Contents

About the author 4

Introduction 5

Chapter 1
The compact layout 6

Chapter 2
Design techniques for compact layouts 13

Chapter 3
Designing for operation 26

Chapter 4
Practical design for compact spaces 34

Chapter 5
Asphodel & Southern (HO scale) 45

Chapter 6
New Hampshire Northern (HO scale) 51

Chapter 7
Crossville (HO scale) 57

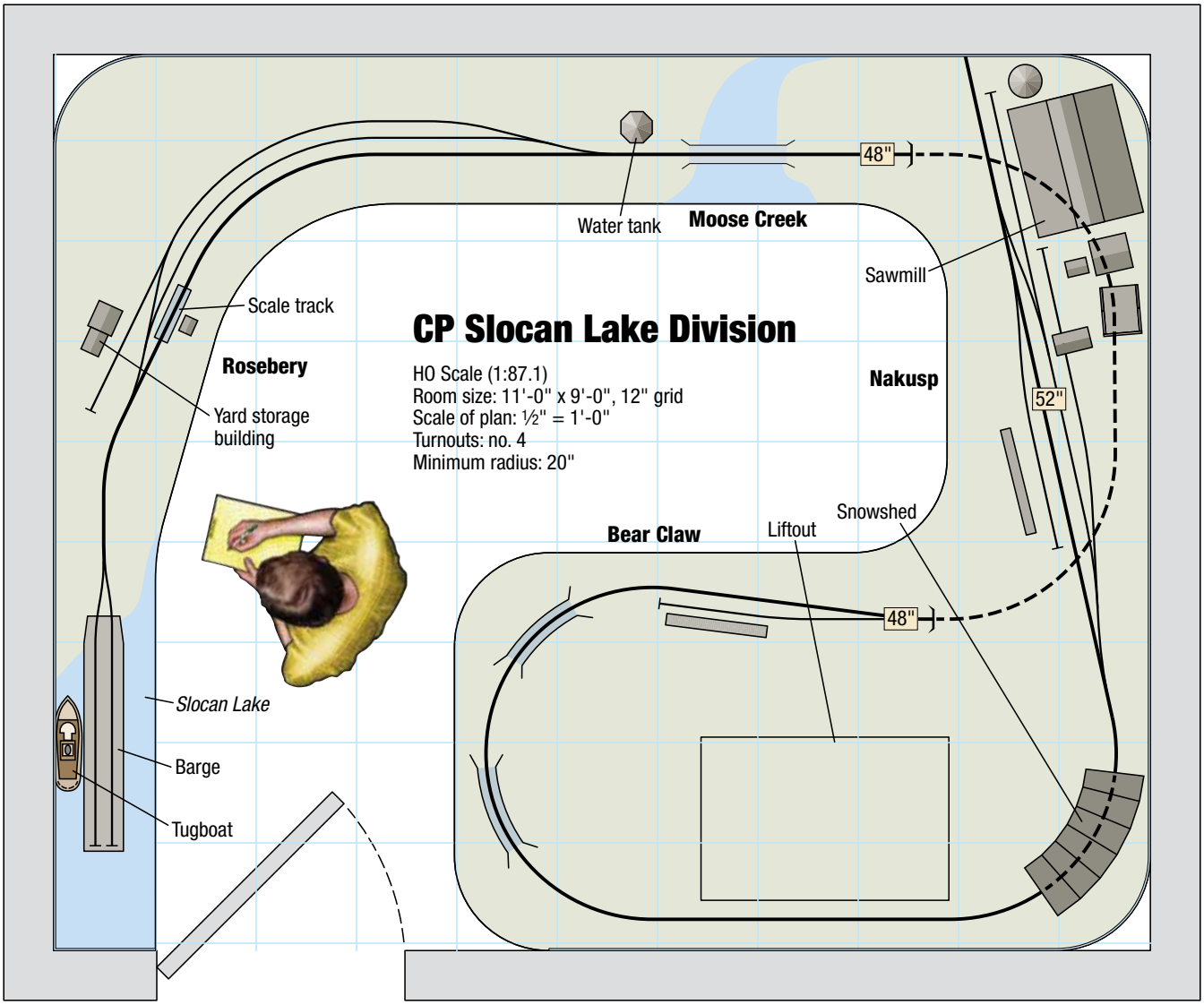
Chapter 8
Fort Boyd (HO scale) 63

Chapter 9
Bridgehampton (N scale) 69

Chapter 10
Black Creek & Buda (HO scale) 77

Chapter 11
Duwamish Belt (N scale) 84

Chapter 12
Pandora Junction (On30 scale) 90



Creating a basic track plan is fine as far as it goes (and this is a very good example, the 9 x 11 HO Slocan Lake by Jim Spavins), but a long way short of a full layout design. This plan appeared in the April 2009 *Model Railroader*. *Jim Spavins*

The chief dangers with a compact design are "over-egging the pudding" and shaving the margins too tight. The former leads to a result that is cramped and crowded, the latter to something that sits uncomfortably close to the practical limits of curvature, clearance, and access. That said, the basic methods I use for layout designing apply across the board. I've described many of my pet techniques in earlier writings—so if any of this seems a bit well-trodden, then apologies!

There are people out there who can conceive, plan, and execute a successful model railroad without setting anything down on paper. But we lesser mortals, apt to forget and easily confused, need to evolve and record our intentions in a clear and concise manner if we are going to achieve that goal. Most modelers, faced with this need, think in terms of a plan—most notably that old chestnut, the Track Plan. Strictly speaking, a track plan is just that: it merely shows the outlines of the site and the disposition of the intended permanent way within it. If you're lucky, it may throw in a few directly track-related features such as bridges, tunnels, turntables, and railroad structures. But that's about it; all the other myriad aspects of a model railroad don't get a look in!

Many such bald plans have been published over the years, and many a modeler has set out to build a complex model railroad armed with nothing more. This is an approach that has long struck me as somewhat chancy—a bit like trying to navigate around a strange city or along rural backways with a map that only shows freeways and interstates.

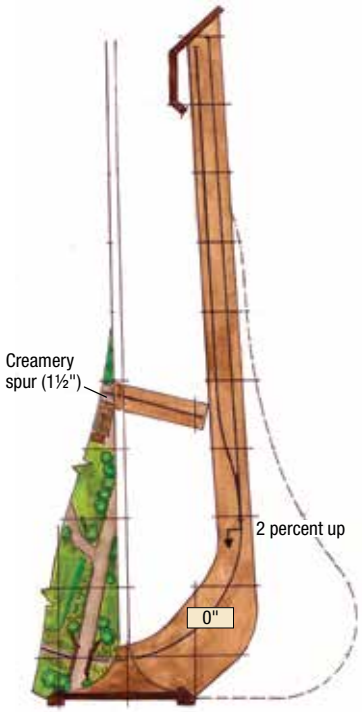
Holistic layout design

My own approach to layout design has long been founded on the plank that what I'm setting out to do is design a layout, in toto. That is, to come up with a set of solutions for *all* aspects of the proposed model railway—site adaptation, benchwork, access, all the content of the modeled scene, the intended mode of operation, the way the model is going to be presented and lit, and how it's going to be constructed

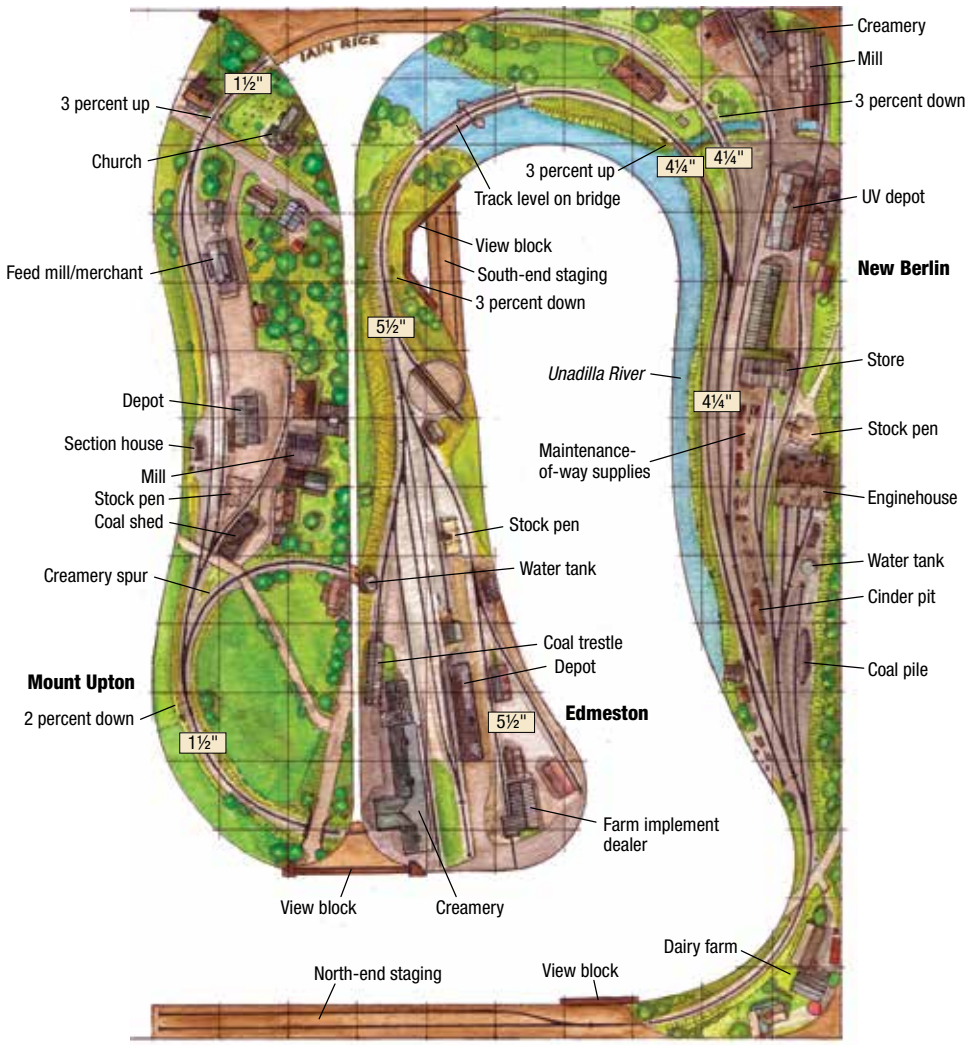
New York State's Unadilla Valley

HO scale (1:87.1)
Layout size: 10 x 15 feet,
plus a viewing aisle along one side
Scale of plan: ⅜" = 1'-0", 12" grid
Numbered arrows indicate photo locations
Illustration by Ian Rice

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



Staging below Edmeston
Access below fascia



A full layout plan attempts to convey as much of the appearance and feel of a prospective layout as possible. Even so, it's only part of the whole story. This is my Unadilla Valley plan from *Model Railroad Planning 2015*.

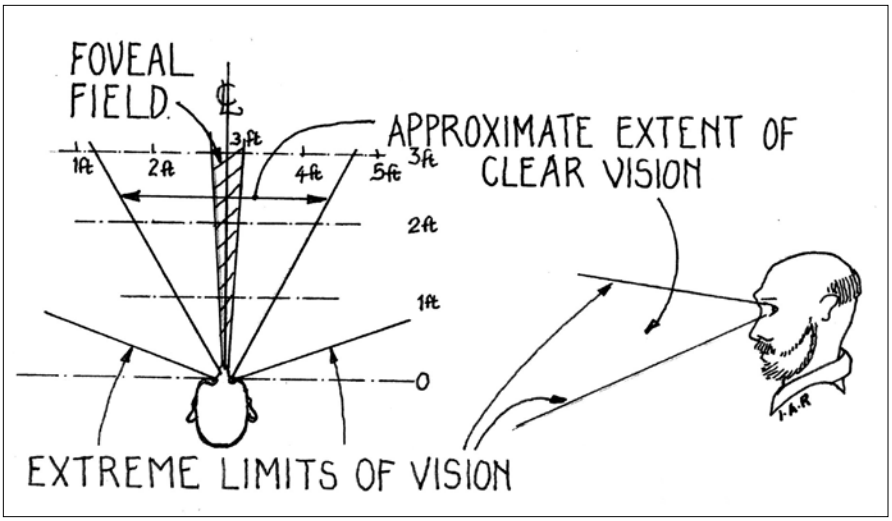
and bankrolled. The basic philosophy is that nothing is considered in isolation; everything is looked at as part of the whole. Each track-planning decision, for instance, is thought through in terms not just of how it affects the potential for operation, but also as to what it might imply for the benchwork structure, what access is needed for maintenance or manual handling, the impact on the electrics and control system, and what it will do for the look of the layout.

Such an all-embracing design process calls for a plan, certainly—although this will be a detailed overall layout plan rather than a plain track plan, drawn accurately to scale and showing as much detail as possible. But to call itself holistic, a layout design calls for a lot more than that; there will be a whole raft of supporting documentation to fill out the detail: a well-thought-out background rationale (usually backed by a comprehensive prototype data file), a detailed layout specification, additional drawings covering fundamentals such as benchwork and electrical systems, and a scheme for the presentation and lighting.

To which I often add a project plan covering the intended order of construction and incorporating a requisition list covering all the materials and components you'll need and where they can be sourced. And, last but not least, an irksome but necessary requirement (unless your pockets are far deeper than mine) is a budget. All of which is a far cry from a scribbled track plan on the back of a beer mat.

Design briefs

Every design job has to start somewhere, and that place is rightfully a *design brief*, a document that sets out the overall mission statement of the project and the various parameters it has to take account of. In many ways, this is the most important piece of paper in the whole design process, as it influences every decision taken during the design process. The mission statement of a layout answers the basic question, "What's this all about, then?" It is, in other words, a summary of the storyline of the proposed model, something that I find well worthwhile



This is the typical field of vision of someone standing in front of a model railroad; the shaded area is the foveal field—the zone in which our vision is most acute. Turning the head from side to side without otherwise moving roughly doubles the width of the scene we can view overall.

The art of compressing structures. You'll have to excuse a British example, the Victorian-era coal-fired china clay "pan dry" on my 4mm scale Trerice layout set in Cornwall around 1960. The building is actually modeled at a scale of 1:90, rather than the nominal 1:76 appropriate to 4mm scale, being careful to maintain proportions—although I did have to raise the loading dock slightly to suit the wagon heights. This was done after experiments with a mock-up showed that a full-sized version of the structure would have looked too dominant in the scene. The colors were also kept subdued to suit this background location.

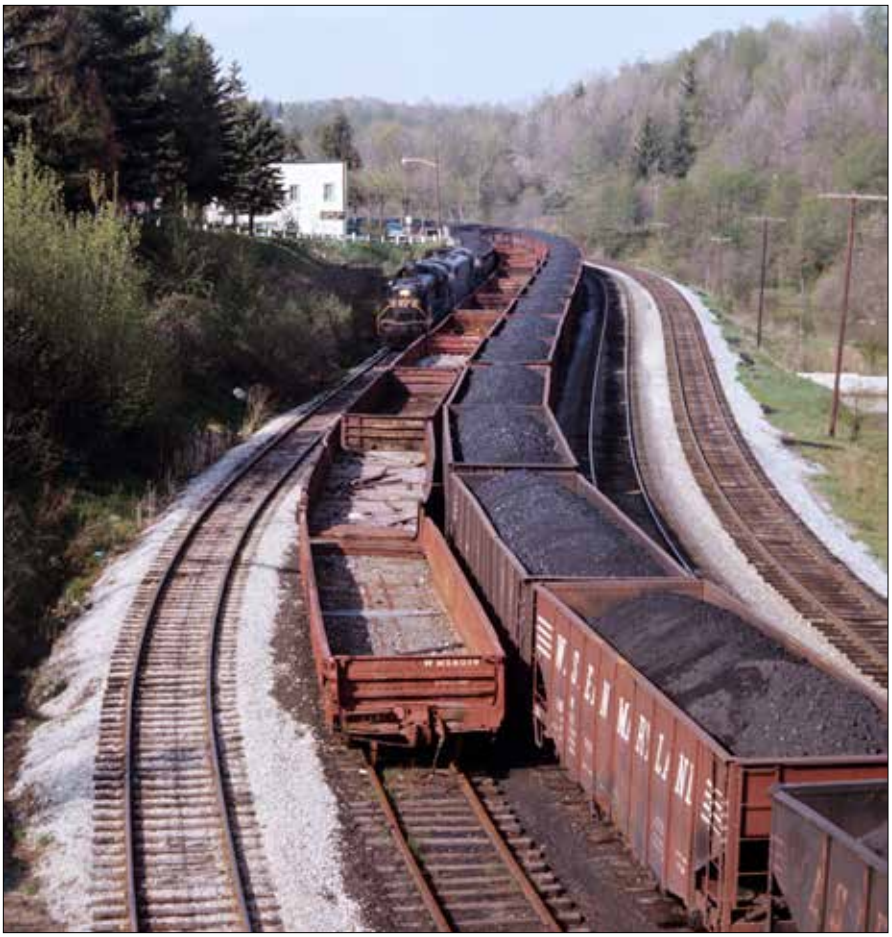
landscape features—within the layout. Bluntly, we make things smaller than they should be, so they both take up less space on the layout and are less visually dominant. So, for instance, a large structure for an HO layout might be modeled to a scale of 1:100 rather then the correct 1:87, while a landscape feature might be shrunk to a workable size by cutting the area and height while taking care to maintain the correct ground slopes or ratios of foliage to bare rock. The important thing, once again, is that the proportions of the original are maintained; simply reducing a structure's footprint without adjusting wall height and widow size merely results in a distorted model, which is not what we're after at all. Once again, a full-size, card-and-paper mock-up can be a useful way of determining how much of a squeeze you can apply in a particular situation.

Such compression is easy enough to arrange in respect of landscape features, but—unless you're scratchbuilding all your structures—is not so simple when it comes to buildings or civil engineering. But, in point of fact, it is usually not too much of a problem to get the right look in our modest compact-sized layout spaces, for the simple reason that, in many cases, the manufacturers of kits or ready-built structures have already put the squeeze on for us. Just running a scale rule over many such models will reveal they're either models of exceptionally small prototypes—or that they are, strictly speaking, under scale. In which case, our contribution to the compression issue simply comes down to selecting structures that look in keeping in their context of the layout.

Perspective regression

I've already mentioned the effects of the combination of the scale viewing distance and the telescopic nature of our normal vision in determining the way our models appear when we look at them from our normal close-to viewpoint of a yard or so. What we're really aiming to capture in our models is the look of the real thing when seen from appropriately far away—that is, 87-odd yards in HO and pro-rata for other scales. The point is that the degree of foreshortening and perspective regression perceived from this far away is much more pronounced than the close-up view we actually get when we stand in front of the layout. So anything we can do to the model to capture this "real thing seen from a distance" look is worthwhile.

The telescoping of things seen from a way away is just one aspect of the phenomenon of perspective, by which we appreciate the distance and orientation of objects. True perspective is a very complex subject, and full-blown perspective modeling is a very difficult trick to pull off. But there



More tight prototype clearances show clearly where conflicts are likely to occur with equipment passing on adjacent tracks: the front and rear corners at the outside of the curves, and the midpoint on the inside. The longer the piece of rolling stock and the tighter the curve, the greater the lateral displacement at these critical points and the greater the clearance needed. Add on a shimmy allowance, and it's evident that, in most instances, model tracks need to be spaced on considerably greater centers than the real thing. (Normal yard track centers allow at least four clear feet between cars on adjacent tracks, while running line clearances are around a yard.) *Tony Koester*

point is the longitudinal centerpoint of a vehicle, where it is displaced inwards in relation to the inside rail of the curve. Be mindful of the fact that these values are not constant between different items of equipment; much will depend on the overall length of a vehicle and the amount by which it overhangs its trucks at either end. A long vehicle with big end overhangs will have more end swing but less midpoint displacement, and vice-versa where the truck overhang is smaller. In all cases, however, the tighter the track curvature, the greater the lateral displacements and, hence, the more clearance room you have to allow between tracks and fixed obstructions and adjacent tracks.

In terms of track planning for tight spaces, it's important to take account of these lateral clearance values, as they can affect the amount of space you'll need to allow either side of curved track; there may even be circumstances—such as accommodating equipment with substantial end overhangs (long streamlined passenger cars and 89-foot auto racks are the worst offenders)—where a less severe curve will actually call for less space. Even if your tighter curves are confined to hidden trackage, you still need to allow enough room on either side of the track to get your fingers in to handle equipment should you suffer a derailment or other mishap.

Curve compression

If we were to apply strict scale criteria, even the widest of the curves I've just described is actually way too tight. Even in the USA, where steam locomotive driving wheelsets are usually tucked tight together and European-style rigid long-wheelbase 2-axle rolling stock with side buffers and hook-and-shackle couplers is unheard of, the absolute minimum curve you'd meet on a normal running line would be in the order of 15 degrees—that's around 380 feet radius. And that would have a strict speed restriction—typically to less than 20 mph! More normal running line curves would be of the order of 10 degrees (575 feet radius) on everyday trackage, with 5 degrees (1,150 feet) on anything approaching a high-speed line. That sounds OK until you do the math and realize that even the 380-foot absolute minimum curve is 52" radius in HO scale; a 10-degree normal line curve runs out at 79" and a highballing express running 60 scale mph should call for 158". What price even the biggest basement then?

But the fact is that even large locomotives and scale-length passenger cars (thankfully!) look OK on curves that are, in strict scale terms, only a fraction of what they should be. Why is this? Well, I reckon that once again it's due to the visual compression described in chapter 2; that is, the way our normal human telescopic vision squeezes together or foreshortens things that are viewed from any distance. Curves, in particular, are closed up so that even a gentle bend seen from a little way away looks like a hairpin, while things like parallel fence lines across the field of view are tightened together as they recede.

The point is that looking at a scale model railroad scene from our typical spectating distance of a yard or so equates to viewing the real thing from a distance that is quite sufficient to allow this telescoping effect to modify the way we see curves, even when were looking across rather than along them. Which means that watching our model trains negotiate typical reasonable model curves actually looks quite

The Smoky Mountain's freight station has seen better days and is an example of how a building can be "dilapidized." *C. L. Bandy*

A turntable such as this one on the Smoky Mountain Railroad, shown in 1950, fits well on the layout. It is definitely of the armstrong variety! *Trains magazine collection*

Facilities were likewise minimal. The terminus might rate a reasonably respectable depot building—usually combining the needs of passengers and freight. In the yard, there would be a team track and usually a stock pen, maybe a rough-and-ready ramp to get farm machinery on and off a flatcar. A few local industries—a fuel dealer, a feed mill, or farm supplier—would line up along a back spur. There would be an engine terminal of sorts: a one- or two-stall enginehouse with the most basic workshop facilities, a leaky water tank, a pile of coal (assuming the road wasn't still burning wood, which quite a few of them were), and maybe—just maybe—a small furnace to dry sand. There might be a turntable but very often not. That'd be about it. Intermediate stopping points were variable. If the line passed through another town, there might be a small combination depot and maybe a spur. Otherwise, the train would pick up or set down the folks at any convenient grade crossing.

The train itself (there would only be one, unless the line ran a gas car as well as a locomotive) invariably consisted of a motley selection of freight cars—none of them lettered for the home road—tailed up by, at best, an ancient wood-sided, clerestory-roof passenger car (usually a combine) which was sign-written, sometimes in gold leaf. Some of these passenger cars were surprisingly sumptuous, having started out half a century earlier as crack varnish on some high-falutin' Class 1.

On the other hand, the passenger accommodations might only amount to a spartan drover's caboose—quite often a homemade affair knocked up from an old truss-rod boxcar, which offered a few hardtack seats in addition to the crew's quarters. And sometimes not even that, the aspiring passengers having to squeeze in to whatever space was available in the regular crummy. Whatever; it was still better than walking, though often not a great deal quicker.

At the other end of the train would labor the line's solitary locomotive—which would probably be even older than the passenger car, at least second- if not third-hand, and much patched and modified over its years of service. But well kept—if not cherished—in a homespun sort of way. A low-wheeled classic American 4-4-0 or ten-wheeler was the usual fare, although the odd Mogul or Consolidation might turn up. The line might possess more than one locomotive—but rarely in working order. Of course, the management was loathe to own up to this status; they might only roster the one engine, but it rarely carried the one spot; often, it ran under the number with which it came from its original owner, even when that put it into three figures!

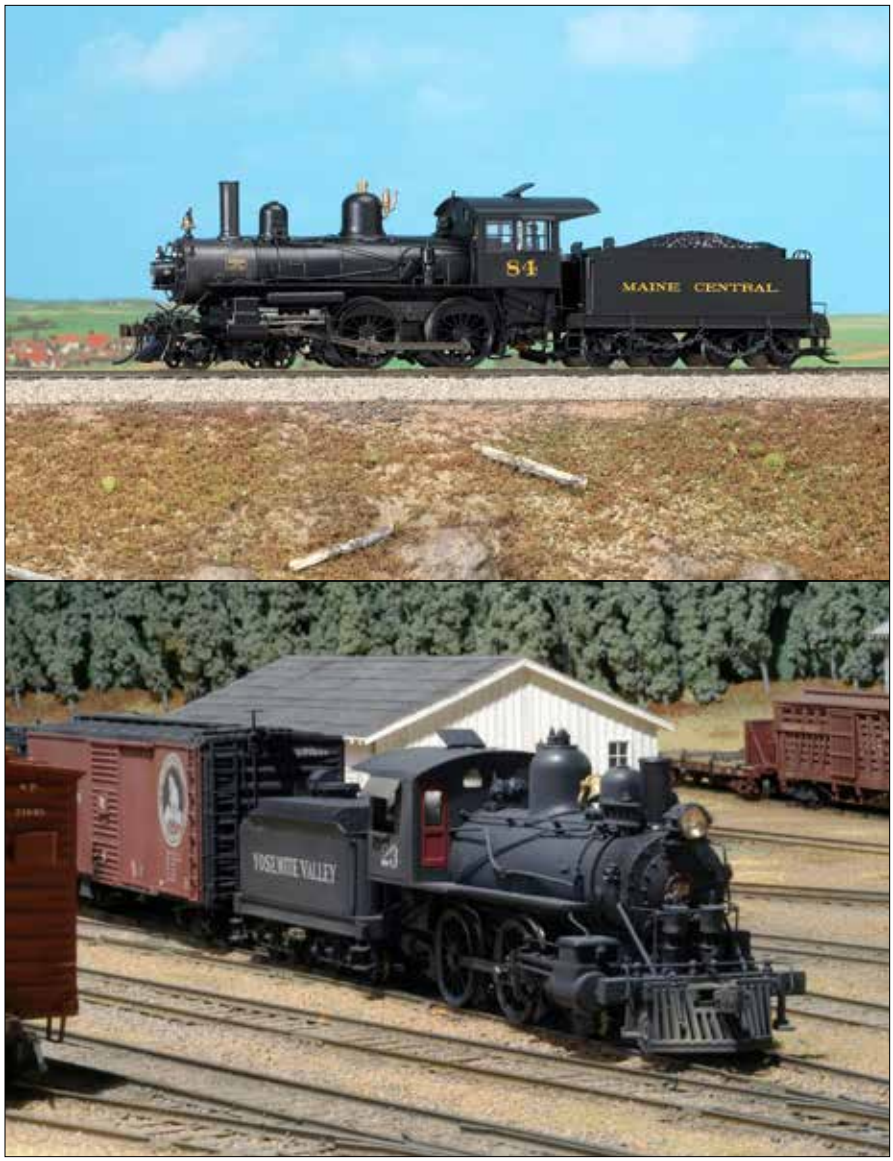
Shortline modeling

To model a short line of this ilk, you have to be good at laying bad track and adept at replicating shabby splendor. Micro-Engineering's Code 55 flextrack is a good starting point for the not-so-permanent way, and you might want to try your hand at stub turnouts with

harp switch stands for that true vintage look. You won't need to do much ballasting, though.

As for equipment—well, the aspiring short-liner never had it so good! Not so long ago, you'd have been on the lookout for some suitably superannuated brass model, or be forced to do battle with a die-cast MDC "Old Timer" kit. But today, you can buy well-detailed, state-of-the-art, plastic-bodied steamers that are right in the slot. Bachmann's classic American Baldwin 4-4-0 or ten-wheeler in either unmodified form with Stephenson's valve gear or improved with Walschaerts form ideal starting points for a bit of customization to produce individual pieces of characterful short-line motive power. Drover's cabooses can be found as resin kits, and if you can find one, the old LaBelle Woodworking milled basswood coach or combine kits make a perfect tail to the daily mixed train.

Much of the joy of modeling these railroads lies in the structures, landscaping, and details. Over the years, there have been a number of traditional craftsman's structure kits that fit right in with the shortline theme, and wood structure kits lend themselves wonderfully to distressing, weathering, and general "dilapidizing" to capture that down-at-the-heels look. These scenes and structures also lend themselves to detailing and to populating, not just with figures, but with *characters*. The landscape is important, too, as it's not just some sort of scenic fringe that borders the railroad; rather, it's seven-eighths of the way to swallowing it up altogether. You don't just landscape up to the tracks, you carry clear on over them!

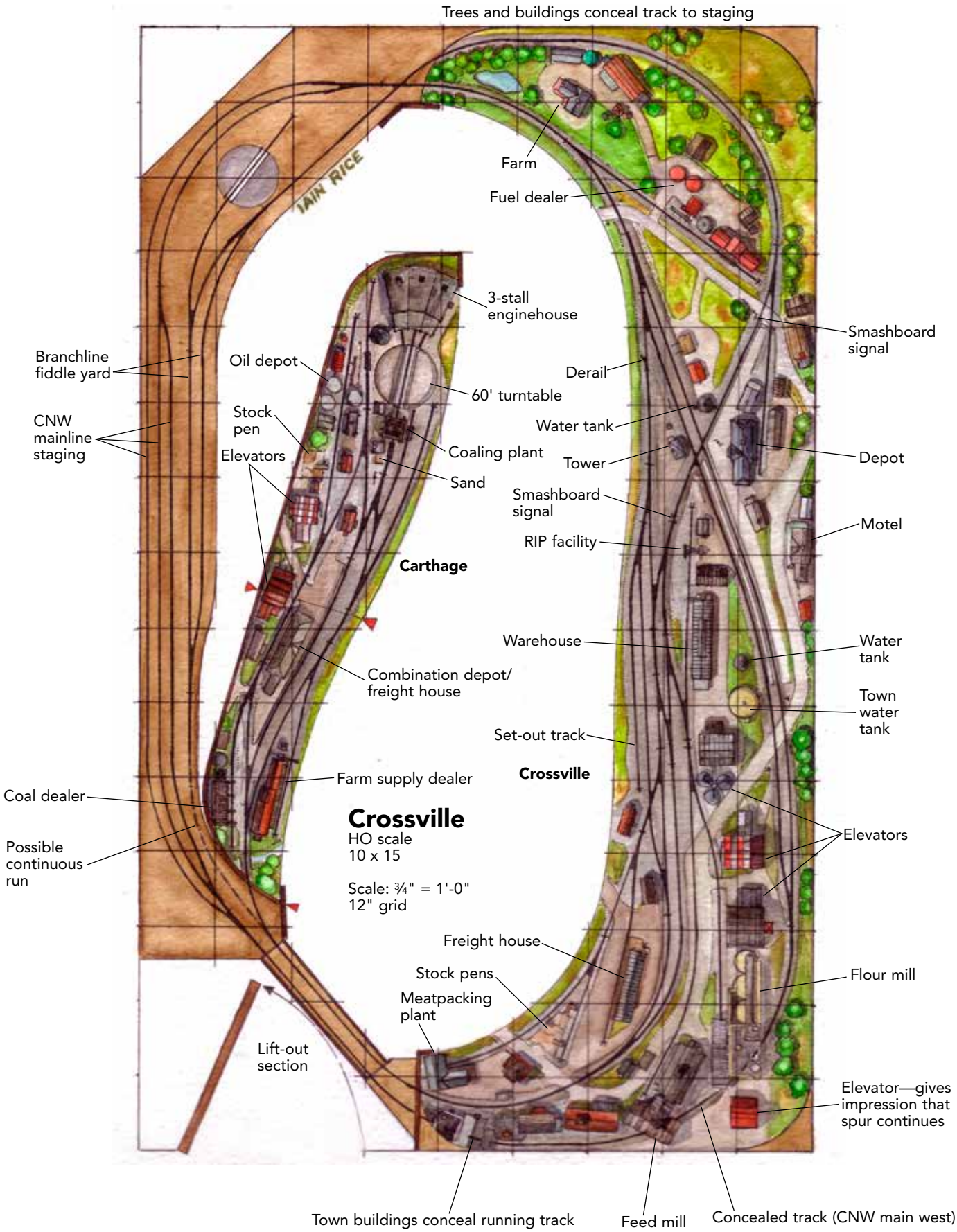


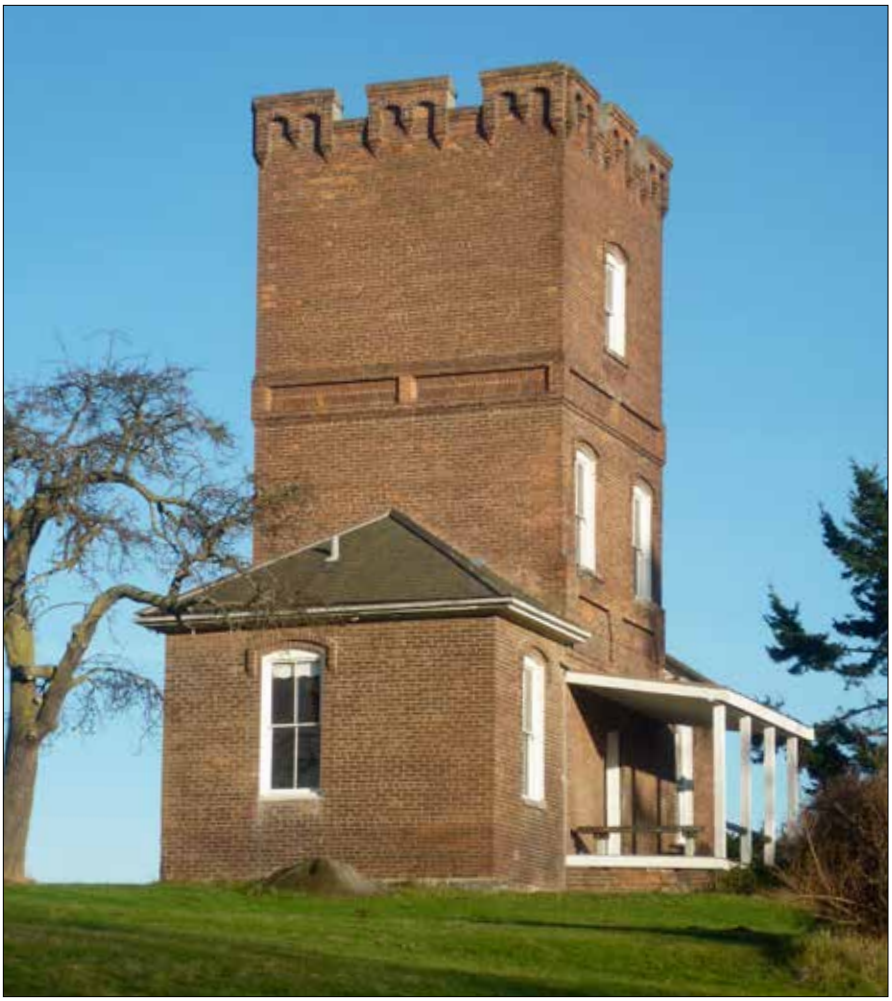
Shortline builders have an ideal piece of motive power in Bachmann's classic American 4-4-0, which can be easily modified into specific prototype locos, as Jack Burgess has done for his Yosemite Valley layout. *Top, KPC photo studio; bottom, Jack Burgess*

Best of both worlds

Essentially, this layout is a variation on that favorite British theme, the stub-end branch line feeding into a fiddle yard that stands in for any part of the branch line not modeled and the rest of the railroad network generally. In this two-scene design, the terminus of the branch line is one scene, and an intermediate station—where the A&S interchanges with another short line that crosses by a diamond—as the other. The fiddle yard is then reached by a concealed track along the back of the terminus scene. The basic mode of operation is thus point to point, terminus to fiddle yard. But, courtesy of a sneak-off track that appears from among the boscage behind the enginehouse, there's also a continuous run, which means you can either lengthen the point-to-point run by reeling off a few laps of the circuit, or just sit back and enjoy the sight of your train ambling gently through some picturesque scenery.

The layout was schemed for a spare-bedroom-sized space and is arranged to be wheelchair friendly, given an apt display height (rail level at 42"–45"). Access to the main operating well is by means of a wide-opening gallows gate, which should allow unimpeded entry. The modest size of the trains allows tight (27") ruling curves to be used, with space-saving curved turnouts in the throat of the station. A modest armstrong (manually operated gallows-type) turntable allows the loco or gas car to always run "right foot forward." The fiddle yard is a simple two-road affair, with a cassette system for train storage and marshaling on the front road. There's also room for a short spur for the gas car, which is shown in dashed lines on the plan. And that's about it.


Trees and buildings conceal track to staging
IAIN RICE
Farm
Fuel dealer
3-stall enginehouse
Smashboard signal
Branchline fiddle yard
Oil depot
Derail
60' turntable
Stock pen
Water tank
CNW mainline staging
Coaling plant
Tower
Depot
Elevators
Sand
Smashboard signal
Motel
RIP facility
Carthage
Warehouse
Water tank
Combination depot/ freight house
Town water tank
Set-out track
Crossville
Farm supply dealer
Coal dealer
Crossville
HO scale
10 x 15
Scale: ¾" = 1'-0"
12" grid
Elevators
Possible continuous run
Freight house
Stock pens
Flour mill
Meatpacking plant
Lift-out section
Elevator—gives impression that spur continues
Town buildings conceal running track
Feed mill
Concealed track (CNW main west)



The brick watch tower at Fort Worden is a characteristic structure of the military forts from this time.

To make this possible, line capacity was increased by every conceivable means, from lengthening passing sidings or adding new ones to double-tracking and installing block signaling systems and Centralized Traffic Control. Every locomotive that could run, did run—from old tea-kettles dragged off the scrap pile to state-of-the-art multiunit diesels fresh from the factory. Likewise, every serviceable car—freight and passenger—was in use, with new equipment being produced at unprecedented rates, and repair shops working double or even triple shifts to keep the rolling stock rolling. This time was, of course, the Second Wold War.

Not only did the war generate high levels of regular freight traffic due to the gearing-up of heavy industry and agriculture to meet heightened demand, it added two large extra categories of lading: military traffic and freight displaced from coastal shipping due to the submarine threat. Passenger numbers also saw a dramatic increase, not just in troop movements and other military requirements, but also in civilian ridership as people were redeployed to meet the demands of the wartime economy. All of which meant that the railroads had to step up their capability by a huge factor in a very short time frame—which they accomplished; by 1944, they were operating at more than 150 percent of their prewar capacity.

Working the war traffic

Unlike during WWI, when the railroads were placed under the direct government control of the USRA (United States Railroad Administration), railroads in WWII remained in the hands of their own management, with overall direction and liaison through the Office of Defense Transportation (ODT) under Transportation Commissioner Ralph Budd. Budd was a railroad man, president of the CB&Q, and he placed the railroads at the heart of his transportation strategy. Working through existing agencies like the ICC (Interstate Commerce Commission) and the AAR (Association of American Railroads), railroad management was coordinated and joint procurement programs initiated; 120,000 new freight cars were ordered, along with 2,600 locomotives.

The ODT also looked at ways of getting more capacity out of the existing railroad plant. The Shipper's Advisory Boards (the organizations that matched shipments to available railroad cars and determined the routes used) were ordered to increase the minimum ladings of cars to a higher percentage of their capacity, cutting down on deadweight and the number of cars needed. They were also instructed to use efficient routing and cut loading and discharge times to get cars back in service more quickly; traditionally, many shippers had used freight cars as rolling warehouses. The labor unions also had a part to play in facilitating more flexible work practices to increase productivity and to get the most from skilled and experienced workers in the face of losses to enlistment.

Other changes to prewar operating practices included speeding up trains as much as possible—again to make best use of the available trackage, especially on single lines. Trains were also run at higher gross tonnages, both by lengthening consists to the limit imposed by the passing sidings, and due to the higher percentage lading of each freight car. Locomotives were worked to their maximum capacity, and powerful locomotives of whatever origin were assigned to key routes; under this arrangement, for instance, the Boston & Maine's big new Berkshires were loaned to the Southern Pacific to work urgent hotshot freight to Pacific coast seaports.

Modeling narrow gauge

Creating a model railroad based on the type of barnstorming narrow gauge railroad prevalent in 19th century Nevada is just what Bachmann's On30 equipment line was made for! No matter about the 6" discrepancy in the gauge, these superb little models are right in the slot for character, which matters far more than the odd missing inch!

You'll be wanting light rail—many of the Nevada lines made do with 50 pounds to the yard or less—so Micro-Engineering's Code 70 On30 flextrack is the one to go for. Some lines used stub turnouts, but the normal "knife pattern" was also common; Micro-Engineering offers ready-to-lay No. 5s, which are ideal. Curved and other fancy turnouts did not figure greatly on Nevada narrow gauge lines!

For power, Bachmann's On30 4-4-0, 2-6-0, and 2-8-0 locomotives are ideal candidates for a spot of Nevada-inspired reworking. If you're modeling the high Victorian era, the wooden cab variants are the ones to go for; just be prepared to ginger them up with a little extra fancy striping and plenty of polished brass. And, of course, you'll need a monster headlight, a sharp diamond or rounded cabbage woodburning stack, and some early-style "cookie jar" domes, all available as detail parts from Boulder Valley Models (bouldervalleymodels.com). For later periods, Backwoods Miniatures in the UK has a superb resin kit for the SP-style whaleback tender suited to the later oil-burning Baldwin 4-6-0s and a kit for the dinky little 4-wheel tender for Porter 0-4-0s, much favored by Nevada mining roads.

As for rolling stock, between the Bachmann ready-to-run range—which includes passenger cars as well as a selection of highly relevant freight cars—and all the superb kits produced for On3, most of which can readily be adapted for On30, there's very little you won't be able to lay your hands on.

After the gold rush

So, given these tempting ingredients and a prototype that got up to such unlikely antics, it's not too difficult to dream up an entertaining and colorful layout. My not-too-serious take on the Nevada slim gauge scene, Pandora Junction, centers on the meeting of a couple of common-carrier railroads with a side dish of a Porter-powered mine tramway. The railroads in this case are the (real) Nevada Central and the (imaginary) Pandora & Copperfield. As with many of the prototypes, there are several ways of getting from A to B, and trains can "box the compass" en route—not very sincere in John Armstrong layout-planning terms (a sincere model railroad being one in which a given route only appears once in each scene). But no one seems to have explained this dictate to the real-life Nevada railroad engineers, so in this case, I'm unrepentantly insincere!

A Nevada Central Mogul is smoking out of Battle Mountain with a typical mixed train. Livestock traffic was also carried on the narrow gauge; populous mining boom towns needed a lot of feeding! *Trains magazine collection*

At base, though, this is an old-fashioned end-to-end plan, with trains running into the junction from low-level staging and then splitting to take one of several alternative routes forward. The staging represents the link with civilization—in these parts, San Francisco, reached by a connection with the transcontinental line through the Donner Pass.

At the junction, the straight route—the Nevada Central main line—sneaks off-scene between the town buildings and runs, concealed in offstage areas and behind convenient pieces of scenery, to climb across the room doorway on a swing-aside gallows gate and sneak into the far end of Copperfield to form a continuous run. That's route No. 1.

But trains taking the straight run through the junction can traverse the balloon track to emerge from a typically tight tunnel and pass the loading point of Windy Point Mine, reentering the junction by the curved route of the Copperfield branch but traveling in the opposite direction, whence they can run back into staging on an out-and-back basis. That's route No. 2.

Route No. 3 sees trains entering from staging take the diverging line at the junction, pass the mine, disappear into the tunnel, traverse the offstage trackage behind Pandora Mountain, and then take the concealed line that sneaks behind buildings at the rear of the junction scene before climbing upgrade to emerge at a higher level and cross the Pandora approach tracks on a trestle. At the far end of the trestle, a connection with a flying spur marks the start of a steep switchback mine tramway climbing up to the Copperhead Mine, which is perched on a craggy outcrop. The running line continues to enter the raw boomtown of Copperfield, where facilities include a steeply graded switchback tramway to Pandora No. 3 Mine as well as a turning wye and team track.

A final route possibility is for Copperfield branch trains to traverse the balloon track at Pandora and run back to staging via the Nevada Central main, which should be enough insincerity for anyone!