was a requirement. This feature allows for breaking in equipment and uninterrupted interaction with guests when hosting layout tours. The bridge section is held in place using the same T-nut and bolt system as the staging cassette. When installed, it creates a duckunder as you enter the room. The bridge section isn't currently used for operating sessions.

Layout construction

Prior to building any benchwork, I finished the layout room. This included installing drywall, carpeting, and lighting. All areas above the layout height, including the ceiling, were painted sky blue. Areas below the layout were painted the same dark green that I would later use to paint the framing and fascia.

Georgia Northeastern roster

Type	Road number	Year built	Former owner
Electro-Motive Division (EMD) GP9	6576	1956	Baltimore & Ohio
EMD GP9R	4631	1958	Grand Trunk Western
EMD GP10	7529	1956	Conrail/New York Central (GP9)
EMD GP10	7562	1956	Pennsylvania RR (GP9)
EMD GP18	8705	1960	Nickel Plate Road
EMD GP20	316	1960	Great Northern
EMD GP20	4125	1962	Southern Pacific
EMD GP38	9706	1969	Penn Central (PC)
EMD GP38	9708	1969	PC
EMD GP38-2	2000	1969	PC



5. This overview of Marietta, Ga., shows Georgia Metal Coaters at far right, the yellow ERB Plastics Facility, and the brown Capitol Building Materials buildings. Argos Cement is to the left of the GP38. The green building is Dow Chemical.

I divided the layout plan into five separate sections to make construction easier. I constructed the benchwork using 1 x 4 or 1 x 6 framing with a 2"-thick sheet of extruded-foam insulation board glued to the framing using a foam-safe adhesive. The framing was constructed and painted in the garage to reduce the mess. Tempered hardboard was used for the fascia and the 12"-high backdrop on the peninsula.

I drilled holes in the framing to accommodate wiring, then carried the framing to the layout room and attached it to the studs. I used heavy-duty shelf supports to prevent sagging in the middle of the longer benchwork sections. This type of construction provided a stable and sturdy base for the layout.

Storage and workbench

In a small room, adequate storage is important. A neat and clean room makes the space seem larger and provides an enjoyable environment to operate the trains. I installed a set of shelves below the layout to hold books and the removable portions of the layout. Plastic bins fit below the shelves and hold those items that aren't needed on a regular basis.



6. Georgia Northeastern's small yard at Tate, Ga., is also where the motive power is serviced between runs. No commercial models of GNRR units have been offered, so Tom custom-painted his modest roster.

I purchased a rolling cart that has 10 shallow drawers that are perfect to store my rolling stock. I lined the bottom of the drawers with soft foam to protect the details and prevent the cars from rolling around. The cart can be moved to the staging area for easy swapping of equipment between operating sessions. Drawers are labeled for each car type to make sorting easier.

A three-drawer cabinet holds all my modeling supplies. The cabinet keeps things organized and reduces clutter on my workbench.

Having a sizable workbench makes building projects much easier. I have a collapsible drafting table that works great to assemble models, yet folds away when not needed. The height of the layout easily accommodates

storage of the workbench when folded up and provides adequate room below the benchwork when in use. Easily positioned desk lights provide additional lighting for projects.

Trackwork and wiring

I used Micro Engineering code 70 flextrack to replicate the lighter rail found on the GNRR. The main line roadbed is cork painted gray prior to track installation to avoid having a bare spot show through the ballast.

I laid the sidings on thinner sheet cork, and the cork was tapered to a smooth transition between the track levels. A few sidings were laid directly on the foam to replicate those that had little ballast or were seldom used. I also included an area where the rail

Switch lists and car reports

Modelers have several choices when it comes to selecting the type of system they want to use to switch and route cars on their layouts. I looked to the prototype to see what it used and to determine whether it would work for my layout. A good friend who is an engineer on the GNRR gave me copies of prototype forms and provided valuable information on how the GNRR operated. From these prototype forms, I developed a similar switch list form on an Excel spreadsheet.

The switch list indicates all the cars in the train, which is in staging, in order from the locomotive to the end of the train. The cars are blocked by industry but not necessarily in the correct order for spotting. The industry each car is routed to is listed on the line with the car information.

The switch list indicates all the industries and sidings as you proceed from south to north. The list also shows cars that need to be picked up as being routed to CSX Elizabeth Yard (staging); cars staying will have the industry listed. Some cars will need to be moved and re-spotted to pull cars that need to be picked up.

The other information on the switch list indicates the type of car, commodity carried or empty, and the weight. The weight isn't critical for the operating session but just makes the list look more prototypical. I have several different sessions formatted and can easily change the car number and type to create a different session. The combinations are endless, so each session is different.

For one industry, Dow Chemical, the switching instructions say to "see agent," which allows me to have the crew do extra work to sort the cars in the proper order for this spot-specific industry. Each tank car must go to a specific spot for unloading, which can mean a lot more work for the crew (again, this follows the prototype). They may also have to remove partially unloaded cars, spot them on a siding south of the facility, and then re-spot the cars to Dow at the next op session when they need the chemical again.

The car report, which is a copy of the GNRR form, is filled out with information as the setouts and pickups happen. The most important item on the form is the time, which is used to bill the customer demurrage charges. I have an 8:1 fast clock and use that time for the form as the cars get set out and picked up. It adds time to the switching operation and makes the job more prototypical. – T.K.

surge protector, and a switch by the door turns off power to the outlet.

Operations

I used a few structures from my old layout to get a quick start on operations. Even though these buildings didn't match their prototypes, it gave a good sense of what will be there and enhanced the operating session. Eventually, most structures will be kitbashed or scratchbuilt to replicate the industries found on the prototype. I made a cardboard mock-up of the unloading shed at the metal-coating plant to determine the proper size before I scratchbuild the structure.

A typical operating session begins with the local in staging assigned to a two-person crew: engineer and conductor. Industries are switched based on prototypical switch lists, with each industry listed in geographical order from south to north (see "Switch lists and car reports" at left). The switch lists indicate pickups and setouts, but the order of consist and how the work is to be done is determined by the crew.

Some industries have spot-specific locations, and cars may need to be moved and reset to accomplish the switching tasks. The local leaves staging and usually switches the trailing-point industries on its way north to Tate Yard. Once at the yard, the locomotive runs around its consist and returns south to switch the remaining industries after conducting a brake test. Simulating a brake test adds time to the entire switching operation and replicates the prototype's required test.

The two marble industries on the peninsula are switched by a local originating in Tate Yard. The Marble Hill Local picks up its consist in the yard and heads north. Imerys Corp. loads marble dust into covered hoppers while Georgia Marble loads marble chips into 40-foot Ortner hopper cars. Occasionally, large marble slabs are loaded into gondolas or flat cars at the overhead crane.

A Broadway Limited Imports Trackmobile is used to spot cars at each industry, and the local sets out cars on the siding to be spotted later by the mobile railcar mover. Loaded cars spotted at the truck dump ramp are picked up by the locomotive due to the weight of the loaded cars, which replicates the prototype operation.

The cars picked up at the marble plant are brought back to the yard and taken twice a week down to the CSX interchange at Marietta. This second



7. Electro-Motive Division GP38 no. 3008 enters the scenicked part of the railroad at Marietta, Ga., from the staging cassette. The track curving off to the right allows continuous runs during open houses.

was removed from a siding, but the ties remained, covered with weeds.

I subdivided the layout into four electrical zones and used a Digitrax Quad Power Manager for short circuit protection. All Digital Command Control (DCC) components were placed on a pull-out tray and wired on

my workbench to make installation easier. I dropped track feeders every 3 feet. A shut-off switch was wired into the locomotive service terminal feeders to allow power to be turned off when not needed to reduce the load on the DCC system at startup. All electrical components are plugged into a



8. This photo shows the early stages of adding scenery and structures to the Marble Hill area on the peninsula. The workbench at lower right can be moved out of the way for operating sessions.

switch job can be run after the first local completes its work or can be run simultaneously if enough operators are present.

Small layout advantages

Modeling a short line offers a great opportunity to simulate prototype operations on a small scale. A simplified track plan enhances realism and still offers plenty of operating potential. It also presents opportunities to model a railroad that few have ever done.

No commercial model of a unit painted in the GNRR paint scheme is available, so I had to custom paint my Geeps. Fortunately, Microscale once offered a decal set for GNRR locomotives, which I was able to find online. I purchased a couple of EMD GP38 locomotive shells and gave custom painting a try. The models turned out great and gave me the confidence to paint the remainder of the small locomotive fleet required to perform switching operations.

A smaller layout allows the modeler to focus on building and reaching goals quickly. Construction on my layout has progressed rapidly, and I was able to hold an operating session within a few months of beginning construction. While I have several more years of construction ahead of me, I still can

operate and enjoy my layout. Being able to hold operating sessions keeps me interested and motivated to move forward with projects.

Solo operations on a small layout can offer an escape from the daily grind. I can go to the train room and switch cars as I like, no switch list needed. This can be a pleasant way to spend an hour or two and not worry that I'm causing a problem for the next session. Staging cars and developing a switch list only takes a few minutes prior to each session when I host guest operators.

My previous layout required six operators, and many times I struggled to fill all the positions. Now that we live in a remote mountain town, I knew the pool of available operators would be small. The layout easily accommodates two or three operators.

I'm pleased with the move to Georgia, and having the opportunity to build a new layout has inspired me to improve my modeling. My new layout has incorporated many things I learned from making mistakes while building my old layout. Each layout I built has been an improvement over the previous one and has refined what I enjoy about model railroading. The continuing challenge is to try new things and enhance skills I never knew I possessed. **MRP**

Learning points

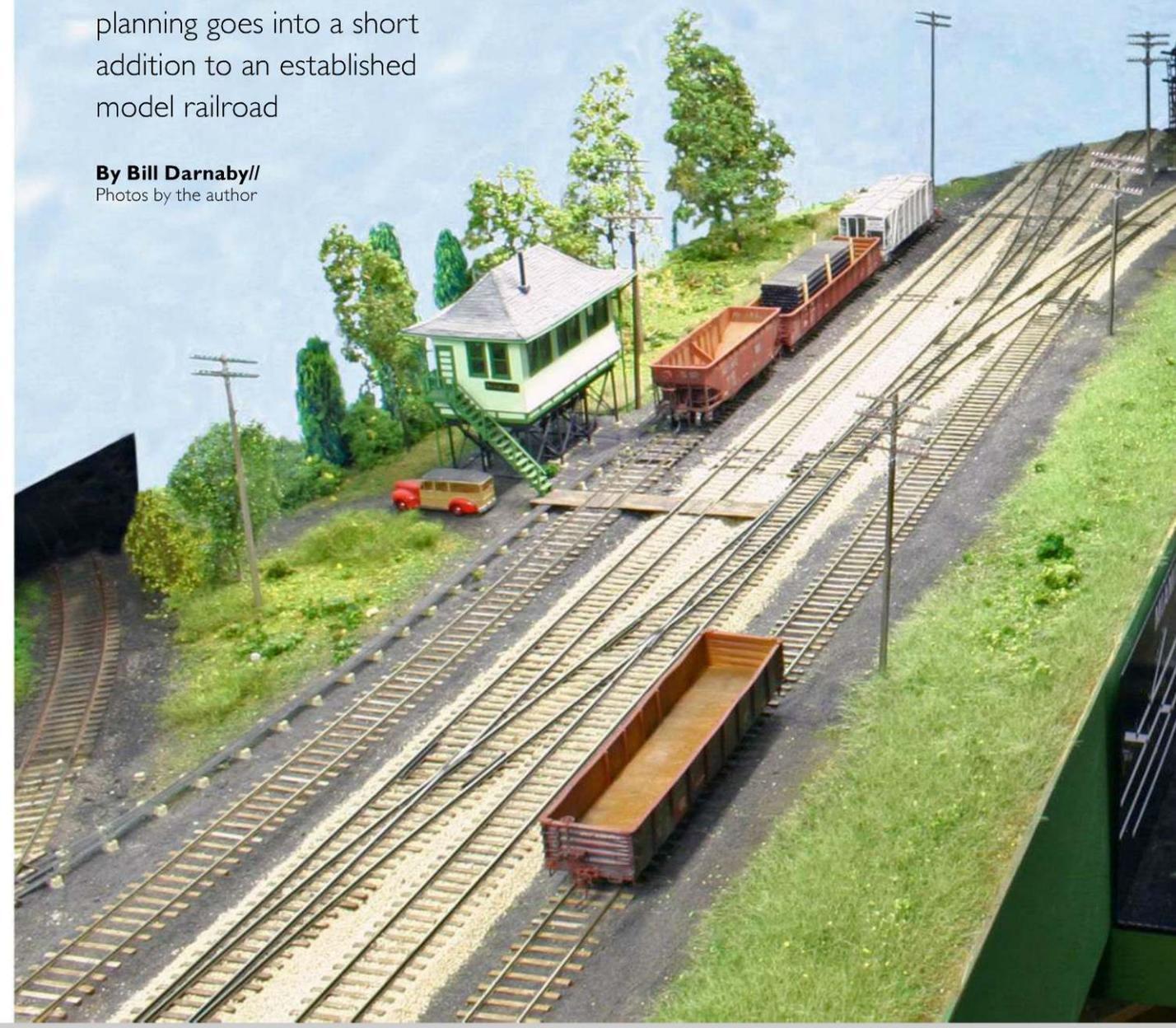
- A move may be an opportunity in disguise.
- The scope of a layout should be matched to expected crew availability and the owner's personal operating goals.
- Storing cars in drawers in a cabinet on casters makes it easier to add cars or remove them from a staging yard.
- Modeling a modern railroad provides the opportunity to learn from the professionals who operate it.
- Modeling a small short line may require custom painting the locomotives – an opportunity to develop a new skill.
- Staging is as important for a small railroad as for a large one.

Thomas Klimoski and his wife, Diane, recently moved from southeast Florida to the mountains of northeast Georgia. Thomas is a retired City of Miami Fire Department captain and is currently a member of his local volunteer fire department. Thomas and Diane volunteer on the Blue Ridge Scenic Ry. (www.brscenic.com) in its namesake town in Georgia. Among Thomas' other interests are photography, kayaking, and golf.

Adding a branch **BELOW** the main

A lot of thought and planning goes into a short addition to an established model railroad

By Bill Darnaby//
Photos by the author





This overview of the branch on the newly added bottom deck also shows Miami Junction on the middle deck, where the branch departs the main line to the left of the tower.



Another overview of the new deck shows most of the branch terminus town of Mesalia, Ohio. Tall industries that would have interfered with reaching in are relegated to the backdrop as flats. Bill placed the branch waybill box on the fascia above to the operator a bit more legroom.

Why add a branch on the Maume Route, which is an already long railroad? One of my primary design objectives, in addition to supporting timetable-and-train-order operation (TT&TO), was to create a feeling of great distance, of actually going someplace with one's train. Traveling down a branch off the main supports this sense of distance. This expands the perception of the geographical expanse of the railroad without necessarily increasing its footprint. A branch also expands operating possibilities – but we'll discuss that later.

The most efficient track plan, in terms of maximizing mileage, is once around the room with a single peninsula in the center. The reason for having only one peninsula is that it will of necessity have a space-wasting turnback curve ("blob") that is the diameter of the minimum radius plus benchwork depth. This space can be used for storage, a crawl-in work area (such as the dispatcher's office on editor Tony Koester's HO railroad), or a helix.

Spiraling down to the branch

I first saw a helix used in this location on Jack Ozanich's Atlantic Great Eastern model railroad, where a track comes off the main and employs a helix to spiral down to a branch on a lower deck. [Jack's HO scale layout was featured in *Great Model Railroads 2005*. – Ed.] I kept this in mind as I designed my Maume layout a few years later.

I envisioned a branch diverting off the main near the peninsula turnback curve and spiraling down to an elevation about chair height. From there, it would progress along the peninsula under the main line's lower deck. I could run the branch all the way around the side of the

peninsula and well beyond, with a fair-sized town to switch and a wye to turn around. There could even be a passing siding or two with grain elevators en route.

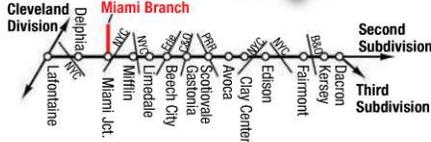
The lower-deck elevation is about 42" in this area, and tests showed that I can get my knees under a 24" obstruction while seated in an office chair on casters. This leaves 18" of separation. Subtracting the lower deck's 4" fascia leaves 14". If a 4" fascia is similarly used for the branch – not ideal, but workable. I kept this in the back of my mind as I built the main line.

Its time had come

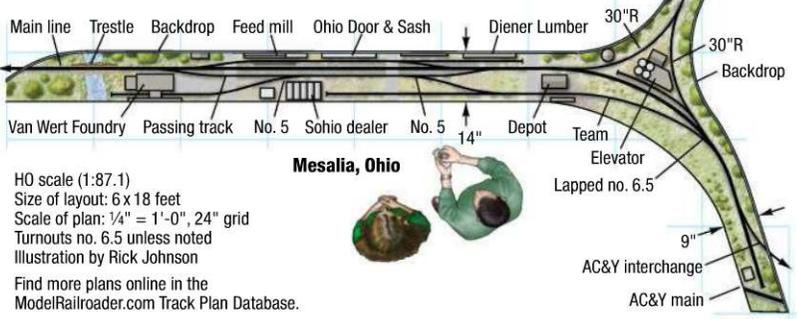
Some 20 years after I first conceived the branch, the railroad's operation had matured. All of the operating features such as industries, towns, and junctions were complete. It was time to reconsider the branch.

A crossing of the New York Central's Indianapolis-to-Cleveland main line with a tower and interlocking plant called Miami Junction had evolved just east of the peninsula turnback curve. I had anticipated the future branch by building a dummy diverging route off the main just west of the NYC crossing. This track, which just stopped at the backdrop, was provisionally identified as the Miami Branch in the timetable. It was a natural point to start a helix that would spiral down inside the peninsula turnback area.

By the time I began seriously considering doing something about the branch, I had some 250 operating sessions under my belt, and experience had taught me about crew congestion. Along the side of the peninsula are the towns of Mifflin, Ohio, on the lower deck and, on the opposite side of the aisle, Fairmont, Ohio, on the upper deck. Below Fairmont is the big dolomite plant at Limedale.



The Maumee's Miami Branch



H0 scale (1:87.1)
 Size of layout: 6 x 18 feet
 Scale of plan: 1/4" = 1'-0", 24" grid
 Turnouts no. 6.5 unless noted
 Illustration by Rick Johnson
 Find more plans online in the
 ModelRailroader.com Track Plan Database.

Scaling back the plan

When crews are working all three areas at the same time, the aisle can fill up, especially when the nearby operator's desk is in use. In addition, I often crawl under the lower deck in this area as a shortcut to other parts of the railroad. So I came to my senses and scaled back the scope of the branch to just one modeled town.

This would be built under the main track just to the east of Miami Junction, which is an area of low congestion. Approximately 20 feet of benchwork was available to develop a town before the aisle narrows down to 24" to get around a fireplace foundation in my basement. Most of the available layout space in this section is 14" wide to match the depth of the lower deck.

In theory, the branch, having come off the main line near the NYC crossing, would head north to some ill-defined point and intersect the Erie, the Pennsylvania RR, and the Akron, Canton & Youngstown. For reasons I no longer remember, I had listed the branch length as 26 miles when the timetable was first issued.

Scaling this on a map put the end of the branch about where it would reach the AC&Y, so I chose to model an abandoned crossing at the far

end of the town but still have an active interchange connection. The branch could have been cut back short of the AC&Y crossing in the 1930s.

The depth or thickness of the main layout is about 54" in this area, so there was room to install a functioning wye for turning engines if the tail extended under the benchwork on the other side of the backdrop. I could therefore achieve everything I wanted in the end-of-branch town, but had to give up the intermediate towns and sidings. Those would have to be fictitious, lying somewhere within the helix.

New construction methods

As I moved closer to actually bringing the branch to reality, I realized that a different construction technique would be required. The railroad is constructed entirely of 2" extruded-foam insulation board on 1 x 2 joists. I chose this method because the construction is fast, and adding scenery is easy as there are no open areas left to fill in. In addition, later modifications to terrain are easy, as is poking holes to install poles, fences, and trees.

The rest of the layout has a 4" fascia to cover the foam and its supporting joists. I wanted to

The branch is now truncated just west of the former AC&Y crossing (note the former tower's foundation), but the interchange is still active. To gain car lengths, the interchange extends through the backdrop and under the opposite-side benchwork. Bill hid a stud in the center of the wye inside a concrete grain elevator.





Industries on the branch include, from left to right, Van Wert Foundry and Mesalia Oil (Sohio dealer) along the fascia, and against the backdrop, Mesalia Farmers Exchange, Ohio Door & Sash, and Diener Lumber. Photos of actual street scenes add depth to the backdrop.

increase the previously calculated 10" clearance window of the branch, so I chose to build the branch on $\frac{3}{4}$ " plywood. This would allow a 2" fascia, including mounting manual switch point controls, while increasing the clearance to 12".

To double-check, I used a C-clamp to attach a piece of plywood under the lower deck at 24" above the floor and calculated the helix grade. The interior of the peninsula stud wall allowed for a 30" radius helix, so each turn yields a distance of 188". If a 3" clearance is used between turns, and considering the $\frac{3}{4}$ " thickness of the plywood, the grade becomes $3.75 \div 188$, or 2 percent, which works for short branch trains.

Four turns of the helix provides a descent of 15" from the 42" of the lower deck, but there is an additional 1" drop created by the entry and exit distances to the helix circle. Subtracting the 4" lower-deck fascia gives the desired 12" free clearance for the branch.

Full-size template

Convinced that everything would work, I rolled out a piece of butcher paper on the floor and, using full-size turnout templates, started laying out what the track arrangement could be. I prefer to lay things out in full-size HO scale with templates and real cars.

Having 20 feet to work with allowed for several industries, the wye track, and the AC&Y interchange without any switchbacks or switching puzzles. I wanted to create enough business to justify the branch but not create congestion.

Consideration had to be given to the 12" clearance, which dictated that industries in the foreground had to be minimal and low enough so that those in the back can be reached. The most significant industries would therefore be flats against the backdrop.

Tackling the helix

I'd never built a helix before and had to explore my way through the process. After

clearing out the stuff I had stored in the peninsula turnback area, I laid more butcher paper on the floor and drew out the helix circle and the connections to the main line and the branch. Doing this at full size allowed me to accurately figure the distances to be traveled so that the drop of the helix could be found at each point where it would attach to the inside of the stud wall for a consistent grade.

I made the helix by cutting circular segments out of a 4 x 8 sheet of $\frac{3}{4}$ " plywood and attaching them to the stud wall with 4" steel brackets. I found that a laser level positioned in the center of the helix was useful in establishing accurate elevations, as basement floors can be unlevel.

My estimation of the curvature of the dummy branch connection at the junction was surprisingly close; only a minor modification was required to make the existing upper connection to the helix. Beyond this, only the attachment of the helix plywood structure to the main layout and cutting a hole in the backdrop were required.

The branch itself was also cut from the $\frac{3}{4}$ " plywood to minimize its thickness. I attached it to

Learning points

- Overly ambitious plans may still have considerable merit in a more refined form.
- An office chair on casters will allow comfortable operation on decks as low as 24" off the floor.
- New construction methods may be required to accommodate different needs.
- Laying out the track plan full size on paper using turnout templates and actual cars stimulates the imagination.
- Looking at examples of operations on other railroads in the modeled region and era may provide ideas for enhancing your own railroad's operations.

the layout stud wall with 12" shelf brackets. This construction limits terrain variations, but that was part of the compromise.

Rather than have the branch appear out of the lower end of the helix through a hole in the backdrop, I created a scene in which the branch emerges through trees and crosses a trestle to enter the town. A 3" drop was built in to the plywood shelf to create the elevation change for the trestle scene. As this lowered section is at the beginning of the town, it doesn't interfere with the crewmember sitting in the chair.

For flexibility, I made the backdrop from 1 x 4-foot pieces of .040" styrene sheet that I painted sky blue before gluing them in place. The fascia is 2" wide strips of 1/8" hardboard, which is just wide enough to cover the plywood edge and manual switch-point controls.

The track is all code 55, to simulate light branch line rail, laid on 1/8" milled Homasote roadbed. I applied earth-colored Sculptamold to the plywood between the tracks to achieve some small amount of variation in the terrain. Adding scenic details such as trees, poles, and fences was more difficult due to the need to drill holes in the plywood within the 12" vertical clearance.

Fitting in the wye

The legs of the wye had to pass between studs of the peninsula's supporting wall. This placed a stud right in the middle of the wye. Rather than attempt major surgery to remove the stud and box the area in above the wye, I chose to hide the stud by building a small concrete grain elevator around it.

The flexibility of the styrene backdrop made it easy to have the backdrop follow the legs of the wye and run back along the tail track. The end of the tail track was left open for access.

Operating the branch

An extra train is called at approximately 8 a.m. at East Yard in LaFontaine, Ohio, for a run down the branch daily except Sunday. I considered making the branch run a scheduled train, but the timetable had little room for another regular train in each direction.

I borrowed an idea from the Nickel Plate Road's Minster, Ohio, branch operation by having the train work the only mainline town, Delphia, between East Yard and Miami Junction in each direction of its journey. This has the advantage of relieving the workload on the two scheduled mainline local trains.

After clearing Miami Junction, the train enters the helix with instructions to remain in the helix for one hour of 3:1 fast-clock time before entering town to simulate the running time of the 26-mile branch. The helix is open between the turnback curve studs, and all locomotives are sound equipped, so the operator can see and hear the train in the helix.

After completing the day's work in Mesalia, Ohio, the engine is turned for the trip back. The crew receives its running orders at the depot. Once back at Miami Junction after the one-hour helix running time, a new clearance and Form V train order is required from the NYC tower operator to enter the main line. (Form V is a check-of-trains order that specifies which trains have arrived and left at a specific point at a given time.) This negates the need to keep a train register at the junction.

Believe it or not, this "little" branch turn job is able to keep a crew busy for the better part of a four-hour session. **MRP**

Bill Darnaby is a retired mechanical engineer and frequent contributor to MRP.

To set the minimum height of the branch benchwork, Bill fastened a sheet of plywood to the peninsula wall studs. He found that 24" would clear the legs of a person seated on a caster-equipped chair. He also laid out the branch on butcher paper using turnout templates.





On Jack Ozanich's Atlantic Great Eastern RR, Craig Wilson studies waybills as he makes up a train during an operating session. Equipment not being used is stored on shelves and in drawers. Jack Ozanich and Craig Wilson photo

Fiddle yards streamline staging

Generating all the trains you need in less space

By Paul J. Dolkos//Photos by the author except where noted

Today, many published track plans contain staging tracks. It may be one or two tracks or a hundred, the latter based on conventional wisdom: "You can't have too much staging!"

Once upon a time, trains on most layouts began their runs from a visible yard and ended in another visible yard, or even the same yard. Then we began to adopt the operating concept that trains should disappear off scene, creating the illusion that they actually were coming from and going to distant points beyond the train room. As this

concept was accepted, staging emerged as a standard layout feature. It really helped to improve operations.

Not a "universal solvent"

But staging has its issues. Often it's located under the layout in dark spaces with limited access, making it difficult to terminate or initiate a run. One wonders, "Is my route aligned, is the track powered, do I have the right train, am I completely in the clear?" and so on.

Indicator lights, video screens, automatic power shutoffs, and mirrors help. But they are usually better on

paper than in practice, particularly for guest operators not familiar with the layout. Ultimately, many layouts are torn down and new ones built because of awkward operations created by hidden staging.

The cure for these problems is building staging that's reasonably visible and accessible to eliminate the angst of beginning or ending a run. In the simplest form, this might be provided by a visible shelf in an aisle behind a backdrop or in a side room.

On layouts in tight quarters, there is the option of staging a train or two on the layout itself. Lance Mindheim

starts his sessions with a CSX local sitting on the beginning of his Miami Downtown Spur layout, which was featured in *Model Railroad Planning 2009*. After switching the line, the train returns to that spot and stops, in theory requesting permission to get back on the main line. It's a logical end point for his sessions.

Dynamic staging

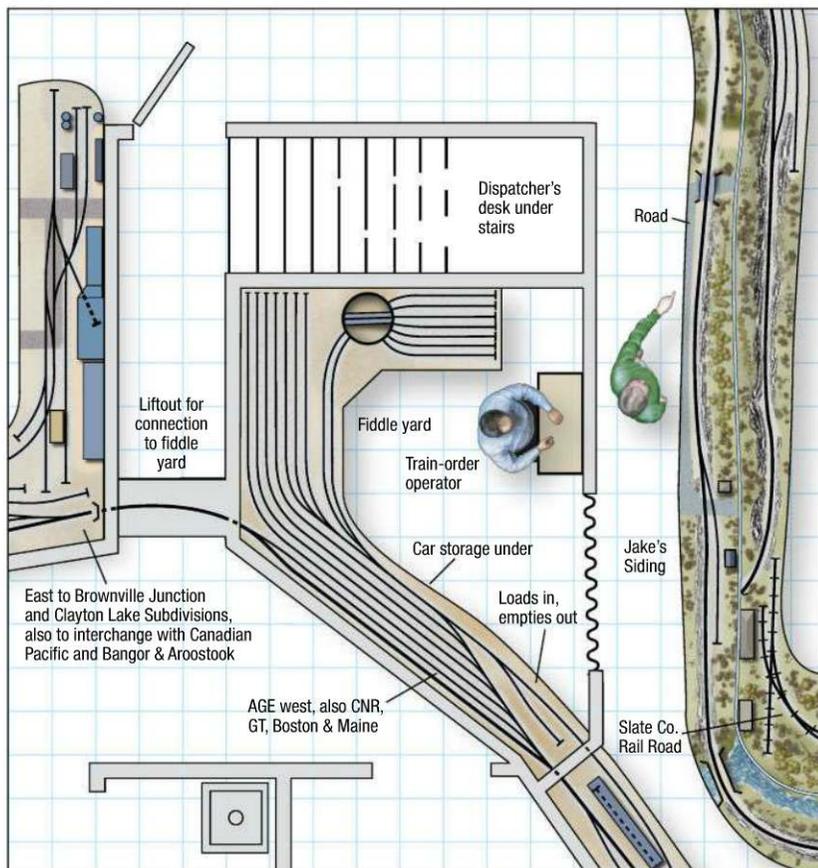
If you run lots of trains, however, allocating enough space for visible staging to accommodate the rolling stock may not seem feasible. That's why staging often ends up being stuck in hidden places, almost as an afterthought. So an alternative approach is to create a dynamic form of staging called a fiddle yard. It lets you create unlimited numbers of trains in space that is visible and accessible. It takes less space because you don't have to build enough tracks to store every train you run.

British model railroaders are often tight on space and have long used this approach with their exhibition layouts. Trains exit the primary scene through a tunnel, under a bridge, or behind a hillside [see "8 ways to hide the end of the line" on page 10 – *Ed.*] and enter a track or a handful of tracks. People manning the exhibition layout's fiddle yard remove ("fiddle with") the rolling stock, place a new set of equipment on the tracks, and run it back on to the scenic portion of the layout to continue the action. Even with relatively short trains, they use side-to-side traversers (like transfer tables), pivoting sector plates, or removable cassettes in lieu of turnouts to make the most of the space.

The Atlantic Great Eastern

Fiddle yards can work for long trains, too, and are used successfully by American modelers. One is Jack Ozanich, whose large freelanced HO railroad, the Atlantic Great Eastern, is set in New England. [See "Flexible operation with a fiddle yard," MRP 1995 – *Ed.*] The railroad's basic configuration is a loop around the basement that passes through the fiddle yard area. One entry/exit is the west end of the modeled railroad, and the other is the east end. One person, often Jack's friend Craig Wilson, makes and breaks up the trains here.

There are several tracks on which to build trains. Extra cars and locomotives are stored on shelves or in drawers. Craig follows a timetable to assemble appropriate trains. He can also get creative and put together



This portion of the Atlantic Great Eastern track plan shows the fiddle yard (and train-order operator's desk) where train consists can be manually rebuilt to continually create new trains during operating sessions. Illustration by Jay Smith

extras if the session is a bit slow, or he may delay some trains if the railroad is getting backed up. He relishes putting together a potato extra or a second section. In essence, he is a backstage manager creating the drama out on the railroad.

Thanks to the fiddle yard, Jack doesn't stage trains in advance to prepare for a session or stop a session to create more trains. Either there's a train from the last session ready to depart or one is quickly assembled.

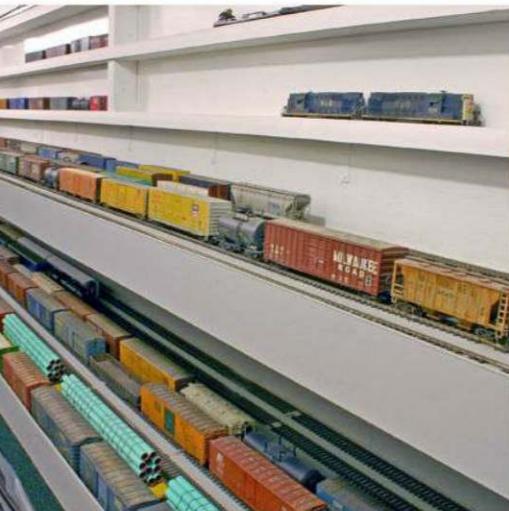
The fiddle yard tracks are on a long shelf running diagonally across an 8 x 10-foot room in the 30 x 35-foot layout space. The fiddle space also accommodates a desk for a train-order operator. The few square feet devoted to the staging function is relatively small, but it can handle an unlimited number of trains.

Jack admits that handling rolling stock in a fiddle yard subjects it to minor damage like broken stirrup steps. But the process makes it easy to cycle through a large equipment roster, and there's no need to build extra track to store the "off-road" equipment.

The Virginian & Ohio

Allen McClelland considered staging very important when he began building the first iteration of his Virginian & Ohio layout, which he referred to as the Afton Subdivision. He constructed a hidden loop on the west end of the railroad that held only three trains. Over time, he extended the main line and expanded staging capacity to five stub-ended tracks, then nine. With this expansion, the area became crowded with track, and Allen wasn't happy with the appearance and operation.

The ultimate solution was to reduce the number of open yard tracks just before entering the staging area. This provided space to locate the staging yard ladder before the track ran under a road overpass into a side room that also housed the dispatcher's Centralized Traffic Control (CTC) panel. [See "The Virginian & Ohio's new west-end staging," MRP 1998 – *Ed.*] He gained more capacity, switch alignment could be easily seen, and the ends of parked trains were visible. It looked like the end of a yard, a logical point for trains to initiate and terminate runs.



The fiddle yard on Allen McClelland's Virginian & Ohio Gauley Division occupied the interior of a peninsula with minimum impact on the layout room space. It provided an almost unlimited ability to generate trains during an operating session.

When Allen built a second V&O layout, the Gauley Subdivision, instead of passive staging, he created a fiddle yard inside a 34-foot-long peninsula. Trains exited one of eight staging tracks. If they ran across the subdivision, they entered a second staging yard either above or below the first one, depending on the train's direction. This staging area also had other staging tracks for branchline trains and a connecting railroad that serviced industries on a short segment.

Road crews avoided having to deal with hidden staging tracks by picking up their trains just outside the staging exits, one located at a tower and the other at the end of a passing siding. When entering staging, the crews looked for a clear signal aspect, indicating a staging track was open, and proceeded until the caboose was clear of the main line. Train crews talked to the dispatcher, and he communicated

with the staging operator, who worked the fiddle yard.

The staging area was about 4 feet wide inside the peninsula, with shelves and drawers on either side of a 30" aisle. Portions of the modeled railroad ran on the other side of the staging alcove walls, so the fiddle yard consumed relatively few square feet of the layout room. This peninsula also concealed a row of support posts.

Where the "mole" was born

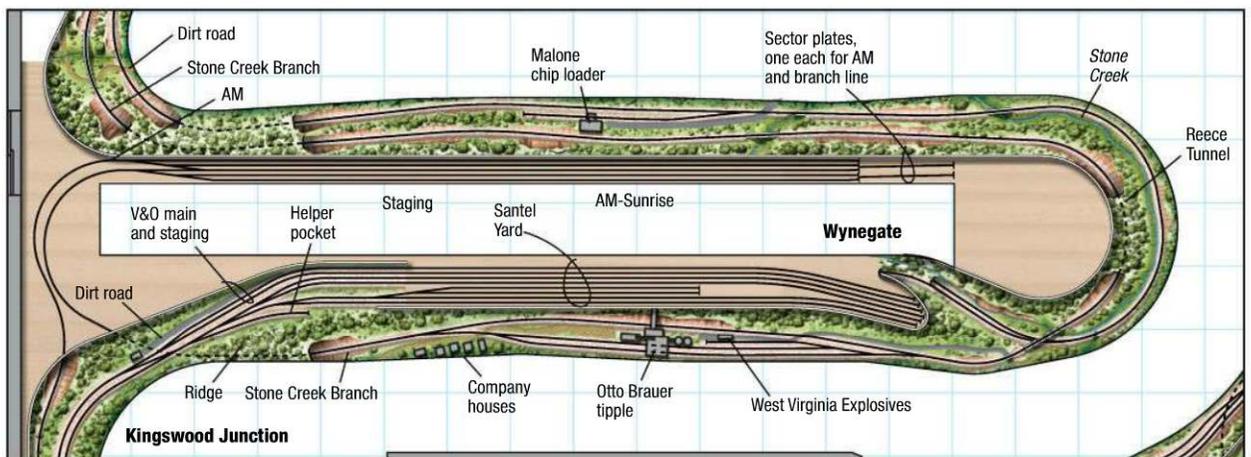
Lee Nicholas' HO railroad [see "Pre-staged fiddle yard" on page 46 – Ed.] is a good case study on how staging has evolved. The layout he began building in 1985 didn't initially have any staging. But once regular operating sessions began, the need for staging became obvious. The model route represents a mainline route between Denver and Salt Lake City, and without staging there was no way to

simulate the traffic's continuation beyond those cities.

So Lee built two 10-track staging yards with reverse loops, one above the other under a peninsula. They served as the east and west destinations "beyond the basement." But with the hidden track and lack of access, the crews found it difficult to exit or enter the staging yards. They suggested stationing an operator inside the reverse loops to align routes in and out and cycle waybills.

To provide access for an operator, Lee cut out a 3-foot-square cubbyhole under the peninsula's mountain scenery. Having an operator there worked reasonably well, but the working environment was less than desirable. The position was dubbed the "mole," a name now applied to many active staging installations.

Lee has never hesitated to rebuild and upgrade his railroad. In 1995, he



The second V&O's fiddle yard was surrounded by the Stone Creek Branch. Illustration by Kellie Jaeger

Learning points

- Fiddle yards reduce the space required for staging.
- It's relatively easy to create additional trains.
- Owners don't have to pre-stage operating sessions.
- Stored equipment shouldn't take up staging space.
- Fiddle yards make it easy to rotate large equipment rosters.
- The more frequent handling of rolling stock increases the potential for damage.

and his crew made a host of track and scenery changes, as well as establishing the freelanced Utah Colorado Western as the operating railroad instead of the previous mix of western railroad prototypes.

The two hidden staging yards were replaced with a single 10-track, 18-foot-long yard on a shelf behind the scenery. A 2-foot-wide aisle provided access. Two operators could be accommodated, and it provided a comfortable environment in a relatively small footprint. Trains were made up from cars stored on shelves and in drawers. Arriving trains were taken off the track and stored until needed. The only major negative was that access required crawling under the benchwork, so the "mole" designation stuck.

But improvements are the norm on Lee's layout. Using Tom Sawyer-like persuasion techniques, Lee has recently expanded his layout area by having crew members dig out a basement crawlspace off the layout room. This has permitted moving the "mole" into a walk-in area. It's user-friendly and attractive.

Fifteen to 20 trains originate in staging during each normal 4-hour session that, at a 2:1 fast-clock ratio, represents an 8-hour shift or "trick." It's not a stressful position and is actually a sought-after job assignment.

Gains exceed concerns

These three veteran modelers had problems with hidden and inaccessible passive staging and resolved them by turning to fiddle yards. Although not everyone will want the "mole" to handle equipment as he or she makes up trains in real time, just having visible and accessible staging tracks will smooth out operations. **MRP**

Paul Dolkos is a regular contributor to MRP.



These photos show one exit/entrance to the fiddle yard on the second V&O from the perspective of a fiddle yard operator (top) and train crew (bottom).



Lee Nicholas' new fiddle yard suggests that the "mole" moniker should be retired. The departure tracks are equipped with rereilers to ease placing rolling stock on the track. Lee Nicholas photo

Pre-staged fiddle yard

Making things more comfortable and productive for the “mole”

By Lee Nicholas//Photos by the author



John Dulaney places cars selected for future trains in holding drawers. He has a computer-generated consist list to verify that the right cars for the right train are in each drawer.

What started out as an addition to my shop ended up as major changes to my HO scale Utah Colorado Western [see *Great Model Railroads 2005*. – Ed.] The shop was tucked in behind the crew lounge and dispatcher's office at the end of a hall in a roughly 5 x 10-foot space that ended in a load-bearing north wall. There was a crawl space that could be excavated to enlarge the shop.

As I started to open up the space, it dawned on me that I could cut into the western leg of the old fiddle yard – an active yard switched by a person we came to call the “mole” during operating sessions – and have it continue on

westward to the exposed part of the layout. It would also allow extending the branch line into the new fiddle yard to expand the presence of the Chicago, Burlington & Quincy at Casper, Wyo., on my railroad.

This turned out to be quite a chore, as the shop, lounge, and dispatcher's office are located under a previous addition to our home. It required opening up a hole through an 8-inch concrete wall to reach the layout room.

Objectives

I use what we call Flex-Bill to handle the paperwork on the UCW, which is a Microsoft-Access-based program the late Steve Karas and I developed to

support active mole-type staging. I've added an agent module to the program that now provides waybills, wheel reports, and switch lists. Trains are made up before each operating session and placed in drawers below the fiddle yard. Building a new train during a session is therefore simply a matter of moving cars from the drawers onto a departure track.

I had several operational goals in mind before construction started:

- Enlarge the dispatcher's office to create a space for an agent. The expanded office provides a large area for the agent to manage all the waybills by customer and prepare the paperwork for the crews.
- Enhance the presence of the Burlington Route by converting the old branch line to the CB&Q and providing real-time interchange at Jiggs, Wyo.
- Add Automatic Permissive Block signaling on the CB&Q. (My Utah Colorado Western is dispatched using Centralized Traffic Control.)

- Rebuild Jiggs, which has turned out better than expected with new industries and a CB&Q interchange yard and main line.

- Bring the dispatcher, agent, crew lounge, and mole to a central location.

Having these related jobs located within steps of each other has been the most rewarding part of the project.

After excavating tons of dirt from the basement (a bucket at a time up the stairs) and pouring five yards of concrete (a bucket at a time down the stairs), my hard-working operating crew and I completed the project in about six weeks. The excavation eliminated the crawl-under to the old mole's operating position while creating a substantially larger combination shop and fiddle-yard room.

Learning points

- Even major physical obstacles can be overcome with determination and a lot of help from your friends.
- A fiddle yard operated during an operating session by a “mole” allows sessions of any desired length, and no extensive restaging is needed between sessions.
- Storing pre-staged trains in drawers cuts the workload during the session.
- Keeping crews comfortable is important.
- A remodeling project can rekindle interest in your layout.

The operating session

Operators start work well in advance of any departures. The staging operator is given a wheel report with a requested train consist, but not specific cars. For a mixed freight, the list may call for 12 boxcars, six reefers, and a pair of gondolas, some of them of a specific configuration. Each car has a barcode (generated by Flex-Bill and printed on an Avery label) attached to the underside, so the mole operator simply scans the bar code to load the car number into the database. Each waybill also has the appropriate car number's bar code, so the agent can scan the number and the appropriate move (spot, pull, set out, pick up, or move) to “fill out” the paperwork.

The locomotives and cars are stored on shelves and appropriate rolling stock selected. For open top cars, if the list says it's carrying a load, the operator inserts the proper load. The car's reporting marks and numbers are added to the train consist list and the list is returned to the clerk seated nearby. Since the staging operator is normally assembling trains well in advance of their departures, they don't put the cars on the staging tracks.

As in a prototype yard, the train being built may not depart until the next shift, or in model terms, the next session. So the selected equipment is stored as a group in a drawer. When the departure time nears, the locomotives, cars, and caboose are placed on a departure track. Since the consist has already been gathered, it only takes two or three minutes to put the train on the track and ready it for departure. Using this process and just eight tracks, the mole can generate a



This view from the entry into the fiddle-yard area shows the shelves for cars not currently billed for outbound trains. Billed cars are stored in drawers below the yard. At the far end is a loop that enables empty hopper and loaded coal trains to be recycled for the next trips without fiddling the cars.



The clerk's office where the train consists are generated is on the other side of the wall from the fiddle yard. The Flex-Bill waybill system developed by Steve Karas and Lee has automated most of the billing chores.

large number of trains, each 20 to 25 cars long, on a railroad with 800 cars.

When the dispatcher releases the train to begin its run, the staging operator moves it out of the room to a point where the road crew takes over. For trains ending their runs, crews turn the train over to the staging operator, who runs the train the final few feet. The incoming equipment is placed on shelves to await the next assignment.

Rebuilding enthusiasm, too

On even-numbered years, we host the Great Basin Getaway, a long operating weekend, during the second week of September here in Utah. I shut down my railroad after the operating

weekend in 2014 and started to remodel Jiggs. We held the first post-change session on April 11, 2015, and despite a little tweaking that needed to be done, the day was a resounding success.

I will admit that the old layout was getting a little stale for me. This improvement project renewed my enthusiasm tenfold, and I look forward to sharing it with friends for many years to come. **MRP**

Lee Nicholas and his wife, Kris, live in Corinne, Utah. His family owned property around the site of the 1869 driving of the gold spike at Promontory Summit, Utah.

Pushing the boundaries of space and time

Ceilings, intrusive walls, and closet access provided design challenges

By Byron Henderson//Model photos by Mike O'Brien unless noted



1. A good beginning: Layout owner and builder Larry Kedes demonstrates the motorized Mianne lift gate spanning the doorway of the Bakersfield & Ventura RR. Tracks to staging and the Port Hueneme branch are carried across the gate.

On occasion, a custom layout design will require thinking outside the box, maybe even punching through the sides of the box – or walls, in this case. My client for this track plan envisioned a reasonably realistic 1950s–'60s Southern California coastal layout where Southern Pacific; Atchison, Topeka & Santa Fe; and Union Pacific trains might reasonably cohabitate.

This would include a number of favorite lines, not to mention the liveries of many on-hand locomotives!

The challenge: That location really doesn't exist – UP trains get no closer to the coast than Los Angeles, and the SP and ATSF don't really share any coastal territory. (At least, this was true in the desired modeling era. Mergers and acquisitions have radically remade the Southern California rail landscape.)

Saved by short lines

Fortunately, there was a willingness to proto-freelance as necessary, but hopefully within some plausible alternate reality. Two lesser-known California short lines came to the rescue: the Bakersfield & Ventura (B&V) and the Hueneme, Malibu & Port Los Angeles Ry. (HM&PLA). Of the two, the B&V is the better known.

Incorporated in the early 1900s to link its namesake cities, the B&V started with tracks in the Oxnard area. While it never extended out of coastal Ventura County, it did become an important independent short line serving Oxnard, Ventura, and Port Hueneme as the Ventura County Ry., with an interchange with the Southern Pacific (now Union Pacific) in Oxnard. It continues today as the Ventura County RR (reporting mark VCRR), a Class 3 subsidiary of shortline holding company Genesee & Wyoming.

The B&V offered many elements of interest: the busy Port Hueneme area, characteristic sugar beet traffic, and a tie-in to the Santa Fe at Bakersfield. This opened the possibility for track-age rights and other ATSF influence. And we could keep the Southern Pacific as an interchange partner. Okay, so we have a plausible (and modelable) short line and checked two prototype boxes – now how about the UP?

SP's loss is our gain!

For this, I turned to the virtually unknown HM&PLA. A project of the Rindge family, landholders of a huge

tract of prime property along the coast in Malibu, the railroad wasn't really intended to be a viable business. It was meant to keep the mighty SP away from that Pacific paradise! It seems that in 1904, the SP petitioned the Interstate Commerce Commission (ICC) to build a line from Long Wharf in Santa Monica through the middle of the Rindge's vast Rancho Malibu property to meet with the SP Coast Line in Santa Barbara.

In response, the Rindge family built 15 miles of standard gauge railroad on their property, which meant the ICC denied the SP permission to build across the same land. The Rindges operated the HM&PLA for a few years, mainly hauling hides and supplies between their ranch operations and the Malibu Pier.

Two more twists of imaginary history pulled together the proto-freelanced scheme (see map on next page). Long Wharf at Santa Monica was originally connected to downtown Los Angeles by the Los Angeles & Independence RR. Rather than have this line fall into the hands of the SP in 1877 as in real life, I simply imagined that the Union Pacific gained control of the LA&I line from Los Angeles to Long Wharf and also acquired the HM&PLA, building northward to Port Hueneme on to a friendly connection with the B&V.

(Although the implementation of the design was quite different, John Armstrong built on the originally proposed B&V in developing his San Joaquin Southwestern layout design in Kalmbach Publishing's out-of-print *20 Custom Designed Track Plans*.)

The next challenge

With a plausible alternative history comfortably in hand, I turned to the space. Yikes! The twists and turns of alternative history may have been easier. The space was of a good size, but sloping ceilings in some areas and low knee walls were somewhat problematic, as was a desire for access to multiple closets around the walls and (the client hoped) a walk-in benchwork scheme. An alcove that jutted into the main space offered a larger layout footprint – but only if I could figure out how to use it!

The client's wish list seemed reasonable: walk-in access, three or so towns, a visible active yard, visible staging representing connections to and/or interchanges with the favored Class 1 railroads, a continuous-running option for entertaining visitors, and some industrial switching. But my first attempts to incorporate all of this were pretty dismal. At the desired 24"



The Oxnard Union Ice platform, seen here in 1972, has been moved to the proto-freelanced Bakersfield & Ventura. It will provide an operating challenge for crews in getting reefers iced for the many packinghouses in Oxnard and Ojai. Alden Armstrong photo courtesy Anthony Thompson



In this photo taken at Oxnard, Calif., in the 1950s, a Union Ice truck supplies ice to express cars on the Southern Pacific. Oxnard was (and is) an important hub for produce grown in the area, which is reflected in packinghouses and other industries on the track plan. The Oxnard depot is directly behind the photographer. Alden Armstrong photo courtesy Anthony Thompson

minimum radius, classic freestanding "dogbone" or "water wings" footprints left too little straight track for yards and other features. And none really made good use of the alcove.

Lifting spirits, toppling walls

Given the realities, I suggested that we might need to sacrifice walk-in

capability for better use of the space. This would also allow us to move the layout into the reduced-height areas near the walls and thus allow the operators to move in the full-height aisles. I knew this would be a tough trade-off for him.

But he mentioned that his desired prefab benchwork supplier (Mianne,



Ojai was at the end of a Southern Pacific branch, which in steam days called for this armstrong turntable. Note the oil dealer in the background in this 1937 view. On the layout,

Ojai is now a Bakersfield & Ventura RR destination between the namesake locations, though there wasn't room for the turntable. Robert McNeel photo courtesy Anthony Thompson



the Santa Fe in Bakersfield (represented by one end of the double-ended staging yard). In real life, Ojai was at the end of a Southern Pacific branch, but we assume that the B&V got there first and pre-empted the SP. A number of the industries, such as citrus packing and the lime kiln, represent actual products of the area.

Take me to L.A.

In the other direction from the yard (south and east in our imagination), there's more industrial switching representing the sugar beet mill in Oxnard. Two long interchange tracks with the SP provide an important source of business for the B&V. Placing these elements against the wall in the reduced-height area is space-efficient, as the operator can work from the full-height aisle. A dummy SP crossing creates a reason for trains headed away from the yard to pause for clearance from the SP dispatcher.

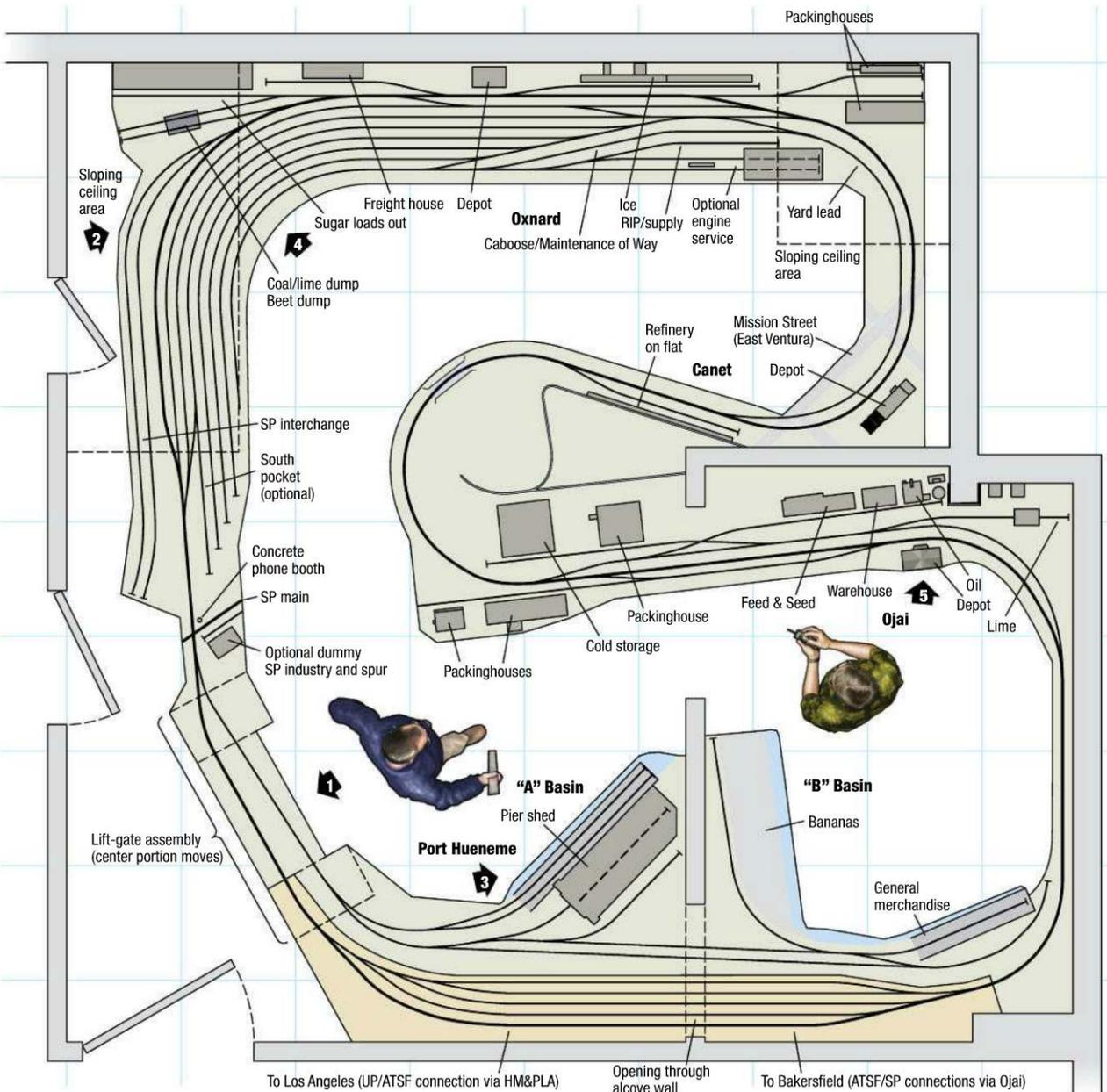
Continuing on, the B&V main line extends toward the doorway and through the lift-up section. At this point, I decided to overlay two elements, a trick I've often found helpful. In this case, the desired rail-marine scene of Port Hueneme lies just in front of the visible (yet secluded) through staging yard. At this end, the staging yard represents the UP-flavored connection to Santa Monica and on to Los Angeles, with an imagined ATSF

www.miannebenchwork.com) had just released a self-contained lift-up unit that might solve the access problem. He was also willing to compromise access to some of the closets. Better still, he suggested that if it helped to open a passage between the alcove and main room wider than a single track or two, that we should explore that option.

With these new parameters, the design came together well. I chose Oxnard to be the main visible yard and set it against the one long wall. To make best use of the space, a peninsula extends along the jutting alcove wall to

add running length, continuing on along through the alcove itself. This path represents the western and northern extension of our proto-freelanced Bakersfield & Ventura, with the first stop being a freelanced passenger station at East Ventura. The oil facility at Canet is inspired by the real location north of Ventura, although much scaled-down.

A small vignette of a rail bridge over a mostly dry creek leads us into the town of Ojai (Oh-hi), offering some switching and a passenger stop on the way to our imagined connection with



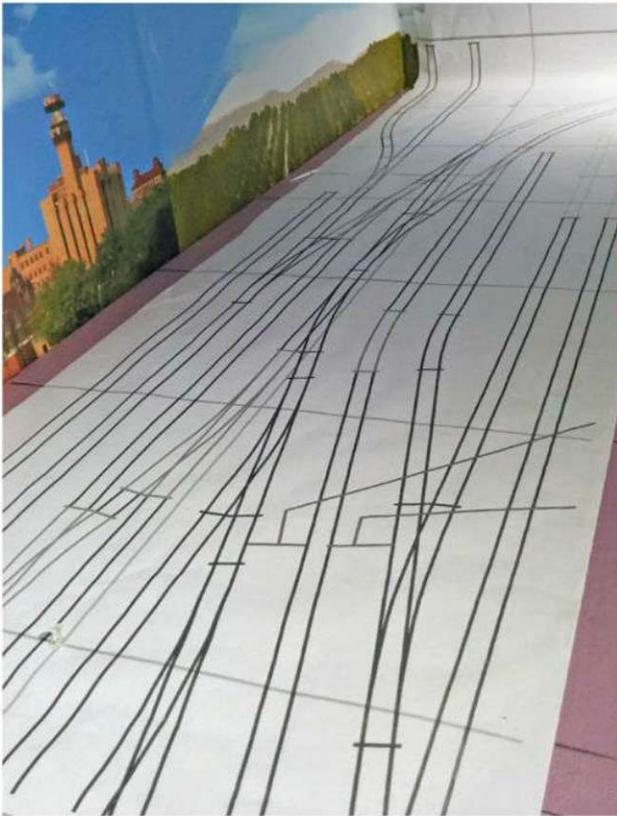
The layout at a glance

Name: Bakersfield & Ventura RR
Scale: HO (1:87.1)
Size: 15'-5" x 17'-0" plus 2 x 9-foot alcove
Prototype: Bakersfield & Ventura RR; Southern Pacific Lines; Atchison, Topeka & Santa Fe Ry.; Union Pacific RR
Locale: Ventura County, Calif.
Era: mid 1950s to early 1960s
Style: around-the-walls
Mainline run: 72 feet
Minimum radius: 24"

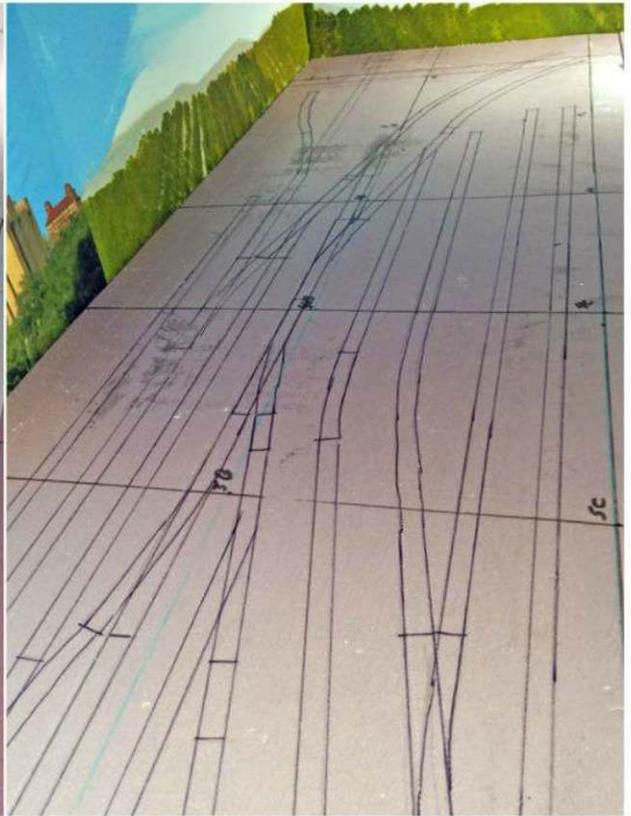
Minimum turnout: Peco code 100 "Medium"
Maximum grade: no grade
Train length: 9 feet
Benchwork: open grid with extruded-foam insulation board
Height: 50"
Roadbed: cork
Track: Peco code 100 flex
Scenery: to be determined
Control: NCE Digital Command Control

Bakersfield & Ventura RR

HO scale (1:87.1)
 Room size: 15'-5" x 17'-0" plus 2 x 9-ft. alcove
 Scale of plan: 3/8" = 1'-0", 24" grid
 Numbered arrows indicate photo locations
 Illustration by Byron Henderson and Rick Johnson
 Find more plans online in the ModelRailroader.com Track Plan Database.



2. A 1:1 printout of the track plan was preliminarily positioned over the extruded-foam insulation board subroadbed, lined-up with the 1-foot grid drawn on the foam, and tacked down. A pounce wheel was used to



transfer track lines to the foam for the east end of the B&V's Oxnard Yard. A felt marker was then used to draw in along the indentations created by the pounce wheel to provide a guide for track laying. Larry Kedes photos



3. The alcove wall created a design challenge, but at the client's suggestion a fair-sized opening was made in the wall. This allows access and visibility for staging tracks (at rear) and the Port Hueneme branch – somewhat unorthodox, but effective.

Learning points

- Proto-freelancing a railroad and its connections may offer a plausible way to combine real-life railroads of interest that didn't share locales.
- Consider placing the layout to the outside and the people in the middle in rooms with restricted ceiling heights sloping down to outside walls.
- Sometimes opening a wall opens up much better track planning possibilities.
- Explore some flexibility in adapting imagined geography, orientation, and connections to the layout design if it improves fit to the room – after all, they're imaginary!

connection at Inglewood. The staging yard also completes a continuous-running path.

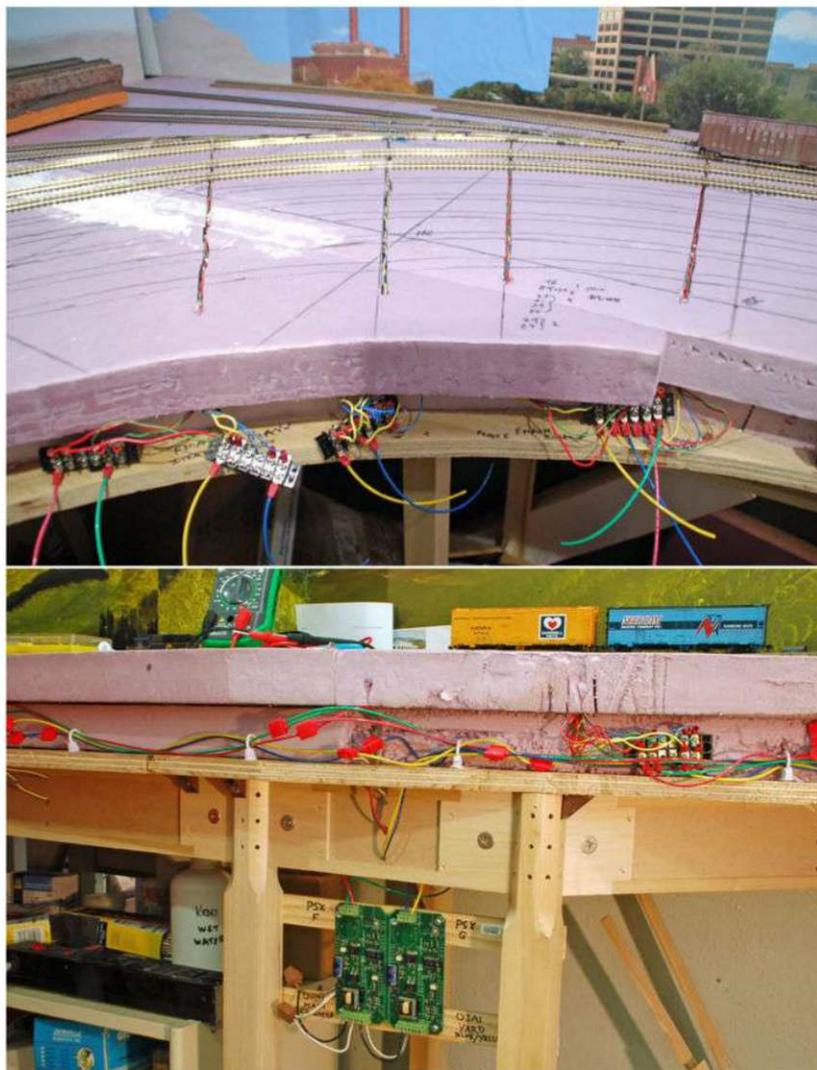
Not another hole-in-the-wall

The wide opening in the alcove wall makes the double-ended staging yard practical and also extends the Port Hueneme branch to include larger rail-marine elements – and more of them – than could be considered without the breach. Note that Ojai closely hugs the jutting alcove wall, permitting a bit wider aisle for crews to interact while switching Port Hueneme. Given the close quarters, it probably makes sense to schedule the switching crews at Ojai and Port Hueneme for different times to avoid crew congestion.

Sharp-eyed readers might notice one track plan concession to the room compared to the map. The HM&PLA connection should really be on the inside of Port Hueneme and the port should face the other way. But this would have put the staging yard toward the aisle and the ocean toward the wall. It works much better to have the aisles represent the harbor and for the staging tracks to be against the wall, so the client decided to live with the minor violation of the imagined geography.

Operating the B&V

The final design offers work for multiple crews and a wide variety of possibilities for connecting or trackage-rights traffic patterns. The yard crew at Oxnard will be busy making up and tearing down locals as well as handling interchange that arrives on trains from



4 and 5. Two dozen wires occupy four channels carved into the foam (top) to bring the track wire feeders to the front of the layout. Larry used two layers of foam, partly to allow a recess in the lower layer for a wire raceway and terminal blocks. Hooks (bottom) retain wires yet allow removal for testing or modification.

the ATSF and UP via trackage rights from the staging yard. (Alternately, these could be behind B&V power, but we might as well make the on-hand ATSF and UP engines earn their keep!) This crew or another will also work the local Oxnard industries and the passive SP interchange tracks.

Along with those freight runs from staging, trackage-rights passenger trains might ply the rails between Los Angeles and Bakersfield, as well as a B&V passenger local and/or Rail Diesel Car. Through train crews might alternate working the local jobs to Ojai and Port Hueneme, or Ojai might be switched by a long-distance local out of Oxnard that is imagined to switch other locations before it terminates in Bakersfield.

Creativity the key

Developing a historically plausible proto-freelanced scheme set the vision for the locales, industries, and equipment the layout is to host. New features in commercial prefab benchwork and a willingness to tear down the walls (a little) gave us the room to make the Bakersfield & Ventura RR an enjoyable modeling and operating experience.

Sometimes looking through the box brings everything together. **MRP**

Californian Byron Henderson, editor of the Layout Design Special Interest Group's Layout Design Journal (ldsig.org), and a custom layout designer (layoutvision.com), is a regular contributor to MRP.



Planning for big bridges

Compression isn't always simple when it comes to these iconic structures

By **Mark Dance**//Photos by the author unless noted



A westbound Canadian Pacific freight from Nelson bound for the smelter at Trail, B.C., crosses the Kootenay River at Taghum. This bridge, which inspired a model on Mark Dance's N scale Columbia & Western Ry., comprises nine spans of varying styles and crosses two islands over a distance of 763 feet. Matthew Hicks photo

large will the modeled bridge and its approach elements be in all dimensions? (Or, if you're modeling a prototype bridge, how will the model be compressed?) Secondly, how will the bridge scene be supported?

If you're freelancing a bridge, you have more latitude in design and construction than if you're modeling recognizable prototypes. Either way, following the prototype's engineering practices and copying its look will make the scene more believable.

I wanted to reproduce the bridges of CPR's Boundary Sub as closely as possible. In all but one instance, however, space constraints required that I compress the bridges. In two cases, that compression was substantial. So I'll review various compression techniques and illustrate them with specific examples.

Identifying a bridge's character

The first and most important task is to identify the elements of the prototype bridge that create its character. This invariably includes the types of span that comprise the bridge – through-girder or deck-girder spans and through- and deck-trusses are examples – and any approach trestles or fills. Strong characteristic elements may also include the material that these spans and supports are made from, their color and condition, symmetry or lack thereof, the relative size and apparent mass of support members, the number of panels making up any span, and the location and construction of supporting abutments, towers, and piers.

The bridge's appearance will be strongly influenced by relative dimensions such as span depth-to-length ratios, the height of the supported track above the underlying terrain relative to its length (and thus the height of abutments and piers), and the relative height of the bridge compared to the rolling stock that will pass over or through it. These height-to-length ratios will also affect the angles of connecting diagonal elements in the scene, like riverbank slopes and diagonal trusses or links. That means that non-uniform compression –

Canadian Pacific's Boundary Subdivision in southeastern British Columbia, the prototype for my N scale Columbia & Western Ry. [see *Great Model Railroads 2016 –Ed.*], required nine large bridges that total nearly 4,000 feet in length to ford the rivers and creeks in its path. If built full scale, that would be 25 actual feet of bridges!

I'd never built a big bridge, but I knew that the bridges would be both significant challenges and strong and recognizable scenic features. I spent considerable time in the planning stages of my layout, first with sketches and then with computer-aided design (CAD), considering the bridges, their

compression, and their support. That turned out to be time well spent, and I'd like to share with you what I learned and how things have turned out.

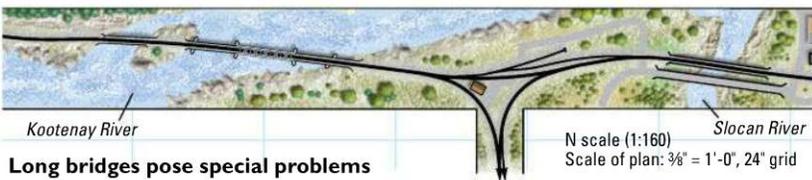
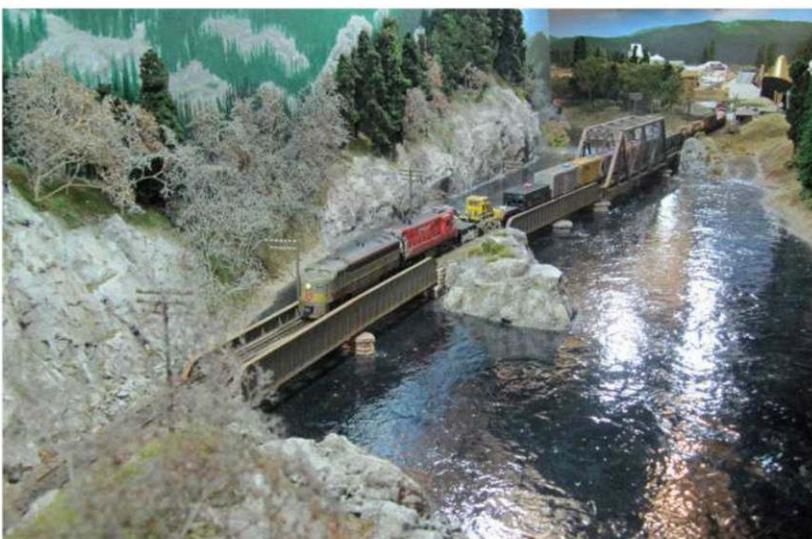
Planning for large bridges

Large bridges require special treatment during the design phase, especially on multi-deck layouts. The layout designer should consider not only the location and size of the bridge, but also its approach, its support elements, and the scenery that it's crossing. On multi-deck layouts, a bridge may also present construction, viewing, and access challenges.

Therefore, it's best to address two questions early in the design: How



The same westbound Canadian Pacific freight crosses high over the Slocan River at Fraine, B.C. Unlike the Kootenay River crossing, this bridge does not have a lot of repetitive spans that can be omitted. The author therefore had to use non-uniform compression to reduce the bridge to a reasonable length and height without having it dwarfed by rolling stock passing over it. Matthew Hicks photo



Long bridges pose special problems

The Kootenay River bridge occupies a scene nearly 5 feet long and is next to an aisle only 3 feet wide, which makes photographing the entire bridge from its side challenging. This segment of Mark's track plan shows the bridges crossing the Kootenay (left) and Slocan rivers on the Columbia & Western.

compressing the length to a different proportion than the height, for example – may change the resulting angles and significantly affect the bridge's appearance.

Try sketching the prototype scene by hand or in CAD and consider what elements you draw first or emphasize

the most when you are drawing. Sketching will prompt you to simplify a bridge and reduce it to its most basic elements. Note which details you haven't drawn, as these likely have the weakest impact on the overall flavor of the scene and may be candidates for omission altogether.

Selective omission

Ideally, we would just shrink all of the prototype bridge's dimensions to our scale. But in most cases, something has to give as we compress the design to fit the space available. The most dramatic and space-saving approach is selective omission – leaving entire elements out. If a bridge is made up of multiple spans, could some of these spans be omitted while still retaining its essential character? If a span is made up of multiple panels, could panels be omitted – a 7-panel span reduced down to 5 panels, for example – while still retaining the characteristic elements of the design?

As an example, my prototype's fourth crossing of the Kootenay River is a highly photographed and therefore very recognizable bridge. It stretches 763 feet and comprises one 157-foot through-truss span and eight half- and full-deck girder bridges while crossing over two islands. ("Half-deck" bridges have the track located part way up the girder sides.) This would scale out to nearly 5 feet in N scale, but I had just shy of 3 feet in which to model it.

Nearly all photographs of the bridge focus on the through-truss span crossing the deepest point in the

channel, so this needed to be retained. Fortunately, BLMA (www.blmamodels.com) makes a beautiful brass 150-foot through-truss bridge that, though it has four taller panels rather than the prototype's five shorter ones, makes an acceptable stand-in. I could retain the signature element of the prototype at close to full scale with this bridge, but I would have to compress the remaining 600 feet of prototype by about 50 percent to make the rest fit. Those would be some pretty wimpy spans!

What I chose to do was selectively omit one of the islands/channels altogether, along with three of the seven half-deck plate girder spans, and compress the remaining spans slightly. The result is recognizable only to those who know the prototype.

All those redundant elements in the Kootenay Bridge lent themselves nicely to compression by selective omission. A bridge just a few miles west over the Slocan River would prove more challenging; other techniques such as general and selective compression would be needed.

General compression is straightforward: You just scale everything in a prototype scene down by a fixed ratio. For reasons of relative proportionality that I mentioned previously, such as the bridge's height above the water, this can be taken too far and the characteristic appearance of a scene lost or rendered unrealistic. Instead, some bridge elements can be selectively compressed more readily than others. For example, the featureless lengths of a deck-girder bridge are more easily compressed than the lacy members of a through-truss.

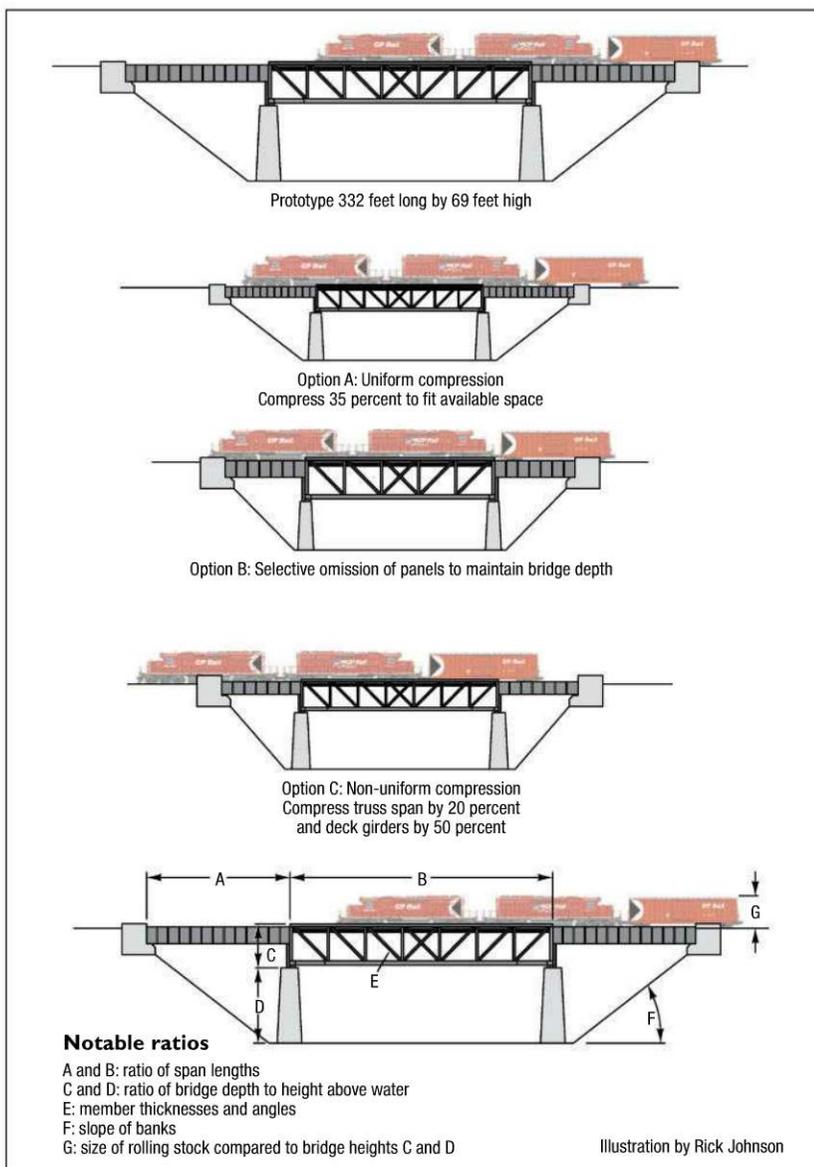
Finally, there's the believability test: Does a specific size and type of bridge make sense to the eye for the compressed distance it's spanning? When crossing a compressed distance, a bridge wouldn't need to be as strong, and its members could be constructed to lighter standards. Conversely, maintaining prototypically sized bridge members for a shorter, compressed bridge can make the bridge look more massive than would make economic sense for a bridge in that location.

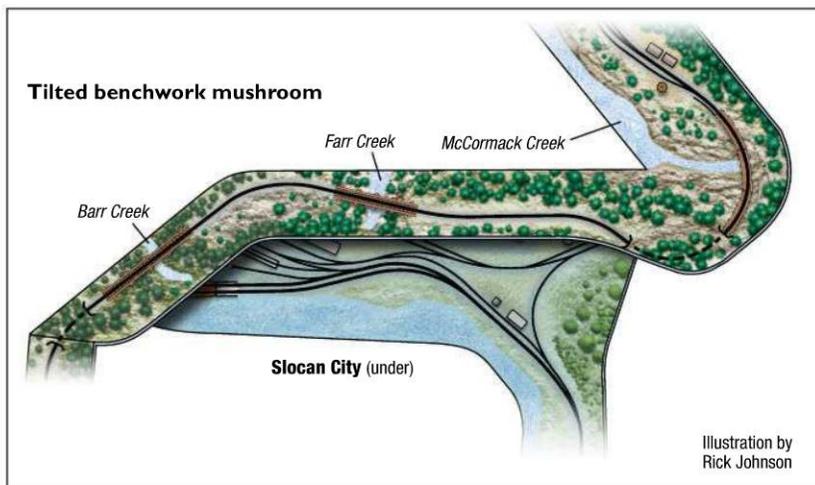
The Slocan River bridge

Let's turn to the C&W's Slocan River Bridge to see how these decisions unfolded. Located at milepost 14.6 of the Boundary Sub, the 332-foot-long bridge soars 69 feet above the water where the Slocan and the Kootenay rivers combine. It has two 85-foot deck-girder bridges sandwiching a 157-foot deck-truss bridge.



The finished model of the Slocan River Bridge retains specific features of the prototype: the symmetric mix of deck-truss and deck-girder spans; the number of truss panels; the combination of stone and concrete-encased piers; the recessed bridge deck; and the gradually varying truss member sizes.





This segment of the track plan shows the “negotiated air rights” over a lower deck for the Barr Creek, Farr Creek, and McCormack Creek bridges in the tilted-benchwork section of Marc’s mushroom-style layout.

I considered this bridge’s most important spotting features to be the symmetric girder/truss/girder spans, the interesting depressed deck of the truss span, the single stone pier and single concrete pier, and the overall ratio of bridge height to length. As the central truss span is the dominant span, its ratios and height above the water, the number of its panels, and the mass of the truss members are very important. (Note also that the truss elements become smaller farther inward on the prototype because they carry lesser forces.)

Another important ratio to consider is the relative size of the deck truss and girder bridges to the height of the rolling stock traversing them. Too much compression will make the bridge look undersized relative to uncompressed rolling stock.

Finally, I had to consider the Highway 3A bridge, which runs parallel to, and just slightly upstream from, the CP bridge. So how would I compress this scene?

The space available was only 200 scale feet long, 60 percent of the prototype. A uniform 40-percent compression in length and height would leave the rolling stock dwarfing the bridge, while compressing just the length would mean the span’s diagonal members would be much more upright. This would unacceptably change the model’s appearance.

I could compress the less interesting girder bridges by 50 percent, which would mean the truss bridge would need to be compressed by only slightly over 20 percent. And if I compressed the truss bridge uniformly in depth and length by 20 percent, thus

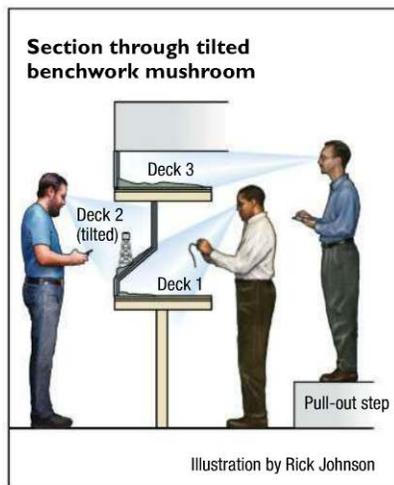
maintaining the angle of the diagonals, the rolling stock would only be 30 percent taller relative to the scale bridge. This could be further reduced by lowering the bridge deck slightly between the trusses. With the shorter distances the deck-plate girders needed to span, I could use the lightweight and readily available 40-foot Micro Engineering girders without the result looking strange.

Since I wasn’t certain I was making the right trade-offs, I prepared sketches of the alternatives: uniform compression; fewer panels but prototypical depth; and a hybrid of selective and non-uniform compression. I then sent them to friends for comment. Responses came back quickly with the last alternative as the favorite.

Significant selective omission and compression techniques were used on these first two bridges to fit the available spaces. Fortunately, the four remaining large bridges were simpler: Three of them – those over McCormack, Farr, and Barr creeks – required only a uniform compression of 30 percent in height and length. I modeled the final bridge, the massive fifth crossing of the Kettle River, without any compression at all.

Supporting large bridges

By definition, large model bridges are long. They may also take up a lot of vertical room. Their assembly can be tricky, so a solid, and ideally flat, base is advantageous. On a single-deck layout, or when representing relatively low bridges such as the Kootenay River bridge, the benchwork design is straightforward: A flat reference surface of plywood under the bridge



A cross section shows the three decks of the C&W’s “double mushroom.” Note how deck 2 is tilted.

scene may be all that’s required, or the benchwork can be dropped in the area of the bridge to give more clearance for the scenic feature being spanned.

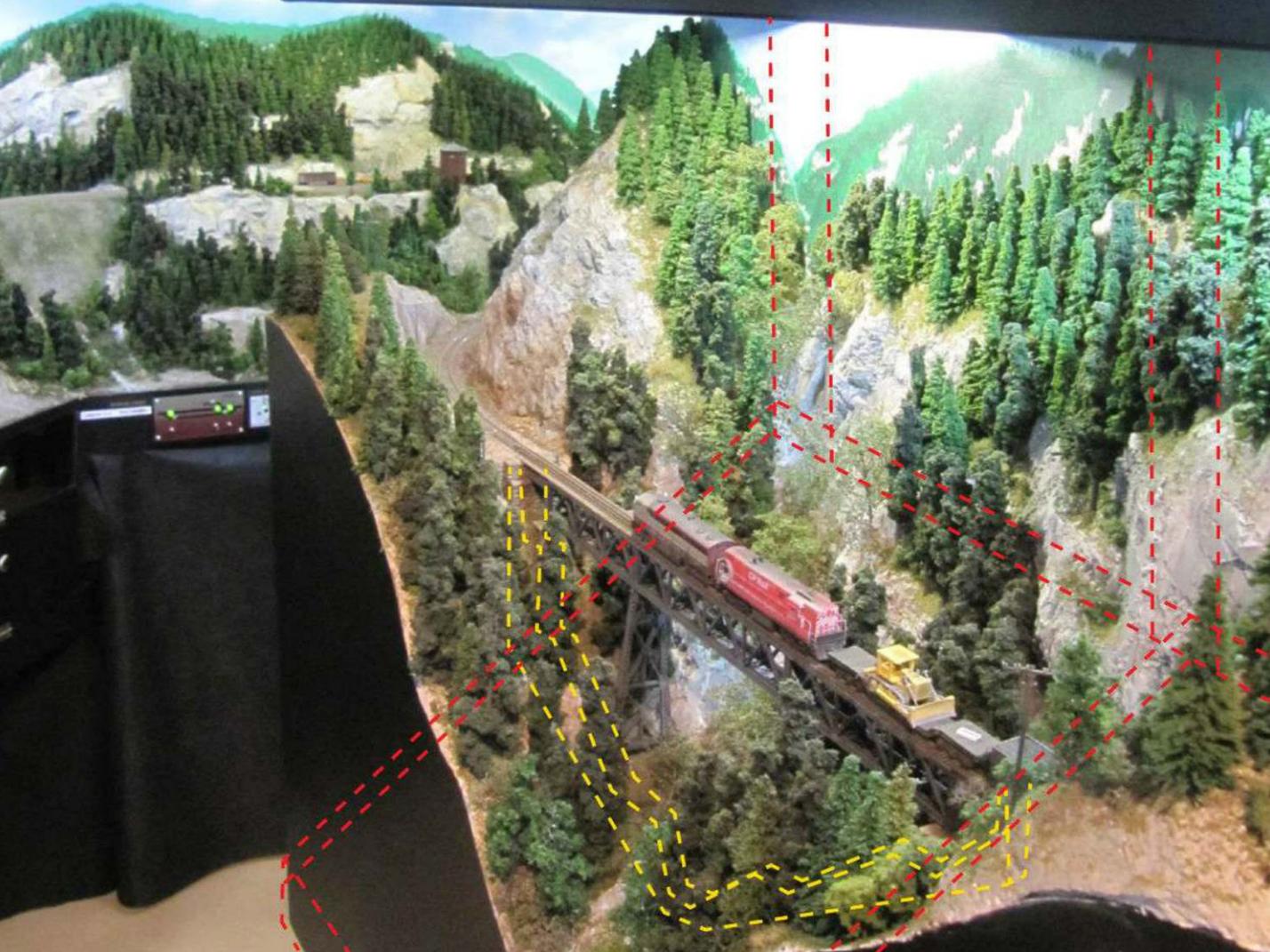
I try to extend the surface under not only the river but also the full length of the bridge so all the piers, approach trestles, abutments, and ballast walls associated with the bridge could be built up from it. While it’s possible to build down from the track, most large bridges will bend without a solid surface to sit on.

On the Kootenay bridge, I used 3/8" plywood under its full length, which allowed for simple alignment of the six spans and eight piers or abutments, resulting in level track. On the Slocan Bridge, however, I extended the plywood under the river and the two piers, but neglected to provide a surface for the abutments. Though I was able to fit the abutments to the ends of the roadbed approaching the bridge, the work would have been considerably easier had I been able to place the abutments on the same flat surface as the piers. A bit more planning in this regard would’ve saved time and headaches later.

A further benefit from planning and installing a solid reference surface for large bridges is that scenery can be finished well in advance of the construction of the bridge. The C&W was operated for years with scenery mostly complete but with only mock-up bridges, because I was confident that when the bridges were built I knew how they would be supported.

Coping with multiple decks

Planning support for any large bridge early in a design process is



The Farron Hill side of the mushroom shows the tilted benchwork (red lines) and a profile board (yellow lines). Multi-deck designs of mountainous terrain can use tilted benchwork and negotiated air rights to allow tall scenes without needing to resort to adding helix turns or increasing grades in a quest for adequate between-deck clearances.

helpful. But if the layout is multi-deck – either conventional or, like mine, a mushroom (where multiple decks face opposite directions on either side of a backdrop), this planning may be crucial. Multi-deck layouts need not be limited to high, narrow benchwork with deck-to-deck clearances of a foot or less. Although easier to construct, simple stacked decks are unlikely to provide the depth necessary to adequately model tall bridges.

Conversely, simply increasing the deck separation may waste the layout's vertical space, place decks at awkward heights, and increase the real estate required for the track to attain vertical separation. An alternative approach for multi-deck layouts is impinging upon the vertical space of the deck below to make room for a feature above.

In his book *Designing and Building Multi-Deck Model Railroads* (Kalmbach Books, 2008), MRP editor Tony Koester

described a situation on his HO railroad where the lower deck track is temporarily hidden from view as it makes its way beneath a key bridge scene that projects downward from the deck above. This “air rights” approach, while allowing vertical space for signature scenes, brings its own challenges, notably restricting access to the scene below and limiting the lower deck's usefulness in that area.

This restriction can take a number of forms, including reduced access for construction, maintenance, photography, and, most importantly, operation. I'll describe two approaches used on the Columbia & Western to mitigate these limitations.

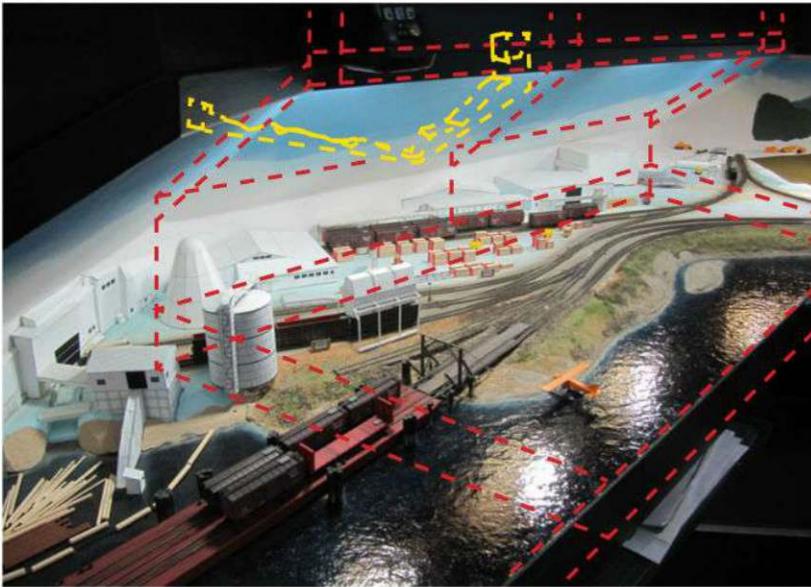
As the Boundary Subdivision winds and climbs out of the Columbia River valley along Lower Arrow Lake to the Monashee Mountain summit at Farron, it crosses three tall steel trestles: the McCormack Creek, Farr Creek, and

Barr Creek bridges. Although difficult to view, the prototype trestles are accessible from the rails-to-trails roadbed, which now exists where the Boundary freights once roamed. I wanted my N scale models to do justice to their engineering.

Another signature feature of the CPR's operations in the area was the rail barge operation between the isolated Slocan and Kaslo subs. These parts of the layout occupy a central, inward-facing 8 x 8-foot area in the layout room with the Kaslo Sub stacked over the Slocan Sub. Rail barges are used to transport entire trains between the decks, just as on the prototype.

A “double mushroom”

Sandwiched between these decks, but facing outward, is the lonely climb to Farron summit, resulting in a “double mushroom” configuration. If



The Slocan City side of the mushroom shows tilted benchwork (red lines) and a profile board (yellow lines). A compromise Mark accepted in the negotiated air rights was a slanted backdrop behind the Slocan City sawmill. The backdrop is made from thin hardboard fastened to the underside of the tilted middle deck.



McCormack Creek is deep at the end of a turnback curve. The track to staging is located directly beneath this deep scene, and the profile board installed when the track was laid is marked in red. Scenery and operations preceded the bridge construction by many years, but when this complex curved trestle was finally installed, the profile board beneath the scenery allowed the piers and abutments to sit at a fixed, known height, greatly simplifying installation.

the outward-facing middle deck were narrow but otherwise of conventional level construction, then the sawmill town of Slocan City beneath it could be fully accessible. However, there wouldn't be enough depth in the middle deck to reproduce the soaring heights of the three steel trestles.

So I made a compromise. By tilting the open girder framing of the middle deck so it was lower at the front and higher at the back, enough depth became available to model the three bridges with a uniform 30 percent compression. Adequate access remained above Slocan City for switching the mill. The sky backdrop behind the mill was angled for a large portion, but this was a compromise I deemed acceptable.

About 20" of vertical scenery was made available for the bridge scenes by tilting the benchwork, versus 9" if the middle deck were conventionally flat. So the added complexity of the benchwork bought an additional 150 scale feet of height, enough to accommodate those 190-foot-high trestles compressed by 30 percent.

To provide a reference support for these bridges, I used CAD to draw the eventual scenery profile under each bridge with flat surfaces for the piers and abutments to sit on. This was transferred to $\frac{3}{4}$ " plywood profile boards, which were hung below the roadbed to provide a surface to support the piers and bridge above.

I completed the scenery, including trees, around all three bridge sites, and the layout was operated for years before the bridges were installed. When they were completed, I simply cut small holes into the scenery above the profile boards, dropped the abutments and piers through the scenery, and secured them to the profile boards.

The bottom edge of the profile boards also helped to protect the air rights above the Slocan Sub, since I knew I couldn't go below these planes without impinging on the scenes below. In fact, I used the bottom edges to fasten the angled backdrop behind Slocan City. Using CAD early in the process to plan the layout and benchwork saved me a lot of calculations, and probably errors, and the actual benchwork construction and the scenery and bridge installation went very smoothly as a result.

The last big bridge

This brings us to the last big bridge on the Columbia & Western, the fifth crossing of the Kettle River at the

western foot of Farron Hill. The prototype bridge stands 80 feet tall and stretches 505 feet long. When originally constructed as a wooden trestle/bridge combination, this bridge was nearly three times as long. But when that wooden trestle was replaced with steel around 1910, the approach trestles were filled in, creating the massive approach fills visible today. The prototype bridge has three deck-truss spans interspersed by deck-girder spans, all supported by a unique pair of angled steel towers.

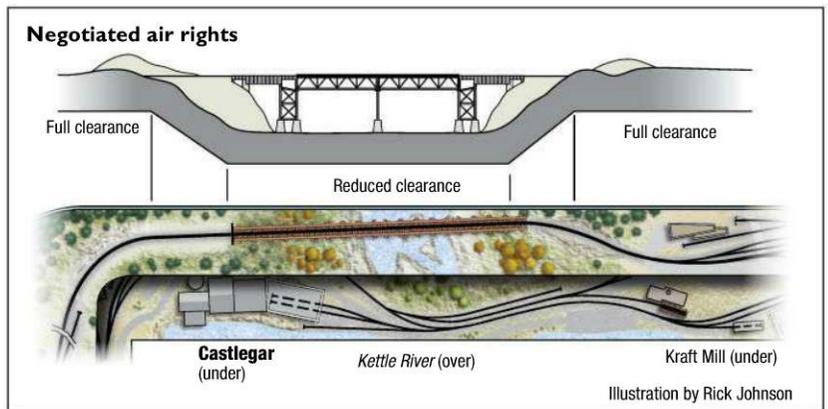
Having biked the trail across this trestle, I was determined to find room for this model in all of its uncompressed glory. The problem was that this bridge was located above a complicated switching area, including Castlegar Junction and its yard, as well as the Celgar Kraft mill. Multiple trains would meet here, and the busy Kraft Switcher would ply its trade, adding congestion to the aisle and requiring unimpeded access to the lower-deck tracks for uncoupling.

I found a solution through “negotiated air rights”:

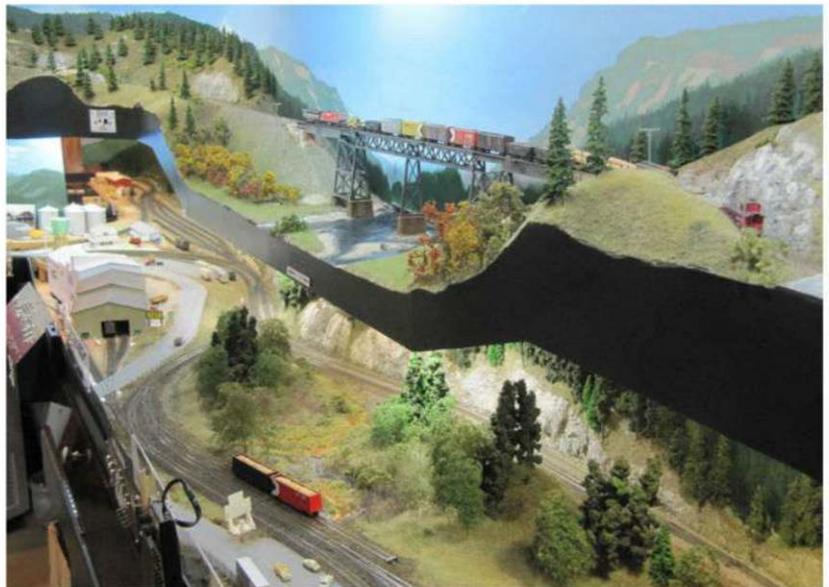
- The upper deck benchwork where the bridge would be located was narrowed to 12" while the lower deck was broadened to 24".
- The upper benchwork was dropped by 5" at the location of the bridge and approach fill, thus permitting a full-scale model of the bridge. This benchwork was framed with 1 x 2s and covered with a 1/4" sheet of plywood, thus reducing the clearance under the depressed bridge scene to a bare minimum 8" but retaining a minimum 14" deck-to-deck clearance in other areas.
- Low-profile fluorescent light fixtures augmented with white light-emitting-diode strips fit nicely between the 1 x 2 framing to light the lower deck in this area.
- Tracks on the lower deck, especially turnouts and logical uncoupling locations, were routed forward and around the low-clearance area as much as possible.

It was important to have a large 4'-6" wide alcove adjacent to Castlegar Junction to allow the engineer of the Kraft switcher to stand relatively unimpeded for much of the session.

The result, while a compromise, works. The full-scale bridge and its approach fill are displayed in all their glory, the lower-deck track is accessible, and – by and large – crew members politely manage the operator traffic jam caused when multiple meets occur at Castlegar.



One of the most active switching areas on the layout sits directly below one of the most prominent scenic features, the Kettle River Bridge. In such situations, benchwork clearance and track location is critical to the viability of operations. The lines on the diagram above and the arrows in the photo below show where the upper-deck benchwork was dropped on a thin frame to permit a full-scale rendition of this signature bridge. This reduced clearance here to only 8", an acceptable compromise, since most track is routed away from this area.



The Kettle River Bridge/Castlegar scene illustrates the trade-offs between the air rights required to make the lower deck operationally viable while not compromising the space available for Mark’s full-scale rendition of the bridge.

Lessons learned

Years of frequent work travel provided the time to plan not only the signature bridges on the Columbia & Western, but also the entire layout well in advance of construction. Did I make mistakes? Absolutely, but I think I would have made more without the planning. The result is admittedly a complex design, but it’s simpler to operate because of the tilted mushroom and the negotiated air rights. And I believe the many large bridges do justice both to their prototypes and to the remarkable engineers who constructed the Boundary Sub. **MRP**

Mark Dance and his wife, Christiane, live in Vancouver, B.C., with children Carys and Isaac. Mark has a degree in mechanical engineering (robotics) and spent 20 years as a product designer/inventor and manager. He has modeled in N scale for 42 years.

Now on ModelRailroader.com

A video walking tour of Mark’s N scale Columbia & Western layout can be seen on our website. Look in the Online Extras box at www.ModelRailroader.com.



1. Modeling in a larger scale meant a smaller roster and more time to focus on details and even animation in the form of wood hoppers that dump “coal” (actually black aquarium rock).

Adapting to a larger scale

Some challenges come with change

By Jeff Kraker//Photos by the author

Back in 2010, I needed to make a change in my life regarding model railroading. I had an HO scale layout [See “Less space, better railroad” in the May 2010 *Model Railroader* – Ed.] that was mostly finished and operating well. All the aspects of building a model railroad that I really enjoyed were done, and I was hosting operating sessions.

This may sound like an ideal situation. But as one who enjoys the process of building a model railroad, I found myself drawing a lot of “what if” track plans.

A segue to a larger scale

I had actually started the “what if” planning a couple years before I tore out my HO layout. My original intention

was to stay in HO scale. While I was considering what I might do if I were to start over, two things captured my attention. One was the growing popularity of On30 (O scale, 30” gauge). The other was a little narrow gauge railroad set in rural West Virginia called the Mann’s Creek Ry, which I came across while doing some research for a project on my HO layout.

As if by fate, Sam Swanson's article on building an On30 model of a Mann's Creek hopper car appeared in the March-April 2009 issue of the *Narrow Gauge and Short Line Gazette*.

As a fun diversion, I tried building a model of a Mann's Creek hopper in On30 as a display piece. I really enjoyed building that hopper from scratch. When it was finished, I started to toy with the thought of changing scales and gauges, which turned out to be exactly what I needed. I decided I would jump in feet first and build a new layout, in a new scale and a new gauge, based on the Mann's Creek.

Doing something totally new was a great way to breathe life back into my hobby. My interest in O scale model railroading went way back to my childhood when my dad took me to see a local model railroad club layout.

Although I enjoy operating model railroads, for me, building railroad models is as much and maybe a bit more rewarding. O scale is an ideal size for anyone who likes to take detailing up to the next level. It's also really hard to not notice the effect that the increased mass has on how much more prototypically the models operate compared to those in smaller scales.

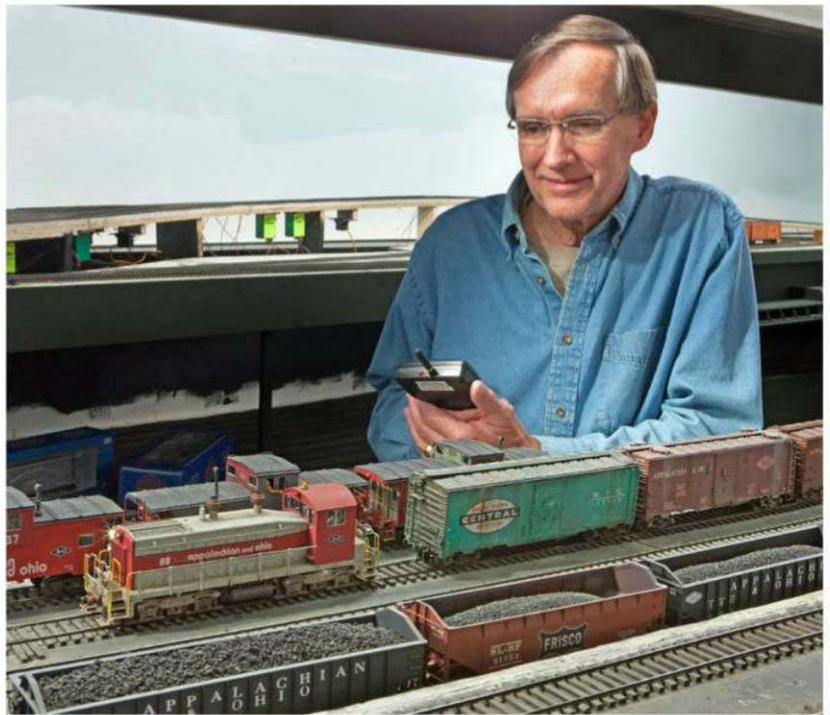
But when I changed from HO to O scale, I found it wasn't as easy as just buying and building bigger trains. I had a lot to learn.

Becoming narrow minded

I've always had a passing interest in narrow gauge. By building in On30, essentially O scale models running on HO gauge track, I got the advantages of building in O scale ($\frac{1}{4}$ " to the foot, 1:48 proportion) yet having slightly smaller trains that would fit better in my smaller room. I liked the unique character of narrow gauge railroads and the remote locations they often operated in. While I did start planning in On30, I decided along the way to change to On3 (O scale, 3 foot gauge).

The National Model Railroad Association (nmra.org) has standards for narrow gauge, but they mostly apply to the larger Colorado narrow-gauge lines. I was going to do a smaller mining railroad, and there would be some advantages to breaking the rules a bit. I used the Internet to network with other On3 modelers to learn as much as I could about minimum radius, turnout size, grades, clearances, etc. I was thus able to define some personal standards that would ensure what I was going to build would run well.

I purchased a few pieces of equipment to use as a reference, along with



Jeff asked veteran modelers David Stewart (top) and Gary Freseman to test his theory about how long it takes to make a runaround move in O and HO, respectively. He found that modelers tend to run their locomotives at the same actual speed regardless of scale. Top photo by Bob Sobol

the one hopper car I'd scratchbuilt. I also purchased a few pieces of flextrack to help me figure out things like track spacing and how turnout frog number (sharpness) affected the clearance point of rolling stock that was spotted on sidings.

One of the lures of narrow-gauge railroads is that many of the lines employed steep grades, and the

Mann's Creek was no exception. The railroad had 5 to 6 percent grades on the main line, and I wanted to duplicate them. I used the sections of flextrack to do a grade test, not only to see what my locomotives could pull uphill but also to see what they would do traveling downhill.

An inherent problem with many model locomotives is that they buck



2 and 3. Animation includes side doors on Jeff's hopper cars that are opened by tiny electric motors to dump "coal" into the tipple chutes. Jeff built a shelf for sorting waybills and a switch control panel. Below that is a panel with pushbuttons to open and close hopper doors. The wood knob is pulled out to deliver a puff of compressed air to the shed to "blow down" the hopper cars.

going down steep grades, a problem that seems to be exaggerated in models of geared steam locomotives. Sometimes the bucking can be corrected, but it's good to know if it can be fixed and how much work that entails before you have the layout built and the grades can't be reduced.

Once I'd established my standards, it was time to get out some paper and see what I could fit into my 9'-3" x 22'-0" space. I've been building HO layouts for more than 30 years, and it was easy for me to estimate what would fit in an area.

"Seeing" in O scale was a bit more difficult. O scale is almost twice as large in every dimension as HO, so to help me visualize what would fit on my

1:48 railroad, I just compared it to a similar scene in HO. For example, my coal dump trestle is 2'-0" deep and 10'-6" long, which translates to 1'-0" deep and 5'-3" long in HO scale. That's pretty small!

This method isn't an accurate way to scale track plans, because there are track spacing differences and aisle widths don't change. But it did help me get a feel for how much railroad I could expect to fit in a specific location.

I toyed with the idea of actually modeling the Mann's Creek in On3. I even drew up a few plans. But in the end, I decided to freelance a railroad based on the MC; I call it the Slater Creek Ry. By freelancing, I was able to alter scenes to better fit my small

space. Moreover, I could include some industries other than those related to hauling coal or lumber to provide some extra operations. I could also build some rolling stock that the MC never had.

O scale is not just twice HO

It's important to understand that 1:48 structures aren't only twice as wide and long but also twice as high. The height factor didn't seem important until I built my first structure mock-up and placed it on the layout. Only then did I notice that O scale structures can become a visual and operational obstacle that has to be allowed for in the planning stage. A structure placed between the operator and the train may create the same effect as a train going into hidden staging, rendering it invisible. A big depot or industry that is two or more stories tall and a few feet long can block a lot of view. Uncoupling rolling stock and maintaining track can be impossible.

Trains and scenery can also become obstacles. Trains spotted on near tracks can block access to those behind them. Trees can also be an issue, maybe even more so than structures: They're often much taller than structures and tend to be somewhat fragile.

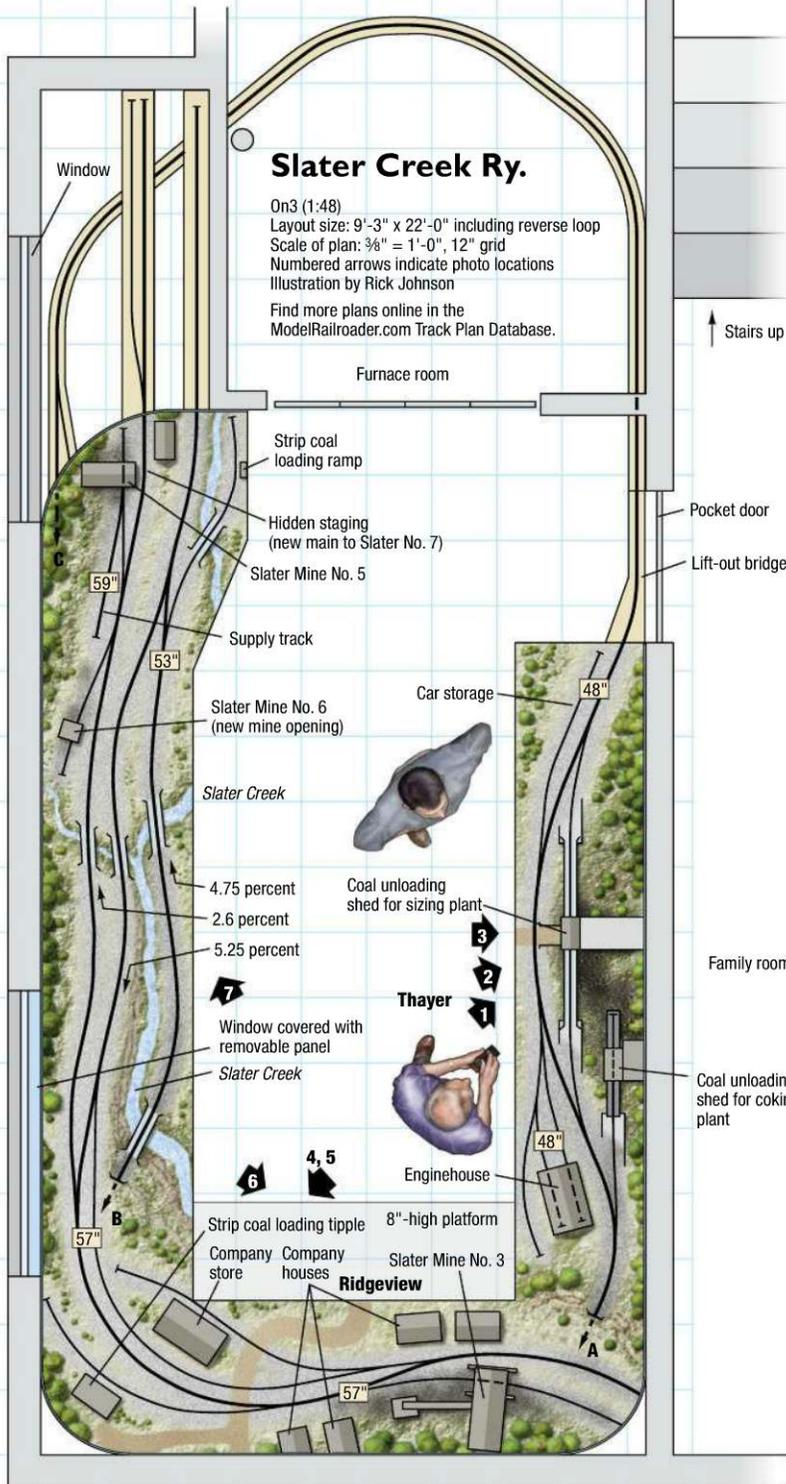
However, having models twice as tall can be an asset when you want to hide an opening in a backdrop where the main line disappears off the layout, especially if the track elevation is around chest level. Creating mock-ups of sections of the layout can help you understand how different track elevations with bigger models may make some track designs unworkable.

Operating speeds vs. scale

Once construction of my new layout progressed to the point it could be operated, I noticed another effect of switching in a bigger scale: It takes longer to do a given operation.

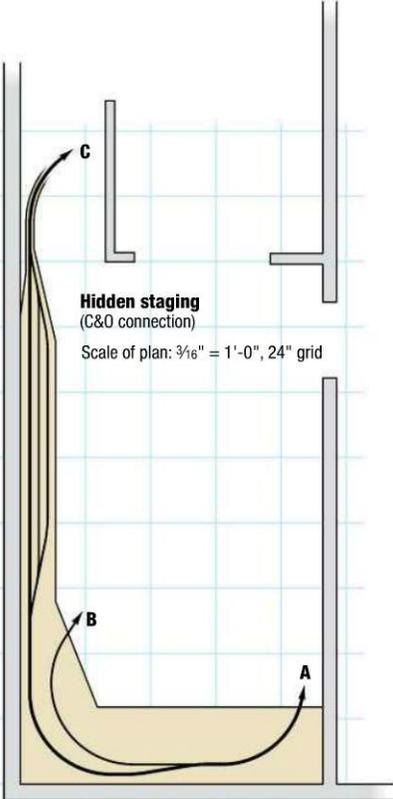
While performing a few simple switching moves, I noticed what time it was when I started to operate as well as when I finished. I was shocked at how long it had taken. At first, I chalked it up to the fact that I was operating a geared steam locomotive, which by its nature runs slowly. However, I dismissed that theory when I noticed that I hadn't been running the O scale locomotive any slower than I would have run my HO trains during switching maneuvers.

It was that moment that I conceived a new theory about switching speeds



The layout at a glance

Name: Slater Creek Ry.
Scale: O (1:48)
Size: 9'-3" x 22'-0"
Prototype: Mann's Creek
Locale: West Virginia
Era: 1944
Style: around-the-walls
Mainline run: 78 feet
Minimum radius: 30"
Minimum turnout: no. 5
Maximum grade: 5.25 percent
Train length: 5 feet
Benchwork: open grid
Height: 48" to 59"
Roadbed: 3/4" plywood and HO scale cork
Track: handlaid code 83
Scenery: plaster and foam
Backdrop: photos on Masonite hardboard
Control: Digitrax Digital Command Control

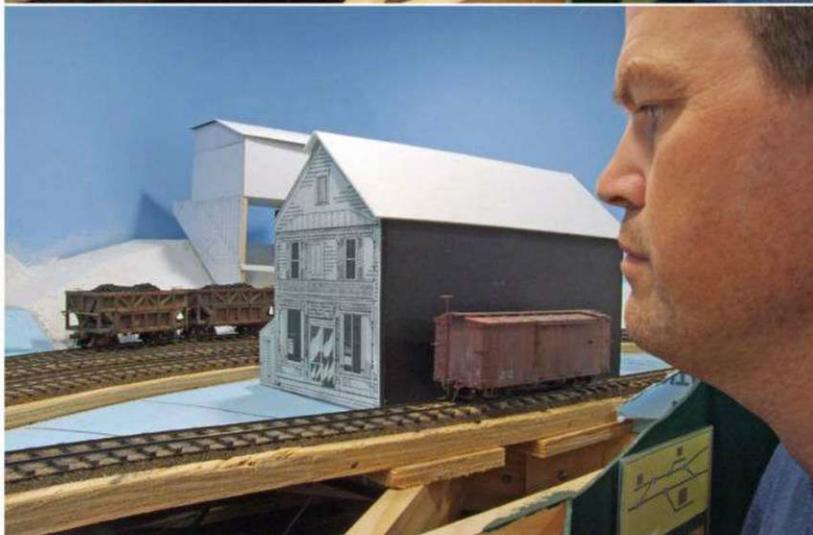
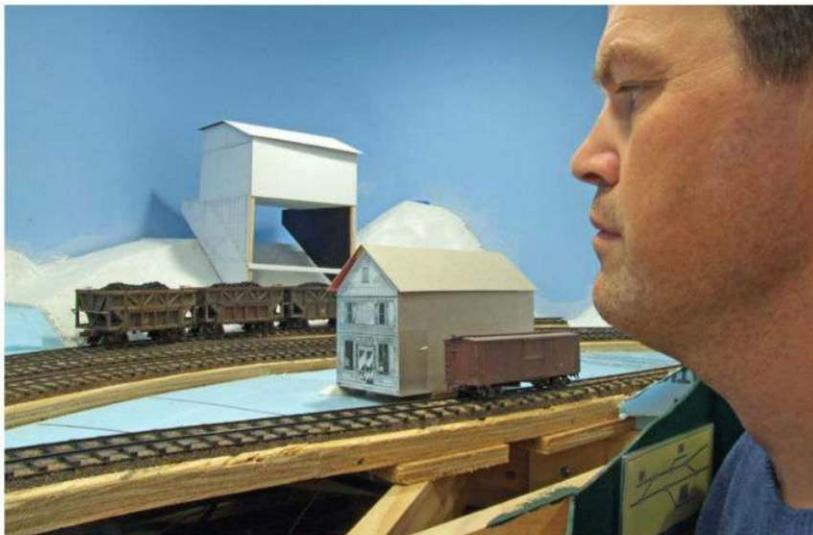


versus modeling scale: Model railroaders don't operate their locomotives at a speed that's relative to scale. Instead, we tend to operate the locomotives at the same speed regardless of scale. If we were to lay 4 feet of O scale track next to 4 feet of HO track, a train in either scale will cover that same

distance of track in the same amount of time.

To test my theory, I e-mailed David Stewart, well known for his outstanding O scale Appalachian & Ohio layout [See the May 2006 *Model Railroader - Ed.*], and asked him to do a simple test for me using a runaround track, four

40-foot freight cars, and a diesel switcher. First, David measured the frog-to-frog length of his runaround track in actual inches, and I converted that distance to O scale feet. Then David timed several operators as they uncoupled the locomotive from the string of freight cars and ran the



4 and 5. The Mann's Creek company store was three stories high. Jeff replaced it with a similar but shorter two-story structure. Size remains a concern in O scale when the benchwork is high: These photos show the smaller replacement store in HO scale (top) versus the same structure in O scale (bottom).

locomotive around to the other end and coupled up.

I also asked local modeler Gary Freseman to repeat these tests on his HO layout, which had a siding that was the same length as David's in HO scale feet. Last, I built an N scale version of the same runaround track. I set up the N scale version during one of Gary's operating sessions and had some of his operators perform the same maneuver in HO and N scales.

On our website

Watch a video of the operating hoppers on Jeff's On3 layout. Find the link under Online Extras at www.ModelRailroader.com.

When I compiled the data from the tests, I discovered that my theory was correct: Most model railroaders operated a locomotive at the same actual speed regardless of the scale. The data showed that as the scale of the trains increased, the speed at which someone operates the locomotive gets closer to scale speed. Of course, the inverse is also true. On David's O scale layout, a simple runaround maneuver took almost 2 minutes to perform, but only about 30 seconds on the N scale version. Also, when I converted the times to scale speed, the locomotives in N scale were performing switching maneuvers at an average speed of 60 mph!

Knowing that changing to larger scales means it will take longer to

perform switching maneuvers can be valuable when deciding if we want to scale up or not. It may seem like not being able to fit as much railroad in your space when switching to a larger scale can be bad. But if you consider that you don't need to include as much yet can still maintain the same length of operating sessions, the change may not be as bad as first thought. Also, by not having to build as much railroad, you don't have to purchase, build, or maintain as much, either. When you don't have to have as much stuff, you can spend much more time enjoying what you do have.

Animation

The Mann's Creek operations were simple: pick up loaded coal hoppers at the mines, haul them down the valley, dump the loads, and return the empties to the mines. To re-create this operation, I exploited another advantage of modeling in a larger scale: the ability to easily add animation.

My On3 hopper cars use small motors mounted under the center slope sheets to turn a crank arm connected to the doors, allowing the doors to open and close. The motors receive power through contacts under each truck. By using a set of jigs I designed, I was able to quickly scratch-build 17 hopper cars from basswood.

Animating the hopper car doors eliminated the unrealistic need to remove fake loads, which would have been required if the doors were not operable. Moving heavy, loaded cars also adds some real-life drama.

A simple track plan

I wanted to keep the On3 track plan simple for several reasons. First, I wanted the scenes to have as little track as possible. Narrow-gauge railroads weren't known for sprawling yards and towns with a high density of sidings. By keeping the track to a minimum, I've increased switching operations: I don't have a track for every car spot, which means that some sidings serve multiple purposes, and many switching moves require moving one car to pick up or spot another car.

I don't have any yard tracks for car storage, but I've included a siding that can be used to store a few cars by the dump trestle. Otherwise, rolling stock remains in the last place it was unloaded. This enhances operation, because sometimes a specific car must be retrieved so it can be put on a train to be delivered to its loading destination.

Being able to spend more time building rolling stock, structures, and

Learning points

- Modeling in a larger scale not only permits but also almost demands more detail.
- The smaller layout that often results from modeling in a larger scale usually translates to fewer models, allowing more time to be devoted to each one.
- Animation may be more practical as a model's size increases.
- Larger-scale structures may become obstacles to viewing the railroad as well as to reaching in to uncouple cars.
- Freelancing a model railroad has not gone out of style and allows more creative freedom without unduly compromising realism as long as one doesn't venture too far from reality.
- The same switching move usually requires more time in a larger scale.
- A narrow gauge railroad can provide the opportunity to model unique equipment and operations.

scenery was another reason to keep the plan simple. I wanted to focus on constructing models and scenes with greater levels of detail without feeling overwhelmed by having too much to do. I planned on scratchbuilding just about everything, and if I had too much to build, experience tells me that I could sink into a funk and withdraw from working on the layout.

Last, I don't like to have to maintain a lot of railroad. Everything one builds is only new once, and over time the layout will need work. It's easy to cram in a lot of railroad, but someday it will almost all need maintenance. I have enough stuff in my life that I need to maintain. I want to keep my hobby a hobby.

The track plan itself draws a lot of inspiration from the Mann's Creek Ry. The MC unloaded coal in bins that were covered with a shed. During World War II, the demand for coal increased, and old mine sites were being strip-mined to retrieve coal that wasn't practical to be mined using tunnels. The strip-mined coal was loaded into dump trucks and either transferred to the railroad at a transfer tipple or, if the strip mine was close enough to the sizing plant, it was just trucked directly to it. To allow the dump trucks to dump at the sizing plant, an opening was created in a side wall of the dump house, which allowed



6. Company houses between the aisle and the tipple at Ridgeview W. Va., made it difficult to reach in to uncouple cars. Jeff solved this problem by providing an 8"-high platform for operators to stand on.



7. Rugged terrain typified the prototype Mann's Creek Ry. as it climbed out of the New River gorge. Jeff's Slater Creek features this challenging landscape, including several switchbacks.

the trucks to dump into the same bin as the railroad.

By orienting the track at the dump trestle so the operator is standing on the mountainside looking down at the creek, I was able to have the dump-truck opening in the side of the shed face the operator, giving a very clear view of each hopper car as it unloads.

I included two staging areas. The lower staging yard simulates general freight that has to travel down to the Chesapeake & Ohio for transfer to or from the standard gauge. Upper level staging consists of a track with a siding and another separate track. These tracks simulate an extension of the main to reach new coal deposits and provides places for track-maintenance equipment and loads to go.

A change for the better

I've been very happy with my switch from HO to On3. Modeling a backwoods narrow gauge railroad has kept train sizes to a practical level for a small room like mine. The increased size of the models has been exactly what I was looking for to satisfy my detailing itch. Modeling in narrow gauge allows for a lot of uniqueness in the equipment, and the rugged scenery and operating conditions that narrow gauge railroaders experienced have been fun to re-create. **MRP**

Jeff Kraker is married with two grown children. He designs process plants and equipment for the oil seed industry at Crown Iron Works. Jeff also likes to fish and play the guitar.



Resurrecting a New England



1. Southbound freight No. 20 rolls by the Sheffield Farms creamery in Florence, Vt., behind light Mikado no. 33 on the multi-deck HO scale Rutland RR built by Randy Laframboise and Mike Sparks.

Bringing the Rutland RR back to life in the transition era

By Randy Laframboise

Photos by the author

Way back in 1999 as I sat in a lawn chair having a brew and watching a bonfire consume our old layout (*Railroad Model Craftsman*, February 2000), I was wondering if I had it in me to build another layout.

Mike Sparks and I had spent the previous 15 years building our version of the Rutland RR, which was based on prototype scenes cherry-picked from throughout the Rutland system. We had decided to tear out the layout owing to our frustration with our substandard building methods and unreliable trackwork. Moreover, an addition to the family home reconfigured the basement and made the old layout unworkable.

After a few months of mourning, with the encouragement of our modeling buddies Jim Dufour, Don Spiro, and Glenn Glasstetter, Mike and I began discussing the possibilities afforded by the new 17 x 36-foot basement space.

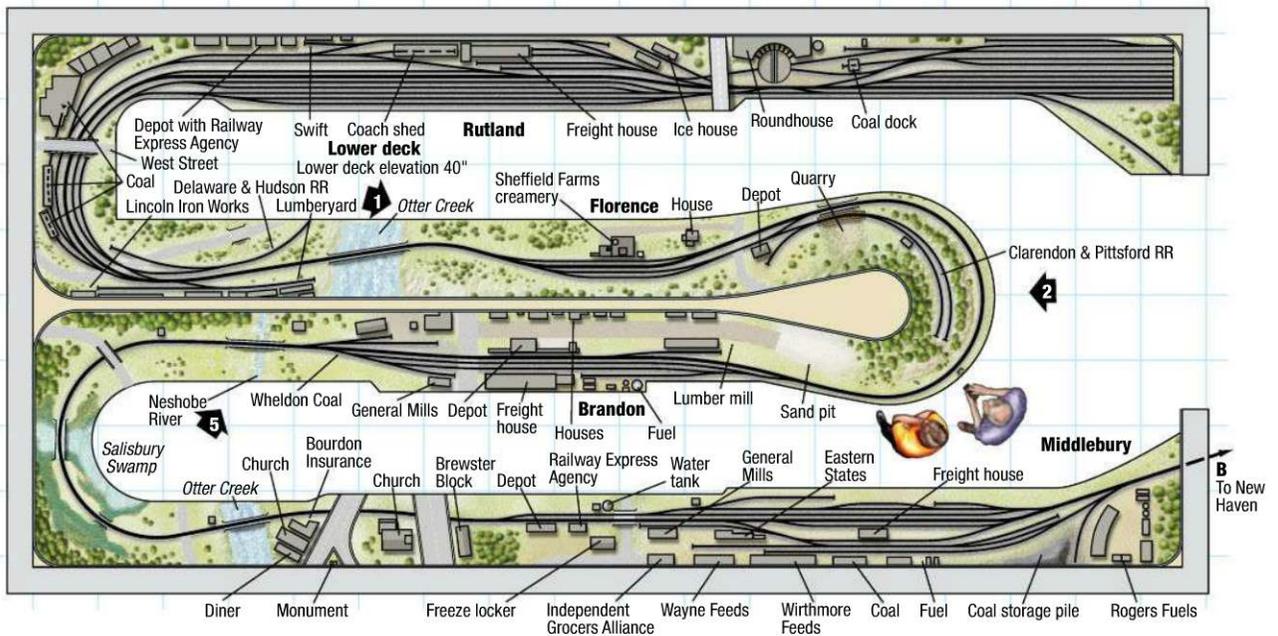
Mike and I both grew up within a couple miles of each other and the former Rutland main line in Middlebury, Vt. We've been modeling together for more than 40 years. As kids, we both had small layouts at our houses and spent countless hours modeling as well as enjoying all the other activities young lads do together.

Book learning

A family friend had given Mike a copy of Jim Shaughnessy's *The Rutland Road* (Howell-North, 1964; Syracuse University Press, 1997) while we were in high school, and Mike and I wore it out. After college, we were both working in other parts of the country, so modeling was pushed to the back burner while we traveled around. We both ended up back in Vermont in the mid-1980s, and after I built a home in 1986, we decided to build a layout based on the Rutland.

Fortunately, we were able to visit some exceptional layouts in the nearby Albany, N.Y., area. Those included the home layouts of Dick Elwell (*Great Model Railroads 1996, 2008*), Lou Sassi (*Great Model Railroads 1999*), and the HO scale New England, Berkshire &

classic



The layout at a glance

Name: The Rutland Road
Scale: HO (1:87.1)
Size: 16'-4" x 35'-3"
Prototype: Rutland RR
Locale: Rutland to Burlington, Vt.
Era: Late summer, early 1950s
Style: double-deck with helix
Mainline run: 285 feet plus 100 feet in helix
Minimum radius: 36"
Minimum turnout: no. 5 Peco
Maximum grade: 2 percent in helix
Train length: 12 feet
Benchwork: conventional grid
Height: 40" lower deck, 60" upper deck
Roadbed: 3/4" plywood, Homasote, cork
Track: code 83 flextrack lower deck, code 70 flextrack upper deck
Scenery: extruded-foam insulation board
Backdrop: hardboard, wallboard, styrene
Control: NCE DCC

Western club layout (see *Model Railroader*, November 2015) at Rensselaer Polytechnic Institute, which gave us a clue as to what direction we wanted to go.

Choosing what to model

We're both railfans and wanted to transfer that experience to our new layout, along with making it as prototypically accurate as we could. We stuck with the Rutland, as we had numerous scratchbuilt structures and rolling stock from our previous layout.

Mike and I devoted a lot of thought to the concept and design of our new layout. After a lot of discussion, soul searching, and negotiating, we decided to model the portion of the Rutland main line between Rutland and Burlington, Vt. The main reasons were the volume of traffic on the mainline division and the towns along that section of railroad.

We both wanted to model Middlebury, our hometown. Beyond purely sentimental reasons, it was the busiest station between Burlington and Rutland and had a very interesting track layout, with twin tunnels through the middle of downtown. We also wanted as long a main line as possible to achieve the feeling of actually going somewhere while operating. And we wanted as much open running outside of towns as we could fit in. This would give the layout the rural feeling this portion of the Rutland is known for.

We pored over our past issues of *Model Railroad Planning* and editor Tony Koester's book, *Designing and Building Multi-deck Model Railroads* (Kalmbach, 2008). Mike and I finally came to the conclusion that we would have to build a multi-deck layout to achieve our goals.

We weren't thrilled with the idea of building and operating a helix, but it was the only way we could meet our goals. We tried designing a constantly climbing (except in towns and yards) layout from point to point, like Tony's Nickel Plate Road (December 2014 *Model Railroader*). But given the fact that we wanted prototypical-size towns, there just wasn't room enough to make the climb from Rutland to Burlington while including the number of towns we "had" to have.

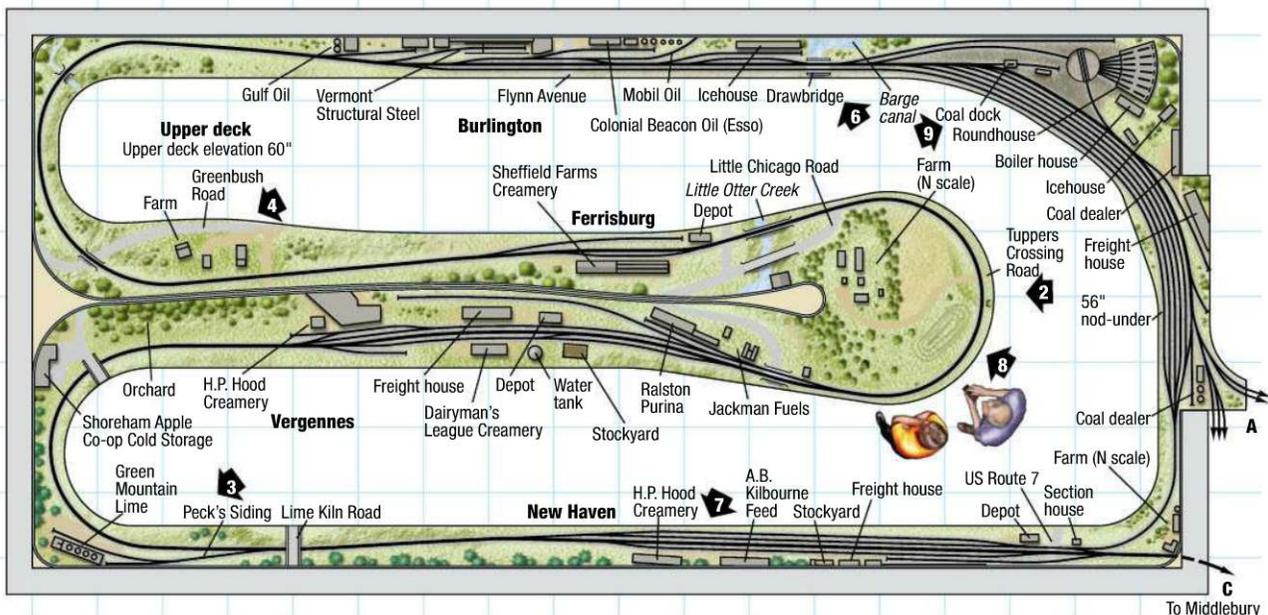
After much negotiating with the real estate department, we got access to an adjacent room in which to put the workshop, helix, and staging.

Designing the railroad

We designed the layout as a double deck with 20" separating the two decks and the top deck set at 60". After we'd decided on the helix and got the additional real estate, things moved quickly through the design phase.

We were intent on having all the towns in geographical order and in the correct orientation on the layout, which worked well with the exception of one town, Florence. It had to be flipped in direction to fit in the scenic elements we wanted.

Our layout is designed as point-to-point with Rutland and Burlington plus stub-ended staging at each end. The helix is in the middle of the run. It's a shelf-type layout running along the walls with a center peninsula.



Including engine facilities was very important, as we are modeling the steam/diesel transition era and needed turntables at each end to turn locomotives. We were able to fit in a reversing loop around the helix on the upper deck at Burlington.

Town selection was based on personal preference, creameries, interesting structures, and basically just what we liked. Heading south out of Burlington, we chose Ferrisburg, Vergennes, New Haven, Middlebury, Brandon, Florence, and Rutland. Although we'd originally planned on modeling Proctor where Florence ended up, we couldn't do justice to Proctor in the space available.

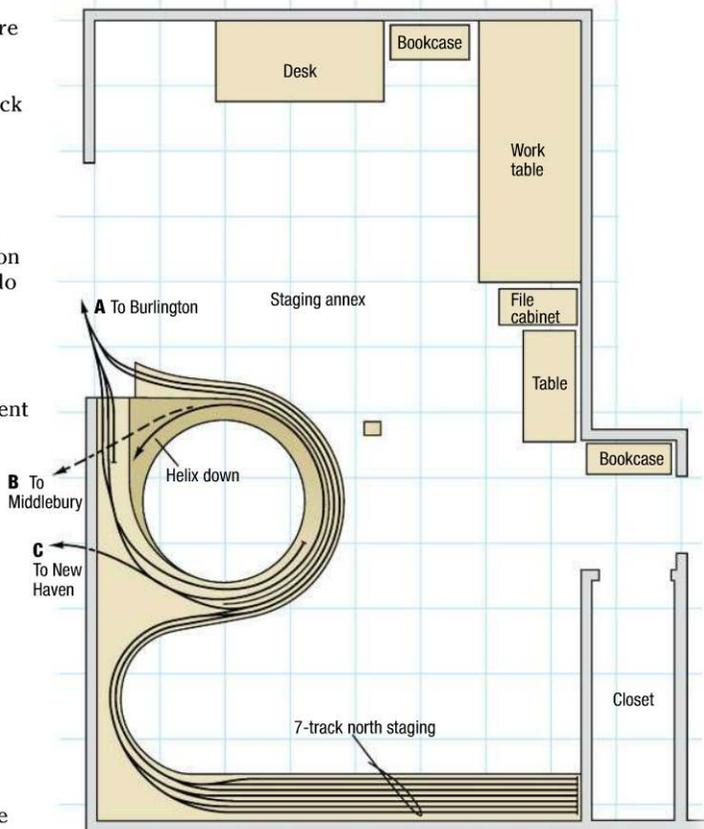
A staged approach

We built the layout in stages to try to avoid getting burned out, and to be able to finish portions of it as we went along. We built the benchwork for the upper and lower decks along the exterior walls first. It was built as a continuous loop so that we could run trains while tackling something manageable.

We used the benchwork for the lower deck as a workspace while building the upper deck. Instead of trying to design the track plan to the nth degree prior to starting construction, we built the benchwork to fit the space with a rough idea of how we thought it would work out. We then laid out the trackwork to fit the available space, a technique that worked well for us. We restricted the benchwork on the upper deck along the walls to 16" wide so it would not overhang and overwhelm the lower deck. This depth was determined by trial and error using mock-ups.

It was important to us to maintain generous aisle space for the comfort and convenience of the operators. In most places, we have a minimum of 42" aisles.

We installed trackwork, structures, and scenery on the upper deck, using it as a testbed to see how things were going to work out and whether we were literally on the right track. The layout was built predominantly using open-grid benchwork topped with $\frac{3}{4}$ " plywood and a layer of $\frac{1}{2}$ " Homasote, upon which we laid cork roadbed. In yards, we sometimes placed track directly on the Homasote.



The Rutland Road

H0 scale (1:87.1)
 Room size: 16'-4" x 35'-3"
 Scale of plan: $\frac{3}{16}$ " = 1'-0" (24" grid)
 Numbered arrows indicate photo locations
 Illustration by Kellie Jaeger and Rick Johnson
 Find more plans online in the
 ModelRailroader.com Track Plan Database.



2. This view shows farmland at Tupper Crossing Road south of Ferrisburg on the top deck and the rugged topography at Proctor Cliffs below. Randy and Mike built the upper deck, took a five-year hiatus, and then finished the lower deck.



3. Alco RS-1 no. 400 switches the Green Mountain Lime plant at Peck's Siding in New Haven, Vt. Limestone from an adjacent quarry was crushed and bagged for Maine paper mills, farmers, and other customers. Up to 10 cars a day move in and out of this plant.

The fun stuff

Our favorite parts of layout building are scratchbuilding structures and adding scenery. We both feel strongly that scratchbuilding structures is the single most important aspect of prototype modeling. Having models of the actual structures in the correct locations was the key to creating believable and "correct" representations of our towns.

I'm disappointed when visiting a layout and am able to recognize most of the buildings as being stock kits, especially those that are caricatures rather than the common buildings that populate most rights-of-way. Although we use kits if we can kitbash them to meet a specific prototype or for background scenery, we scratchbuild if needed.

As Rensselaer Polytechnic Institute's John Nehrich said many years ago, "Model the ordinary." While there's always the temptation to add "interest" by adding buildings or vignettes that weren't there, that really defeats the purpose of prototype modeling.

We also build structures to full prototypical proportion if possible. This makes the scenes look much more correct and gives the impression the modeled industries are capable of generating the business associated with rail transportation. And after years of scratchbuilding, I can generally scratchbuild a building faster than I can construct a kit.

Trackwork and power

The trackwork was installed using flextrack from various manufacturers and Peco turnouts. We used code 70 on the upper deck and code 83 on the lower. Code 83 track is more



4. New 1,600-h.p. Alco RS-3 no. 201 teams up with 2-8-0 Consolidation no. 30 as they head south out of Burlington, Vt., toward Ferrisburg with freight No. 19. Randy made the wire fence using toothpicks and mesh fabric.

forgiving, and the viewing distance is farther away on the lower deck, so the somewhat large rail size isn't that evident.

After much discussion and agonizing, we decided to line all switches by hand rather than with switch motors. I like the fact that you have to physically move the points versus pushing a button. Moreover, on other layouts I've gotten frustrated trying to find the correct button to push, which takes away from the operating experience. Lining the switches by hand would make it easier for visiting operators to navigate the layout, as it's very intuitive.

The biggest concern using this method is that track power is routed through the points, which is problematic. Fortunately, various Digital Command Control (DCC) suppliers have recently marketed super-capacitor packs, which allow our locomotives to run through any dead areas.

We can't emphasize enough the need to build bulletproof track. In retrospect, I wish we had spent more time and effort on that from the outset.

We're using NCE's DCC system and have been very pleased with the performance and especially the exceptional customer support the company provides. A lot of modelers in our area use the same system, so most of our operators are familiar with it. All of our locomotives are sound-equipped.

Doing things in phases

Although the generally accepted approach is to build the benchwork, install the track, and run everything to get all the gremlins out prior to adding scenery, that's not how we proceeded. We built most of the structures and installed all of the base scenery prior to operating on the layout.

We did run test trains as we proceeded to make sure we didn't have major issues, but we didn't start operating until fall 2014, after almost all the scenery and structures had been installed. Mike and I just couldn't get excited about operating on bare Homasote and plywood. We're railfans and hence needed to get enough done to make it enjoyable to "railfan the trains" around the layout. While not for everyone, it worked for us and was a good incentive to keep pushing on the structures and scenery.



5. United States Railroad Administration 2-8-2 light Mikado no. 37 rolls southbound freight No. 20 over the Neshobe River and into Brandon, Vt. Many deck-girder bridges had distinctive "legs" to cope with masonry approaches designed originally for wood spans.

Learning points

- "Modeling a prototype" usually means finding a specific segment of that prototype to model.
- Choosing a specific railroad and era is economical in that it limits what you should buy.
- A second deck doubles the amount of railroad and can be added in phases.
- Building bulletproof track avoids major hassles later on.
- Enjoying building structures and scenery and realistic operation are not mutually exclusive.
- Staging is important to represent the unmodeled portions of your favorite railroad as well as the rest of the rail network.



6. United States Railroad Administration 0-8-0 no. 109 – the Burlington switcher – moves near the drawbridge over the barge canal leading to Lake Champlain at the north end of the modeled section of the Rutland in Burlington, Vt.

We spent three or four years working on the upper deck and then took a five-year break on the layout as family, work, and other pursuits took precedence.

After I spent a weekend helping our friend Jim Dufour build benchwork for his beautiful Boston & Maine layout, I came back reinvigorated and motivated to get back into layout building on the Rutland Road with a vengeance. Sparky – that’s Mike – was also ready to roll, so we tackled building the remainder of the benchwork and constructed the helix. Since then, we’ve been going full bore on the layout and have made substantial and rewarding progress.

The scenery

The scenery base is extruded-foam insulation board carved with knives and hot-foam cutting tools. We covered that with Lou Sassi’s famous “ground goop” (See *Model Railroader*, March 2015) and then covered everything with Woodland Scenics blended turf to make it green. It’s amazing how a single coat of ground foam can make such a huge change in the appearance of a layout. It’s so quick and easy to do, yet adds so much!

We covered the foam base coat with static grass, more ground foam, and various other types of ground cover. The

trees are mainly Scenic Express SuperTrees with some commercial trees – most notably from Sterling Models – scattered in.

Filling in the roster

We settled on a minimum radius of 36" for the layout, which resulted in a 2 percent grade through the helix. While we were concerned about the ability of brass steam engines to haul trains up the helix, it hasn’t really been much of an issue to deal with. We do, however, continually fine-tune our fleet to optimize its running characteristics.

Equipping all cars – a varied mix of brass, resin, plastic, and scratchbuilt – with metal wheels, and adding ball-bearing wheelsets from InterMountain to some of the poor-rolling cars, has made operations much smoother. The trucks on brass rolling stock often exhibit poor rolling qualities, so we don’t hesitate to replace trucks and wheelsets, cut off interfering details, and the like to make things run well.

Mike and I model the early 1950s, and the layout depicts early September. But I have to confess that we’re not averse to occasionally running equipment 10 years on either side of that timeframe if the mood strikes.



7. Carrying milk from rural creameries to metropolitan areas was a major source of traffic for the Rutland into the 1950s. Northbound milk train No. 87 is dropping an empty at the Hoods creamery at New Haven Jct.



8. John Deere and International Harvester products team up to get the hay in. The farm buildings in the background, accurate models based on measurements of an area farm, are N scale to enhance the sense of depth to the scene.

The steam fleet is mainly brass with some kitbashed and detailed plastic models. Atlas Alco RS-1s and RS-3s comprise the diesel fleet.

Operations

The railroad interchanges with the Central Vermont in Burlington, the Delaware & Hudson in Rutland, and the Clarendon & Pittsford in Florence. Staging in Burlington represents the connection to the CV and to the northern end of the Rutland system. Staging in Rutland represents the connection to the Bellows Falls Subdivision, the Chatham Subdivision, and the D&H from Whitehall.

Since we've started operating, it's been really interesting to see how things have worked out with our design. I'm pleased to report things are running just about the way we'd anticipated. We run with an operating crew of eight people: two 2-man crews on the north and southbound way freights; one yard operator each in Burlington and Rutland; and two operators running the four passenger trains, two milk trains, and the northbound and southbound through freights.

Although the railroad can certainly handle more operators, I prefer to keep everyone busy, and the operators also seem to enjoy that. We have several other jobs that can run when operators are looking for something to do.

We use the standard four-cycle waybill routing system. A roving dispatcher, typically Mike or me, keeps the railroad fluid. We plan to have a central dispatcher and other enhancements, but I want to avoid large volumes of paperwork and rigid operating schemes.

A typical operating session is planned to be 4 hours long, but often runs into 6 hours or so with everybody busy and operating nonstop. We're fortunate to have an experienced group of modelers and operators willing to make the drive to operate on a roughly monthly basis.

Looking back ... and forward

We're pleased with the results so far and would change very little in our design. A frequent question is how we like prototype modeling versus prototype-based freelancing or just plain freelancing. Many modelers say they wouldn't model that way, as they feel it's too constrictive and limits their imagination and creative process.



9. Burlington hosts a roundhouse and engine terminal as well as an interchange with the Central Vermont. The structures are all scratchbuilt. Mike's beautiful version of the massive Elias Lyman Coal Co. dominates the tracks as it did on the prototype.

Having done both, I feel there are as many creative challenges when modeling prototypically as when freelancing. In many cases, it's more challenging to design and construct a prototype layout, as the builders have to decide how to fit the Layout Design Elements in the proper order to make a coherent and believable representation of the railroad being modeled. It helps to carefully choose the prototype you want to model with great thought given as to what makes that particular railroad interesting and enjoyable to model and operate.

One thing that's been really helpful on our latest layout is the willingness to rip out and redo things we're not happy with. Many sections of the layout have been scened out two and even three times as we fixed unforeseen problems, discovered new techniques, and changed things that just didn't look right.

Many visitors comment on what they perceive to be a high level of detail on the layout. That's nice to hear, but we feel we have only scratched the surface of what's possible. We're really just beginning to add the hundreds of details that will add life to the layout and achieve our scenic and operating goals. **MRP**

Randy Laframboise is vice president of a heavy-construction company. He lives with his wife, Sue, near the Rutland (now Vermont Ry.). He also enjoys collecting and maintaining classic cars, hiking, and skiing.



A better first impression of the railroad and the opportunity to “complete the run” led James McNab to rebuild a staging yard into the Iowa Interstate’s (IAIS) Fleur Yard in Des Moines. Yard procedures also offered additional car movements: Here the Des Moines Switcher sorts outbound cars underneath the Martin Luther King Jr. Parkway overpass.

From hidden staging to visible yard

New opportunities in an under-used location

By James McNab//Photos by the author

Two words. Just two words made me decide to completely rebuild the staging area of my Grimes Line layout into a scenicked and functioning version of the Iowa Interstate Railroad’s Fleur Yard in Des Moines, Iowa.

I’d just publicly stated that I was close to finishing my layout, a milestone that few model railroads ever reach. Among the accolades, suggestions, and words of support was an e-mail from *Model Railroad Planning* editor Tony Koester, asking me a very simple but pointed question about the future of my layout: “Then what?”

I was amazed that it only took two words to turn my model railroad world upside-down. After all, I’d spent the better part of 10 years observing,

learning, and gathering every scrap of information I could about the Grimes Industrial Track. I thought I’d designed and built the best approximation of the Grimes Line I could in our basement, and I was looking forward to operating it for years to come. But those two words made me realize there was more that could be done.

After taking a few weeks to think about what additional modeling and operating opportunities I could apply to my layout, I realized that my staging area wasn’t up to par. While the on-stage portion of the layout featured every track and customer from the prototype with little compression, the joint staging and fiddle area was a single track placed on an un-scenicked shelf.

In theory, it represented the Iowa Interstate’s (IAIS) Fleur Yard in Des

Moines, Iowa. But in practice it was a poor approximation of the real thing. Trains would appear and disappear on the modeled portion of the layout with no explanation of where they had come from or where they were going.

By having the yard represented by the plain staging area, it made a less than stellar first impression for the entire layout. If I were to change my staging area into a model of the Fleur Yard, it would serve as a better front door for my layout while offering a new set of operating possibilities.

The front-door effect

Accessibility and ease of maintenance are a high priority in my layout design, and staging is no different. Therefore, I designed an open and accessible area that allowed for quick

The layout at a glance

Name: Iowa Interstate Fleur Yard

Scale: HO (1:87.1)

Size: 1'-4" x 8'-10"

Prototype: Iowa Interstate RR

Locale: Des Moines, Iowa

Era: September 2008

Style: shelf

Mainline run: not applicable

Minimum radius: 22"

Minimum turnout: no. 6

Maximum grade: none

Train length: 5 feet

Benchwork: brackets cantilevered from studs

Height: 58"

Roadbed: extruded-foam

insulation board

Track: Micro Engineering code 70 flextrack

Scenery: joint compound over foam board

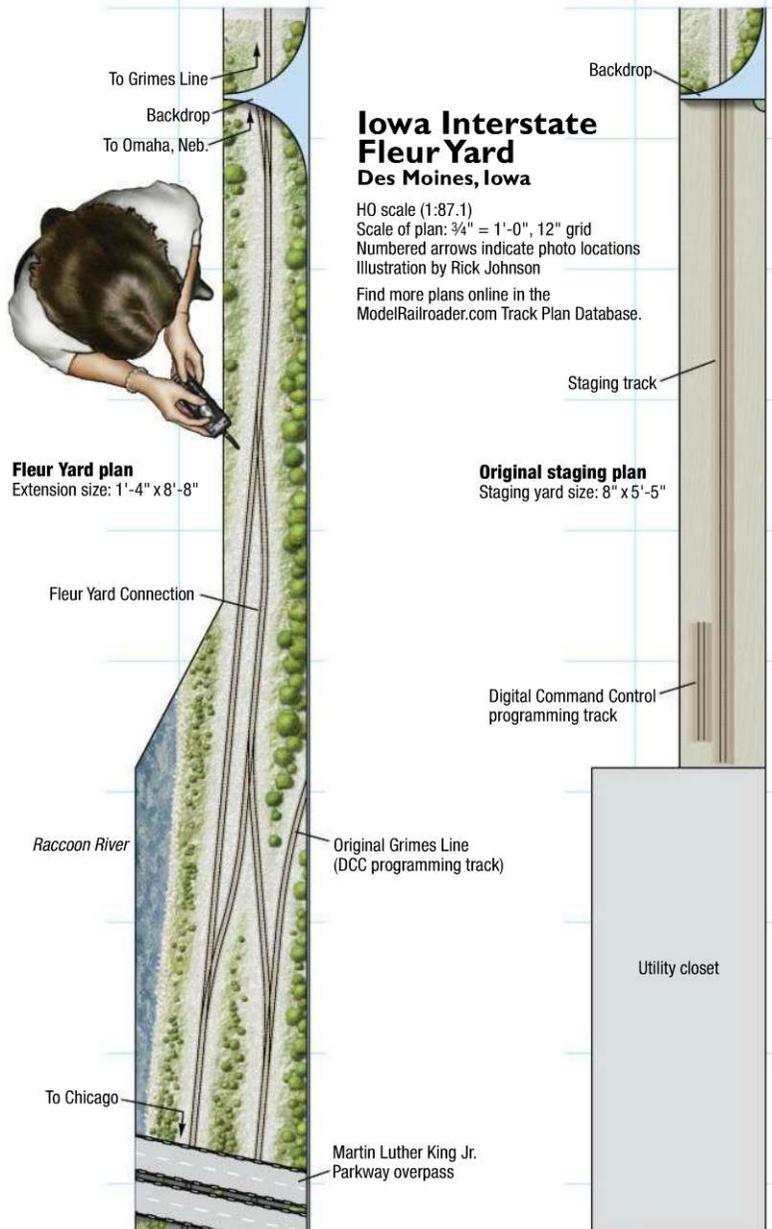
Backdrop: aluminum flashing with photo murals

Control: CVP Products Digital Command Control

and easy fiddling of cars. Because of the way our basement is arranged, the staging area is the first thing you see when you enter the layout room. But since the space was un-scenicked, it didn't make a particularly good first impression. As progress continued and more of the layout was finished, the difference became even more apparent.

Originally, I worked to make the space as aesthetically pleasing as possible. The entire staging area was painted the same color as the fascia to help blend it with the rest of the layout, while still indicating that it was separate from the modeled portion. I added a full valance and lighting that matched the rest of the layout, and I mounted the electronics and Digital Command Control (DCC) system in a pullout drawer behind the fascia. As a final step, I built simple shelves along the back of the space to store my freight cars. The shelves allowed for cars to be quickly cycled into out-bound trains, and also served as a display case for my car fleet.

While these steps brought a cleaner, unified, and more professional look to the staging area, it still paled in comparison to the developed layout that took up most of the space. Part of the decision to change the staging area into a scenicked and detailed classification yard came from the desire to give a better entrance to the room, and to set



up the layout's concept and story from the first viewing. Yes, trains will no longer leave the modeled portion of the layout, nor will I have a dedicated staging area. But the addition of a fully scenicked, fully operating yard that can act as both visible staging and a better "front door" more than makes up for the losses.

A yard without the yard

My original layout design was based on maximizing the available space in our basement for the modeled portion of the Grimes Line. As part of the design process, I made sure to include adequate space for staging, which is always a good idea in any layout plan.

Iowa Interstate Fleur Yard Des Moines, Iowa

HO scale (1:87.1)

Scale of plan: 3/4" = 1'-0", 12" grid

Numbered arrows indicate photo locations

Illustration by Rick Johnson

Find more plans online in the ModelRailroader.com Track Plan Database.

Learning points

- Operating on a prototype or prototype-based layout is enhanced when there's a clear start and finish to each job.
- Consider aesthetic value when planning and building staging.
- Tracks can be deleted from a model railroad yard design if they don't play a direct role in your operating scheme.
- Trains don't need to disappear from the modeled portion of a layout at the end of their runs.



“Before and after” views of the former staging yard, now IAIS[®] Fleur Yard, show the expansion. Car storage shelves are now below the benchwork and above magazine storage racks.



Fleur Yard serves as the linchpin for Iowa Interstate’s operations in Des Moines. The yard sits on a narrow strip of land between the Raccoon River and Terrace Hill. James modeled the west end of the yard, as it offers better operation value.

Since my prototype is a single-train industrial branch serving three customers, a 5-foot-long area to fiddle cars and stage outbound trains was more than adequate.

When it came time to design a working version of Fleur Yard, I knew I was going need more space. Even the rather modest arrangement of the prototype (see “A simple setup” on the next page) takes up a respectable amount of land. I was able to steal a few more feet in the corner of the basement where several utility pipes entered the house, but I was left with a little more than 8 linear feet to work with. Not exactly an ideal size to build a modern-era yard.

Using XTrkCAD computer-aided design software created for model railroads, I was able to draft an accurate track layout that I knew would fit the available space. It also allowed me to simulate yard operations by

using the software’s built-in library of cars and locomotives. Both features were a major benefit when I needed to test whether or not a track arrangement would work with my planned operations, without having to either mock-up or build the plan.

To make the most out of the limited space I had, my design centers on the west end of the yard, including the Martin Luther King Jr. Parkway overpass, the Fleur Connection Track, and the junction between the IAIS main line and the Grimes Line. Luckily the low-volume nature of the Grimes Line, both on the prototype and on my layout, was an advantage. Average outbound train lengths are three to five cars.

So where’s the rest of the yard? It’s that-away! The overpass sits atop the turnout to Yard Tracks 1 and 2, just as it does on the prototype. The rest of the yard is theoretically to the east, or right, of the overpass. By including all the tracks, even ones that are purely cosmetic or don’t contribute to the operating plan, the yard appears bigger than it actually is.

The other side of town

The Iowa Interstate’s Des Moines Switcher, while officially labeled as Train

DMSW, is better known by its crew nickname, the “Tramp.” While most of the Tramp’s day is spent on the Grimes Line, the train is also responsible for working the two interchanges with the Class 1 railroads in town, the Union Pacific and the joint BNSF Ry./Norfolk Southern interchange. Both are located east and south of downtown Des Moines.

Because my layout space wasn’t big enough to include the entire IAIS route through Des Moines, all other interchange points were originally represented in the staging area. With my decision to model Fleur Yard, I needed a way to bring the Class 1 interchanges into the operating plan. Since I didn’t have any additional space to model the interchanges separately, and didn’t want to further compress my yard design, the solution was to have the operating session start after the interchange work had been done.

I learned about this technique from Tony Koester’s former layout, the HO scale Allegheny Midland. Tony had several branches that ran to and from an un-modeled interchange point. At the start of his operating sessions, he had several trains visibly staged on these tracks with cars bound for delivery to towns served by the Midland Road.

Now on ModelRailroader.com

Want to see more James McNab’s HO scale Iowa Interstate layout? Check out his User Videos under the Video tab at our website, www.ModelRailroader.com.





Basic construction methods are evident: 1 x 4 joists overlaid with 2"-thick extruded-foam insulation board. The backdrop is aluminum flashing with photos of the modeled location glued on.



The car-storage shelves and a utility closet were removed to make room for the new yard. James packed a lot of railroading into the available 8 linear feet.

Toward the end of his sessions, the trains would start back up their respective branch lines with any outbound cars, where they would finish their runs on the visible part of his layout.

Procedures at Fleur

In my case, I start my operating session after the Tramp has worked the east-side interchanges, but before its run up the Grimes Line. The day begins with cars from the previous night's road freights already spotted on the Connection Track.

The Tramp's first task will be to sort and block the cars in the yard. Since all the spurs on the Grimes Line are facing-point for outbound movements, and there's only one available runaround on the branch, crews don't want to leave Fleur Yard with a poorly blocked train.

After the outbound train is built, the crew will pull up to the switch connecting the IAIS main line to the Grimes Industrial Track. All IAIS tracks through Des Moines are within yard limits, which means trains can occupy and move on the main without specific authorization. However, the Grimes Line is "FRA Excepted Track" and is governed by a different authority. The IAIS dispatcher will give verbal permission to

Train DMSW to occupy the track. Operators can then unlock the switch and proceed up the line. Regardless of whether the crew is governed by yard limits or excepted track, a restricted speed of 10 mph is enforced.

Once the work on the Grimes Line is complete, the Tramp returns to Fleur, where it sets out cars bound for other IAIS locations into east and west blocks. Those cars will be picked up by that night's road freights. Any cars bound for interchange with the Class 1 railroads are pulled to the east end of the main, where the session ends.

Working the yard at the beginning and end of each session has distinct benefits to an operating layout. In addition to giving my operators a clear start and finish to each session, the yard increases the time needed to complete the session. Initial tests have shown it takes nearly 30 real-time minutes to work the yard, a major enhancement for an 8-foot-long addition. **MRP**

James McNab is an award-winning producer and video editor with more than 400 production credits to his name. His HO IAIS Grimes Line layout was featured in Great Model Railroads 2015, and this is his second byline in MRP.

A simple setup

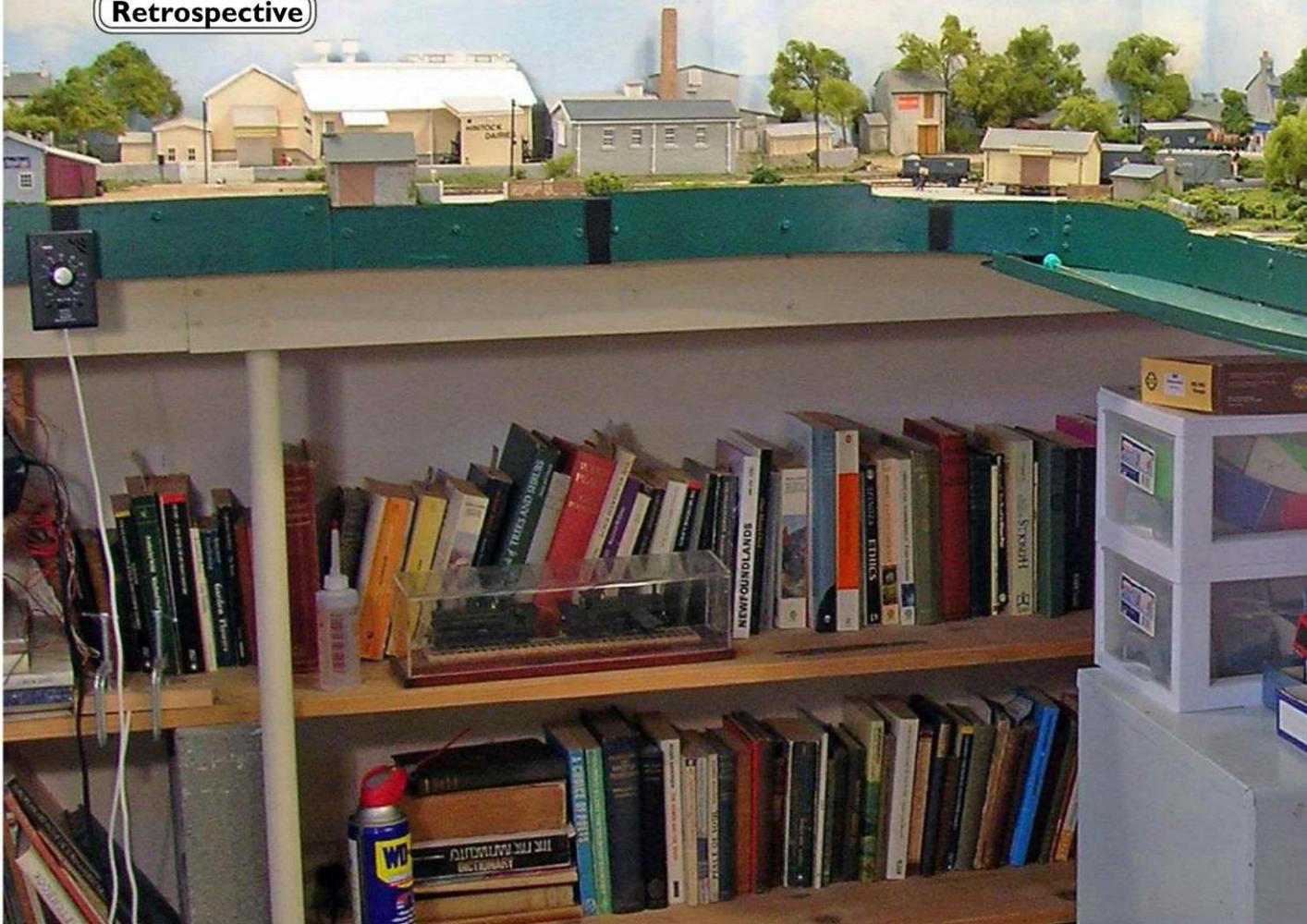
Set on a small strip of land

between the Raccoon River and Terrace Hill on the west side of Iowa's capital city, the Iowa Interstate's (IAIS) Fleur Yard seems like an afterthought for the railroad. With only two yard tracks and one siding, it'll never be mistaken for a division point or full classification yard. Yet this small and unassuming collection of tracks serves as the linchpin for the railroad's operation in Des Moines.

Two daily road freights, one in each direction, set out a cut of cars blocked for Des Moines. The local switch crew sorts the cars for delivery to the various interchange points with the Class 1 railroads in town, or to customers on the IAIS Grimes Line, which I model in HO. After working the interchanges and the Grimes Line, the switch crew sorts the outbound cars into eastbound and westbound blocks in the yard for pickup by the appropriate road freights, where the process starts all over for the next day.

Iowa Interstate road freights will generally leave the Des Moines block on the Connection Track, a double-ended siding on the west end of the yard. It's more than long enough to handle the typical traffic levels on the IAIS, with eastbound and westbound cuts set out on opposite ends of the siding. On days with higher traffic levels, the two classification tracks, known simply as Yard Tracks 1 and 2, can handle the excess. Otherwise, they're used for sorting and organizing the cars for their final destinations. — J.M.

Retrospective



Extending an English branch

Doubling the size – and the benefits

By John Flann//Photos by the author

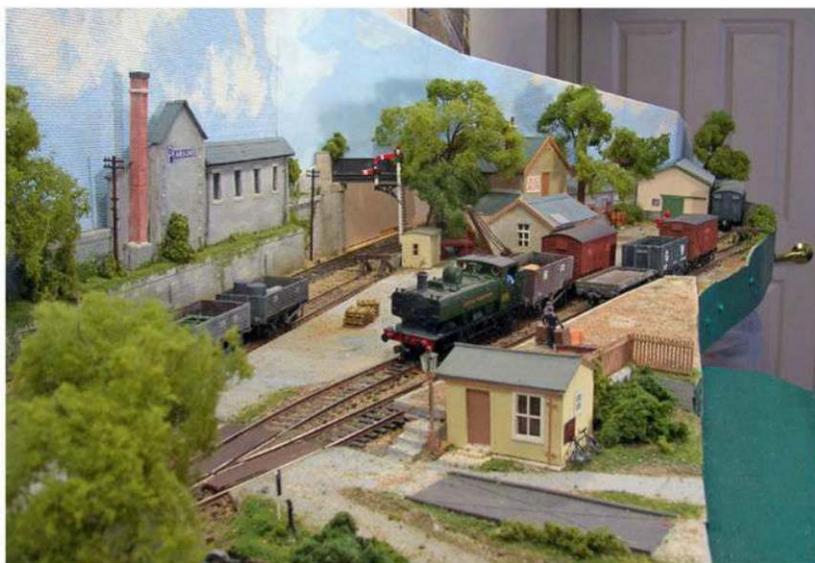


1. This overview shows much of the original OO scale layout at left and nearly all of the 10-foot extension along the right-hand wall. The view block that screens the partially hidden staging yard is at the far right.

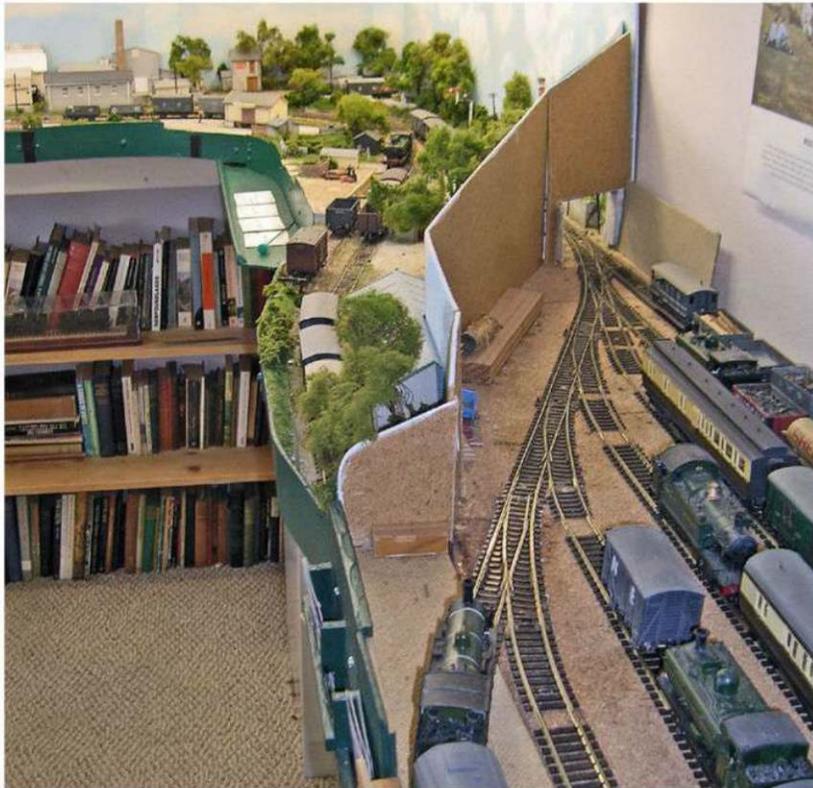
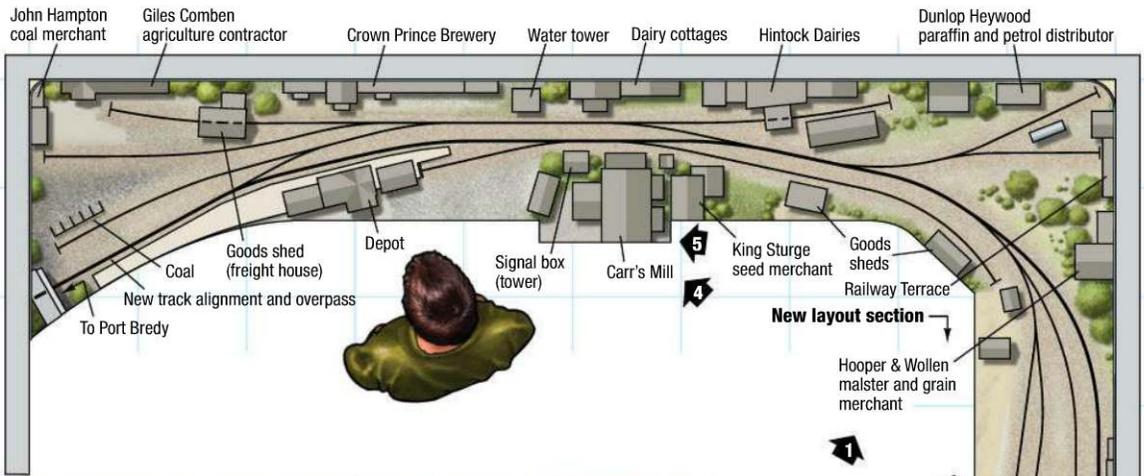
The time is a beautiful English summer day in the 1930s. The place is the market town of Hintock Magna, Dorset, England, which was reached in 1857 by a joint Great Western Ry. and Southern Ry. branch line.

I described the original OO model of a typical English branch line in *Model Railroad Planning 2011*. But when I'd essentially completed my layout, I began to ponder what could I do next. I decided to extend along a vacant wall with a 1'-6" x 10'-0" baseboard resting on shelf brackets. It doubles the size of the original layout.

The benefits of this expansion have given me several additional features:



2. A Great Western Ry. pannier tank engine shunts (switches) the goods shed (freight house) on the new extension to the Hintock Branch layout. The low backdrop and road bridge screen the staging yard from normal view.



3. "Pay no attention to the man behind the curtain!" Seven semi-hidden staging tracks allow a wide variety of traffic to flow into and out of Hintock Magna.

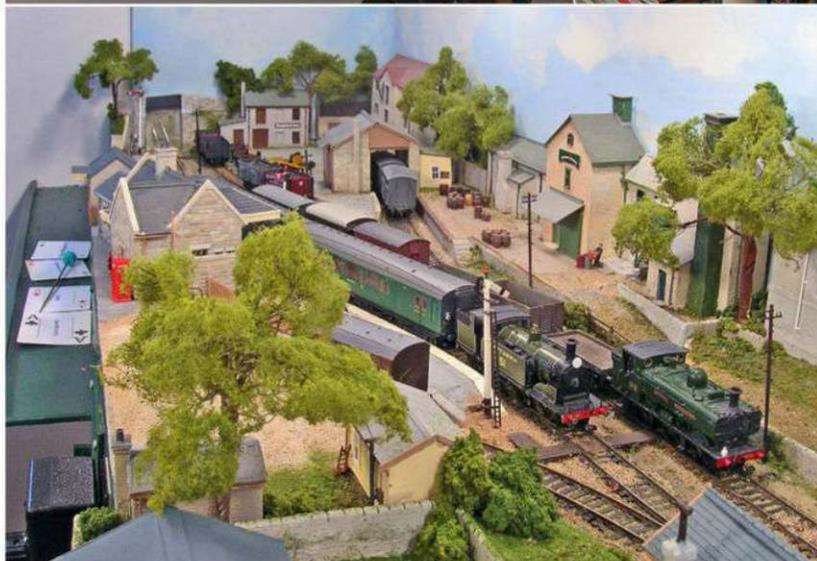
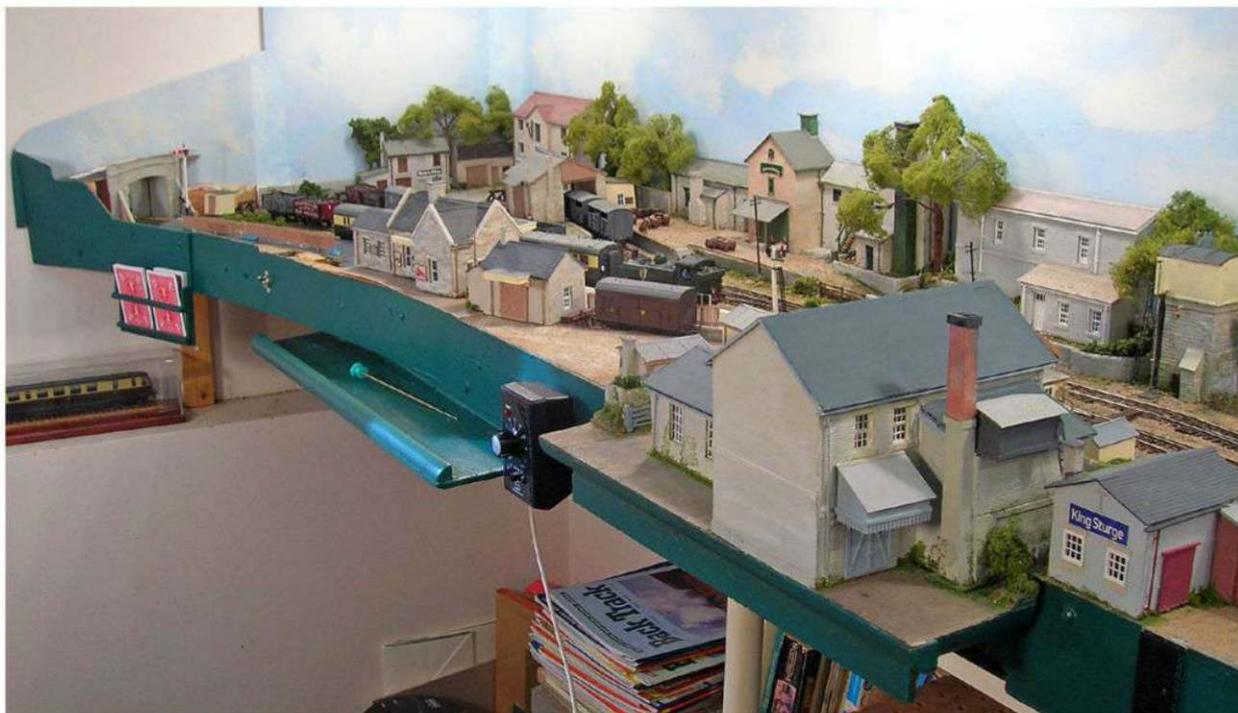
The layout at a glance

Name: The Hintock Branch
Scale: OO (1:76)
Size: 10'-0" x 10'-0"
Prototype: English branch line
Locale: Dorset, England, U.K.
Era: 1930s
Style: shelf
Mainline run: 14 feet
Minimum radius: 22"
Minimum turnout: Peco small radius
Maximum grade: none
Train length: 3'-9"

Benchwork: plywood on shelf brackets
Height: 46"
Roadbed: cork floor tiles
Track: Peco and Atlas code 100 flextrack
Scenery: scrap foam packing covered with paper towels, paint, and flocking material
Backdrop: tempered hardboard
Control: direct current cab control

The Hintock Branch

OO scale (1:76 proportion), H0 gauge
 Room size: 10'-0" x 12'-6"
 Scale of plan: 5/8" = 1'-0", 12" grid
 Numbered arrows indicate photo locations
 Illustration by Rick Johnson
 Find more plans online in the
 ModelRailroader.com Track Plan Database.



4 and 5. John modified the original 10-foot section of the layout by curving the fascia to accommodate an overhead bridge view block and an additional siding. This allows visibly staging a train that appears to have come from Port Bredy and is now going up the branch.

Learning points

- An expansion can also offer the chance to redesign and rearrange existing layout elements.
- Even a relatively small expansion (1'-6" x 10'-0") may greatly enhance operational and scenic possibilities.
- Model railroading can be a rewarding endeavor well into one's golden years.

- eased curve of 22" in a corner
- increased length of run
- enlarged staging yard
- additional and longer sidings
- added operating potential
- opportunity for more switching
- space for more equipment
- more scenic possibilities.

Enhancing the railway

This list of opportunities encouraged enhancements elsewhere. Among them were the addition of the Hooper & Wollen malsters, Railway Terrace and Dunlop and Heywoods premises, and two new goods sheds (freight houses).

I found that I could also move the existing signal box (tower) and the water tower to better positions; relocate King Sturge, a seed merchant; reconstruct Ayling & Strudwick's mill as Carr's Mill, makers of men's corduroy trousers ("Don't go to work without them!"); re-arrange the station buildings; remove the sharp curve on the platform road; and add a new siding, bridge, and associated scenery.

For the fun of it

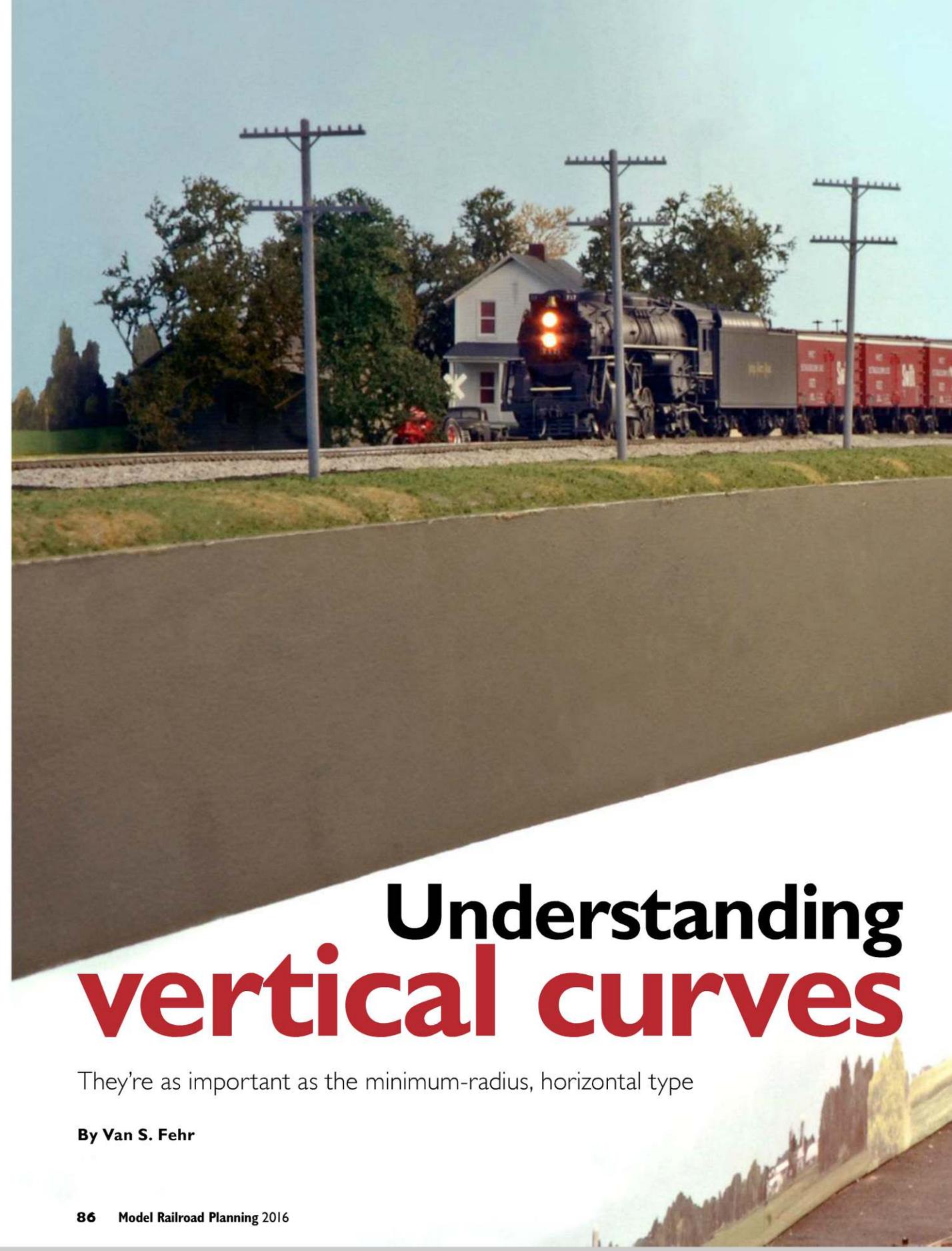
It's fun to have a larger model railroad, and just thinking about the possibilities, planning and designing

the extension, and creating the new elements to meet the overall effect I wanted to achieve was a rewarding experience.

But just having fun with model railways in my 86th year is itself a worthwhile goal and reward, one I recommend to everyone!

For more information, please see www.hintockbranch.com. **MRP**

John Flann and his late wife, Jeanne, immigrated from the United Kingdom upon his retirement as a surveyor to join their two sons and families in the United States. He lives in Smithfield, Utah.



Understanding vertical curves

They're as important as the minimum-radius, horizontal type

By Van S. Fehr

A westbound freight crests Cayuga Hill as it nears Humrick, Ill., on editor Tony Koester's HO railroad. Note the summit of the gradual vertical curve just to the east (right) of the grade crossing. Tony Koester photo



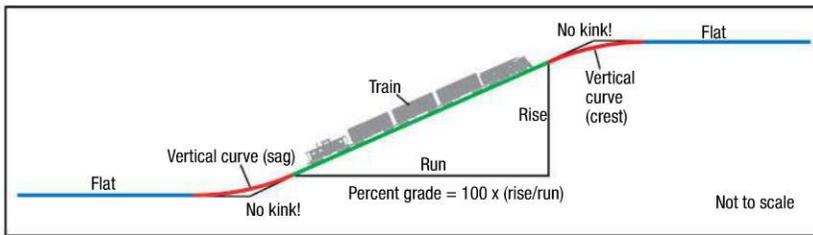


Fig. 1 Getting rid of the kinks. Grades require vertical curves at each end to avoid angular kinks and ensure reliable operation.

Prototype railroads use grades to accommodate changes in terrain and to get over or under obstacles. Railroads follow rivers, build bridges, bore tunnels, and use loops to keep grades to a minimum. Where grades begin or end, as in the photo on the previous page, civil engineers use a vertical curve to avoid the unacceptable kink that would otherwise occur.

Like full-size railroads, model railroads need to employ well-designed and -constructed vertical curves at each end of every grade for smooth, reliable operation. But a search for a simple method to design and construct reliable vertical curves was fruitless, so I developed a plan. It utilizes sound engineering principles and works for any scale. I'll describe the engineering study I did, the simple design formulas I developed using its results, and – happy days! – a math-less construction method. I'll close with an example showing how it all works.

Prototype vertical curves

I started by reviewing prototype practice for grades and vertical curves. Civil engineers quantify grade as the ratio of its rise (change in elevation) to its run (horizontal distance) multiplied by 100 to express grade as a percent. Because grade is a ratio, it does not depend on model scale.

The American Railway Engineering and Maintenance-of-Way Association (AREMA) provides a formula for the vertical curve horizontal length, given the two grades on each side of the vertical curve, a specified train speed, and a standard vertical acceleration. Engineers set the calculated length to a positive value, even if the arithmetic difference in the two grades produces a negative result.

A vertical transition curve has the shape of a parabola. An upward curving transition is a sag; one curving downward is a crest. These names apply whether or not there's a high or low spot somewhere between the ends. The net elevation is the difference between the end-point elevations.

For the typically small difference in grades, in both the prototype and the model, a circular arc is a close approximation of a parabola. In fact, the AREMA length formula actually comes from the physics of circular motion. The radius then depends only on the vertical curve length and the two adjacent grades. Though radius serves no purpose in construction, it's useful as a point of comparison.

Model vertical curves

Figure 1 shows a typical model railroad grade, exaggerated to show its features. Because model railroad cars have no brakes, modelers usually build yards, spurs, and other switching locations on a flat (zero grade) so cars standing alone won't roll away. When two such switching locations are at different elevations, a grade with vertical curves at each end connects them. The crest has the same shape as the sag, but it's upside down.

Applying prototype practice to a model railroad isn't simply a matter of scaling. Prototype vertical curves are many times the length of the longest rolling stock. For example, the AREMA formula shows that a 50-mph freight train transitioning from level to a 2 percent grade requires a vertical curve length of 1,075 feet, more than 10 times the length of the longest freight cars. The curve's radius exceeds 10 miles. The equivalent HO scale length is over 12 feet, likely longer than an entire grade. For practical use, the model vertical curve length and radius must be much smaller than the scaled prototype – another case of necessary selective compression.

Two MR articles suggested radius values: one by John Lukesh (March 1970) and another by Philip Page (November 1972). In the February 1974 *Model Railroader*, editor Linn Westcott asked for a volunteer to study a variety of equipment sizes to determine vertical curve tracking ability. No volunteers appeared in the years that followed.

So what should the radius and length be? I found an answer in the

study I did – the one Linn Westcott requested 40 years ago.

Vertical curve radius study

While the value of a vertical curve radius isn't important for construction, it is for reliable operation. Sharp model railroad vertical curves can derail rolling stock and cause inadvertent uncoupling or short circuits if metal locomotive pilots touch the rails. To learn how to avoid these unpleasant-ries, I developed equations for the minimum vertical curve radius at which they occur, verified them by hand calculations, and programmed them into an Excel spreadsheet.

I selected 76 freight and passenger cars; steam and articulated steam locomotives; and diesel locomotives representing a broad range of equipment and era, and used their HO scale dimensions. The dimensions came from the *Model Railroader Cyclopedia: Vol. 1, Steam Locomotives* and *Vol. 2, Diesel Locomotives* (Kalmbach Publishing Co.). I scaled prototype car dimensions from a variety of printed and online sources.

I used flange depths from National Model Railroad Association (NMRA) Recommended Practice RP-25 and NMRA Standard S-4.1 (Proto 87.1). I measured Kadee HO standard and scale coupler knuckle height dimensions, and used a representative .05" coupler droop. For pilot clearance, I scaled 3 and 6 prototype inches, the extremes allowed by the Code of Federal Regulations, Title 49, Section 229.123. These parameters combine into 16 unique cases that I applied to each of the 76 equipment selections. This produced 1,216 calculated

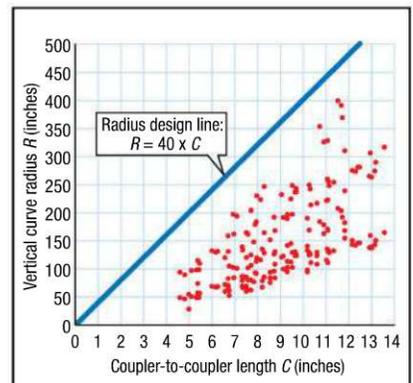


Fig. 2 Plotting the data. A formula sets the vertical curve radius for the given coupler-to-coupler length of a piece of rolling stock. The red circles represent the minimum vertical curve radius for each of the 1,216 combinations (some are duplicates).

minimum radius values, graphed versus rolling stock overall coupler-to-coupler length in **fig. 2**.

Showing considerable variation, the limiting condition for the minimum radius was typically flange exposure on a sag, but all of the other possible conditions were limiting for some equipment in some of the cases. Much of the variation is due to flange depth, the roughly upper-half of the points associated with Proto:87.1 flange depth, with some overlap with RP-25 flange depth results. The rest is due to the variations in pilot clearance, knuckle height, and coupler droop.

The results tend to converge at the origin, suggesting the vertical curve radius should be directly proportional to the coupler-to-coupler length. To include equipment not analyzed, I selected a proportionality factor of 40, producing the radius design line shown in **fig. 2**, opposite. Simple statistics show that over 99 percent of all rolling stock will have a minimum radius falling below this line. Even better, because the proportionality factor is a ratio, the value "40" applies to all model scales.

Great! A simple formula to calculate a vertical curve radius – it's 40 times the coupler-to-coupler length of any instance of rolling stock. Equally important, the minimum length of the vertical curve is always its radius times the adjacent grade. This leads to the length formula in "Grade and vertical curves" on the next page, and avoids difficulties in the methods of Lukesh and Page.

Vertical curve design

Model vertical curves must operate reliably and should look prototypical. The length formula on the next page ensures reliability, but prototypical appearance is another matter.

Appearance is subjective. I think the vertical curve length should never be less than the coupler-to-coupler length of the longest equipment traversing it, or it begins to look more like a roller coaster than a railroad. It's possible, with shallow mainline grades, that the calculated vertical curve length will be less than the coupler-to-coupler length. In that case, set the curve length to the coupler-to-coupler length or longer, longer being more prototypical. For steam engines, exclude the tender and use the coupler-to-drawbar distance.

Vertical curve length in excess of twice the coupler-to-coupler length, although looking more prototypical, may take too much space. However, some extra-long, modern-era equipment may require vertical curve



Without the vertical curve at the crest of this grade in the staging area of *Model Railroader's* club layout, couplers would separate at the kink. Bill Zuback photo

lengths that exceed twice the coupler-to-coupler length. In that case, use the calculated length to ensure reliability.

Figure 3 details the geometry (exaggerated) of a model railroad grade between two flat locations. Notice the actual grade (solid line) is steeper than the nominal grade (dashed line) obtained by dividing the overall height by the overall horizontal distance. It's better to start with the required grade and adjust the overall height or overall horizontal distance accordingly. If you don't do this, your final actual grades can be steeper than you expect, and locomotive performance may suffer intolerably.

Once you select a grade, measure the coupler-to-coupler length of the longest equipment you plan to operate on the grade. Then calculate the vertical curve length and the vertical curve net elevation using the formulas in the sidebar. As a fortuitous consequence of the "40" proportionality factor, for any grade at or below .025 (2.5 percent), simply set the vertical curve length to the coupler-to-coupler length (or longer). Calculate the

vertical curve length only for grades exceeding .025 (2.5 percent).

Complete the design of the grade and its vertical curves using the formulas in the sidebar. Once you've set your required grade, make the compromises between the overall grade height and overall length using the last two formulas.

Vertical curve construction

My construction method requires no elevation calculations between the vertical curve end points. That's because the subroadbed itself "does the math" automatically.

Here's why. Subroadbed is normally a constant width and thickness along the vertical curve. When gently bent, it takes a natural, predictable mathematical shape. This behavior is what makes the flexible stick used in the "bent-stick" method work so well for laying out horizontal easements. Better, for vertical curves, when you hold one end flat, and hold the other end to the net elevation and slope of the adjacent grade, the subroadbed takes the shape of a parabola, just like the prototype.

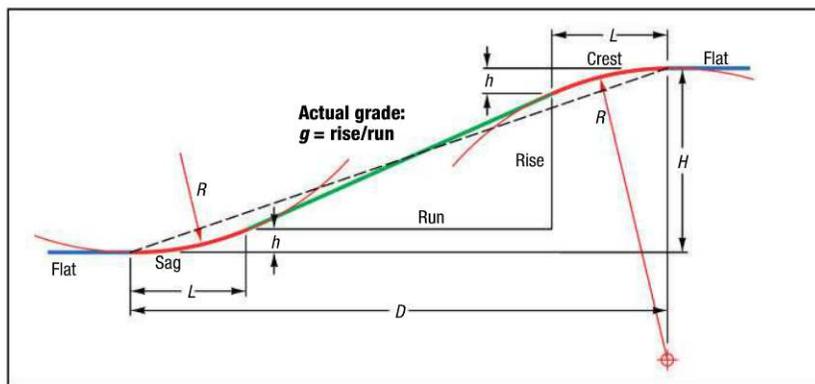


Fig. 3 Geometry of a model grade. Compromises in overall length and height will be necessary to ensure the actual grade (solid line) meets your goal.

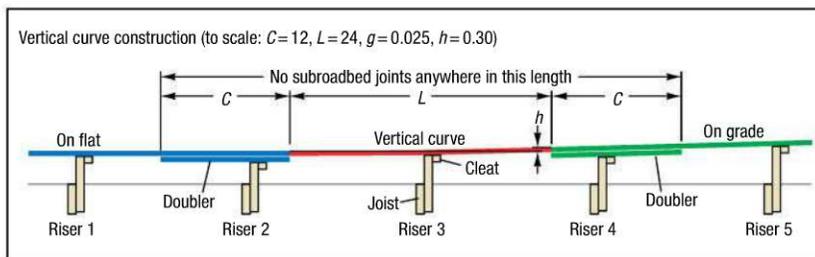


Fig. 4 Building vertical curves. Keeping in mind the location of joints and the stiffness of the subroadbed is important in constructing a vertical curve.

There are numerous documented methods for constant-grade construction. One method uses risers spaced at convenient intervals along the grade, adjusted vertically to hold the subroadbed to the desired grade. The example that follows designs such a grade with vertical curves at its ends, but only describes building one of the curves.

Grade design and construction

Suppose you wish to run HO scale passenger trains with 85-foot cars having an HO scale coupler-to-coupler distance $C = 11.7"$. Your trains are just a few cars in length and you expect your somewhat shorter motive power can pull them up a desired 2.5 percent (.025) grade without difficulty. You have two flat towns separated vertically by 2" and horizontally by 80".

Because your desired grade is 2.5 percent, you see the minimum vertical curve length is simply 11.7", which you round up to 12" for simplicity. Wanting the curves to look more prototypical, you select twice that length so $L = 24"$. Using the equation at right, you calculate the net elevation at the end of the vertical curve as $h = .025 \times 24 / 2 = .30"$.

So far, so good. You check the grade overall height by calculating $H = .025 \times (80 - 24) = 1.4"$, considerably less than the 2" you need. Not so good! You then calculate the overall length using your

required overall height and get $D = 2.0 / .025 + 24 = 104"$, far beyond your initial horizontal distance. This is the dilemma we face when designing grades – we must often make compromises. You decide you can't increase the grade because locomotive performance will suffer. You could shorten the vertical curves to 12", but decide you would be unhappy with the appearance. You also decide the 2" elevation change is important. That means you have to accept the calculated overall length of 104" and increase the distance between the towns.

Figure 4, drawn to scale, illustrates one method of vertical curve construction, specifically for this example of an HO scale .025 (2.5 percent) mainline grade, a 24" vertical curve length, and a calculated .3" net elevation. The risers are 16" on center, attached to joists mounted on L-girders or open-grid benchwork, all shown as black lines. Blue lines represent the lower flat area, red the vertical curve (sag), and green the constant grade of the subroadbed. At the high end, the vertical curve (not shown) has the same geometry, but inverted, as **fig. 1** and **fig. 3** illustrate.

Allow no joints in the subroadbed in or near the vertical curves, or you could get an unacceptable kink at the joint. Glue and screw a doubler, the same width and thickness as the subroadbed, to the subroadbed along a distance C just outside each end of the vertical curve. The doublers make the subroadbed eight times stiffer, forcing it to bend only within the vertical curve.

First, fasten risers 1 and 2 to the joists and the subroadbed to the cleats, making sure the flat section stays level as you proceed. Then, by trial and error, adjust risers 4 and 5. Clamp riser 4 in place until the end of the vertical curve is the height h above the flat (.3" in this case). Measure the grade using an appropriate tool, such as Micro-Mark's miniature digital level.

At this point you may find the grade is slightly steeper than you want. Clamp the subroadbed to the cleat on riser 5. Push the subroadbed down

until you achieve the desired grade, then clamp riser 5 to the joist. Check the vertical curve elevation at the end of the vertical curve, and again adjust riser 4 to match h . Adjust riser 5 again until the grade is correct. At this point the vertical curve end elevation should be close enough. Screw risers 4 and 5 and the subroadbed in place, and remove the clamps.

Finally, adjust riser 3 until it just touches the bottom of the subroadbed. Screw it to the joist. Then screw the subroadbed to the cleat, tightly enough to be secure, but without changing the shape of the vertical curve.

The thicker the subroadbed, the harder it is to bend into a vertical curve. Some modelers use 3/4" plywood for subroadbed, which is more than three times stiffer than 1/2" plywood, and eight times stiffer than 3/8" plywood. Try bending a sample length of your subroadbed, and if you decide it's too difficult, consider reducing its thickness.

Ends justifying the means

It's difficult to embrace using analytical methods – math! – when we're designing and building a model railroad. But when slight errors can cause big problems later on, it's well worth the added mental effort. **MRP**

This is Van Fehr's second article in MRP. Van, who models in HO scale, is the NMRA Data Sheet Committee assistant chair and NMRA RP-12 Turnout Working Group chair.

Grade and vertical curves

Actual grade:

$g = \text{rise} / \text{run}$
percent $g = 100 \times \text{rise} / \text{run}$

Vertical curve length:

$L = 40 \times g \times C$

If the calculated length L is less than the coupler-to-coupler distance C , set $L = C$ (or longer) for good appearance.

Vertical curve net elevation:

$h = g \times L / 2$

Grade overall height:

$H = g \times (D - L)$

Grade overall distance:

$D = H / g + L$

Learning points

- For reliable operation in any scale, design grades and vertical curves using the given formulas.
- For good appearance, use vertical curves that are no shorter than the coupler-to-coupler length of the longest equipment traversing them, or up to twice as long if space permits.
- Take advantage of the flexibility of the subroadbed to aid in vertical curve construction, eliminating the need to calculate intermediate elevations.

Reader forum

Go for the gold

I have been enjoying *Model Railroad Planning 2015*. Gary Hoover's, Andy Dodge's, and Greg Johnson's layouts are amazing. Talk about fast work!

While I found the overall issue packed with good information, the photo spread across page 46-47 of Dennis Daniels' layout [right] really hit paydirt. I have been planning to expand my layout into the TV area of my basement. I was thinking about building shelves and incorporating the rarely watched TV into the benchwork. Whenever I mentioned it to my wife,

however, she gave me one of those looks that only wives can muster. But when I showed her this photo, she said, "Oh that's what you mean. Go for it!"

In my case, the layout in this area will only be a single deck. But the photo helped my wife visualize my plans. Now she's a big supporter of the project. It saved me from having to do a mock-up in Sketch-up.

I purchased the digital version of MRP (and MR) as well as the paper. Reading the magazines on my new 5K iMac is amazing. The images are crystal clear and just gorgeous – much better than the PDF scans that were on the DVDs, which alas aren't compatible with the new iMac.

*Bernard Kempinski
Alexandria, Va.*

10 – make that 11 – tips

I really enjoyed editor Tony Koester's "10 tips for a better railroad" article in MRP 2015. Many, many great points there.



Don't overlook the operating potential of maintenance-of-way equipment, Iowa Interstate modeler Joe Atkinson suggests. Here, a well-worn flatcar holds a load of new railroad ties. Joe Atkinson photo



Combining family and hobby needs proved just the ticket for MRP 2015 author Dennis Daniels. This picture of Dennis' layout convinced Bernie Kempinski's wife that something similar would work in their basement. Dennis Daniels photo

One overlooked "industry" I might add would be handling maintenance-of-way equipment. Maintenance-of-way movements don't require a spur of their own but can be routed to just about any track on the layout. That weed-overgrown siding or out-of-service yard track would be a perfect place to tie down a few MOW cars between track projects, and there's a great variety of car types involved: gondolas, boxcars, flatcars, ballast hoppers, side-dump gondolas, etc., including some of the oldest, most beat-up examples on the roster.

Iowa Interstate's maintenance-of-way fleet is mostly ex-Rock Island, but it also includes cars of Santa Fe, Chicago Great Western, and even Maryland & Pennsylvania heritage. Snow plows need a track on which to spend the warmer months, and if you model spring or fall, they could be

moved to or from storage even when the snow's not yet flying.

Bill Darnaby's article on drop-down mainline extensions has once again got me thinking about ways to extend the Harlan Elevator spur on my HO Iowa Interstate layout with a General Electric 45-ton diesel locomotive at end-of-track. A drop-down like Bill described, crossing the aisle to connect with an extension of the spur under the peninsula on the other side, could work. Replacing the drop-down with a cassette that would slide into the end of the peninsula, under the main line there, on a roller track within the peninsula, is another option.

*Joe Atkinson
Council Bluffs, Iowa*

[See Joe's article on modeling the Iowa Interstate in MRP 2011. – Ed.]

An interesting variety

There's an interesting variety of articles in MRP 2015. That issue is a great demonstration of how different people with different tastes and different resources come up with a broad variety of layout designs. It ranges from Andrew Dodge's approach to managing time so that he can do all the necessary crafting to the client who hired Messrs. Henderson and Fortin to build a layout that can be populated with ready-to-run trains.

To update "East Bay in the present day," BNSF Ry. now runs trains of empty intermodal well cars from the Oakland International Gateway to Tacoma and Seattle (OIGTAC and OIGSEA symbols). These run east to the Santa Fe connection at Stege,

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thence to Stockton, where the power runs around to change direction before heading up the former Western Pacific to the Pacific Northwest.

Because of agricultural exports from California, Oakland is one of the few ports that actually ships out more loaded containers than it receives in ocean trade. Power is a pair of 6-axle General Electric units coupled back-to-back to facilitate the direction change at Stockton.

Gerry Leone's "3-D drawing board" article helped answer my question of staying with the drawing board or moving into a computer program.

*Rick Mugele
La Grange, Calif.*

Annual idea book

I just received the 2015 issue of MRP. Every issue is filled with more good ideas than a single issue of a typical model railroad magazine. You could call MRP an annual "idea book."

Regarding Gerry Leone's "Planning in 3-D," that's how I planned my industries for my present layout. I used Fome-Cor illustration board, and one of the buildings formed the core of a large structure in the corner of my layout.

I think there was something important (more like a warning) that you omitted from that article about mock-ups: They can be addictive! I had so much fun switching on my layout with those mock-ups that I didn't start building real structures for almost three years! And I knew a fellow who used boxes for his structures for many years – in fact, all the time when he lived near me, around 1981 to 2004.

*Bill DeBuvitz
Mendham, N.J.*

One of those days

Did you ever have one of those days where you had just about all of your benchwork completed, only to realize that maybe you were making it too complex? It happened to me last night after reading *Model Railroad Planning 2015*. After digesting "Modeling a small town" by John Golden, it finally hit me: All I need is to concentrate on just a few towns that had plenty of activity.

I also happened to come across a John Armstrong plan that was published many years ago based on the Atchison, Topeka & Santa Fe's Alma District. Jared Harper commissioned that plan, modified it, and modeled this line [see MRP 2009 – Ed.]. I have just about double the space that the plan required, and by spreading it out I can get a close representation of the Rock Island in western Iowa.

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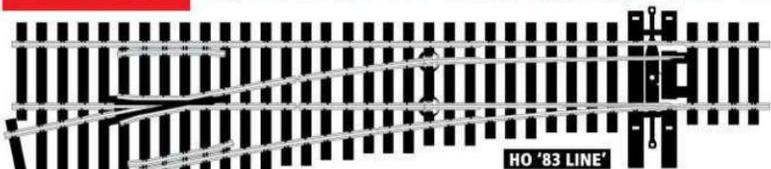
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John Golden's daughter couples cars on her father's HO scale Minneapolis & St. Louis layout, which was featured in MRP 2015, inspiring reader Otto Brauer to tear down his benchwork and start over. John Golden photo

Needless to say, the wrecking bar came out today, and 80 percent of the benchwork was disassembled and reworked to meet the new requirements. Thanks to the inspiration found in MRP 2015, I now have the long, narrow shelves needed to accommodate the long segments of tangent track with gentle curves weaving through the cornfields.

*Otto Brauer
Audubon, Iowa*

Unadilla Valley

I just completed a first read-through on the 2015 MRP, and I did like several pieces, particularly Gary Hoover's article on his N&W adventure. But I found Iain Rice's notes on the Unadilla Valley to be very compelling. Here's a north/south Northeastern line that uses my favorite engine, a Prairie – a steamer that seems underappreciated. Given that I can begin to see the end game for the Clinch Valley Lines, mental gymnastics about what's next often arise. The UV might be it.

But what really struck me were Iain's comments on scene composition. Some modelers seem to understand how to fashion and present a scene that works while others do not.

Whether the better modelers instinctively use some of these principles or just have a better artistic hand seems to be the question. I would have thought that being able to "see" the real scene and then translate that into a model is the key rather than adhering to set of concepts such as Iain's. But I suspect I've got a lot to learn.

*Roger Sekera
Potomac, Md.*

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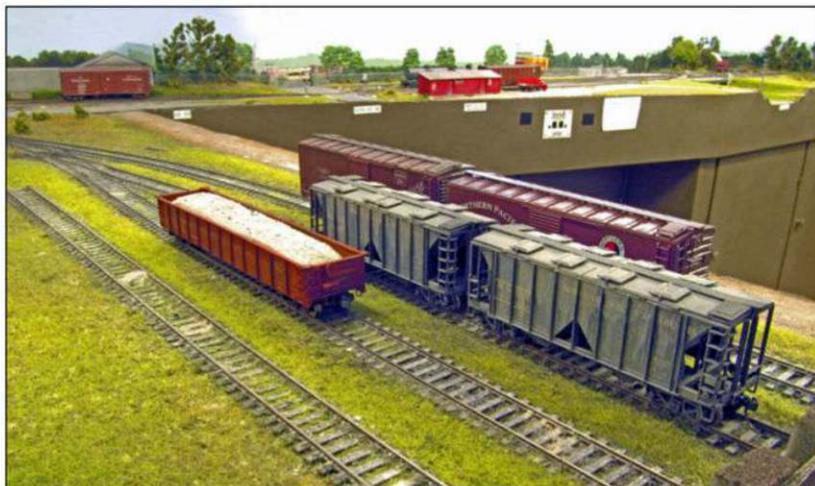
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Drop-leaf yard

What to do when you hit the wall – literally



Clark Propst built a compact drop-leaf yard to accommodate the tracks that are associated with a cement plant, but not the plant itself. It holds fewer cars than the prototype, but requires a similar number of switching moves.

Photos by Clark Propst

I wanted my present layout to replicate the prototype as closely as possible. Like most model railroaders who seem to want it all when we make our layout wish list, reality set in: I had space to do justice to only a single town.

I chose Mason City, Iowa, the small city where I live, and the railroad my father worked for, the Minneapolis & St. Louis Ry. as it appeared in early May 1954. [See *Great Model Railroads 2016 – Ed.*] Mason City was the second largest source of revenue on the entire railroad because of a major meatpacking house here. The M&StL also switched two large cement plants: Lehigh Portland Cement and Northwestern States Portland Cement.

The town's track arrangement is a layout within itself, with several excellent Layout Design Element (LDE) candidates lined up from north to south. When I laid out the track plan, I started with the depot LDE in the center and worked in both directions. The packinghouse was north of the depot, and both cement plants were on the north edge of the city. There was no way I could build the large cement complexes, even if I used my entire room, so I had come to terms with the

fact I would have to model the traffic without a physical customer.

The depot LDE was situated in the center of my room's longest wall. Anything built to the north (left) would sit on a shelf attached to the wall at the shorter end of the room. After I laid out an abbreviated packinghouse along the short wall, I was left with only a few inches of length for the cement plants. My original plan was to get by with a couple of staging tracks, one to shove empties into and the other to pull loads from. But clearly this was inadequate.

After considerable brainstorming, the solution smacked me in the face: Why not just build the lead into the plants as it was in 1954? The M&StL was on the east side of U.S. Highway 65, and the cement plants were on the west side of the highway. Lehigh was northwest of Northwestern States, and the two were separated by a gravel road, 25th Street Northwest.

The M&StL had leads that curved off its main line and crossed the highway into each of the cement plants. The lead into Northwestern States was on a highway overpass. In 1953, the highway was widened and the overpass removed. There was a storage yard along the north side of



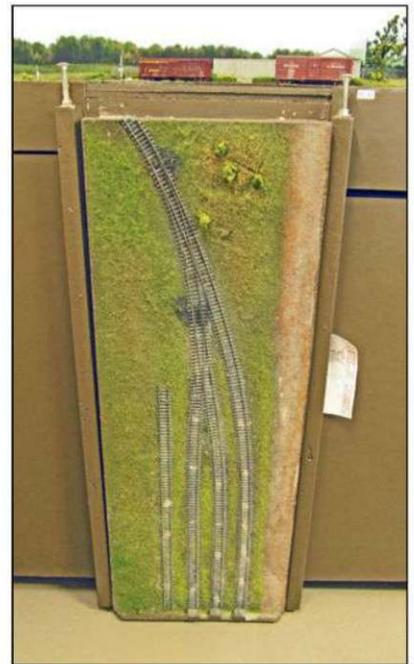
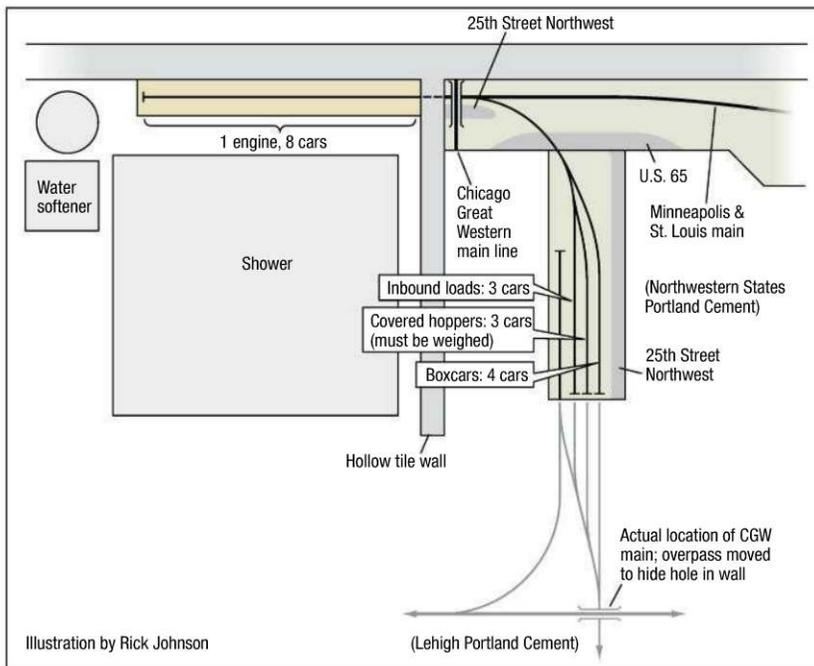
The drop leaf in the operating position shows its simple construction. All materials came from the author's scrap pile. The piece of paper hanging from the side is a job aid for the operators. Shelves above the layout hold cars that will add variety to future operating sessions.

25th Street; a turnout was laid in the south track of this yard, and a lead crossed 25th Street into Northwestern States property.

So by my modeled era, both plants were served off one lead through the storage yard. If I bored a hole through the hollow tile wall at the end of my shelf and placed a turnout just before the entrance, I could swing the lead to the edge of the shelf and have headroom to work the lead from the other room.

This meant the benchwork would have to jut out into the room to accommodate the storage yard. This protrusion would have to be removable, as it would partially block a doorway. It would have to lift, swing, or drop out of the way. I chose the last.

I tackled the drop leaf first. I checked my layout construction scrap pile and found a piece of 1/2" oriented strand board (OSB) and a few lengths of 1 x 2. I trimmed the OSB to 16" x 43". Since the track onto the drop leaf was on a curve, it had to be 16" wide. The surface of the layout at that point was 43" off the floor,



The 2 x 2 legs are fastened to the drop leaf by 10-24 bolts with self-locking nuts tightened to create friction as the legs are moved to the extended or stowed position. The light areas between the rails are small piles of cement, as covered hopper gates have a tendency to leak.

for only eight cars plus the engine, I've created a nifty little switching puzzle that can be a head-scratcher at times, all the while staying true to the prototype.

If you're struggling with a way to fit in track that ran perpendicular to your benchwork, consider a drop leaf.
– Clark Propst

so it couldn't be any longer than 43" and still lie against the benchwork when dropped.

I framed the underside of the piece of OSB with 1 x 2s on edge and attached the leaf to the benchwork with two door hinges. For legs to hold it up, I drilled holes through a pair of 2 x 2s and the 1 x 2 frame and attached the legs with long 10-24 machine screws and self-locking nuts. I placed washers between the frame and legs to act as bearings when the legs were swiveled and at each end of the bolts as well. The ends of the legs received T-nuts and bolts to level the drop leaf.

The Chicago Great Western crossed over the west end of the storage yard. I made a model of its bridge and relocated the bridge so it would help hide the hole in the wall.

Switching the plant

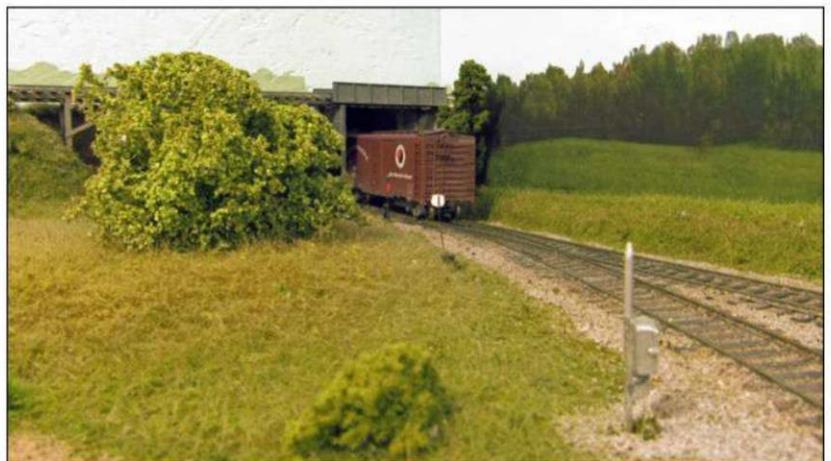
Even though the railroad hauled hundreds of loads of cement out of the plants during the shipping season, I only had a couple linear feet to work with. My approach to prototype operations is to simulate actual moves, not necessarily duplicate all prototype car movements. The same number of moves can be accomplished with just a few loads of cement.

The storage yard consisted of four sidings. There was enough switching at the plants to have a switch job assigned to them. I found a drawing showing the north track disconnected at the east end, which helped me with track length, as I could use only two

(instead of three) curved Peco code 75 turnouts.

I found I could simulate some of the in-plant moves by dedicating my yard tracks to certain cars. The south track is for boxcars; covered hoppers go to the middle track; and incoming loads are spotted on the north track. Usually there are two empty covered hoppers and three empty boxcars to be delivered to the plant and a like number of loads to be pulled. Cars delivered one operating session are pulled the next.

The number of inbound cars varies, but generally there's only one or two at a time. By assigning car types to individual tracks and having headroom



The boxcar is on the turnout to the drop leaf. Clark disguised the hole in the wall with a railroad overpass that he relocated from the opposite end of the prototype yard. The hole leads to the switch lead. Small details that add realism to the scene are the switch stand, whistle marker, and call box.

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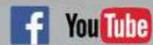


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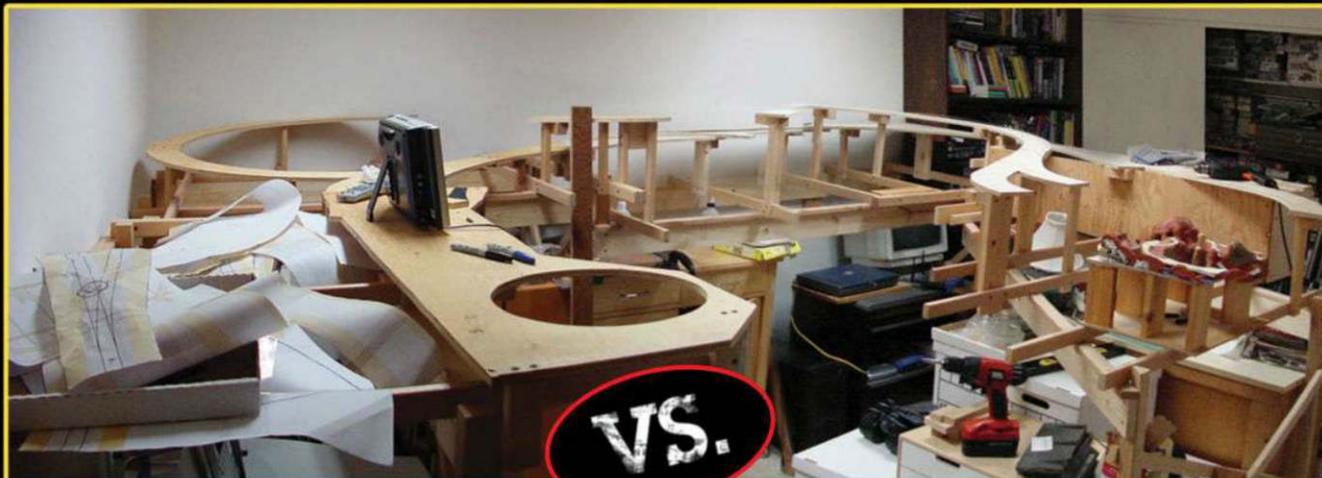


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